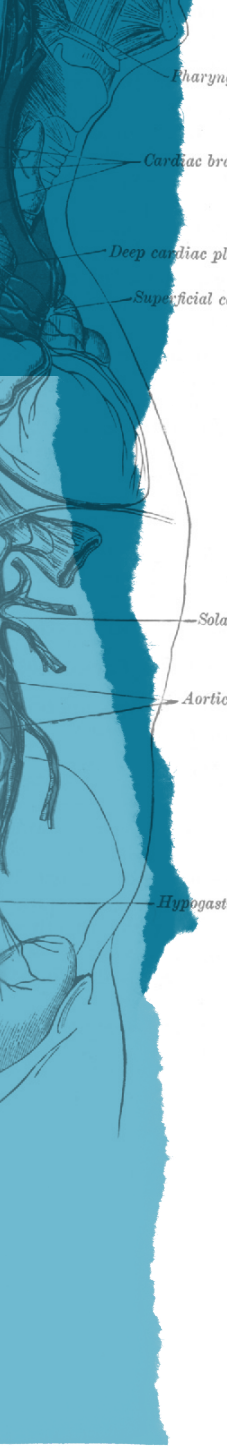

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Organic Dysphonia in Adults Caused by the Use of Vaporized Electronic Cigarettes: A Systematic Review

Disfonía orgánica en adultos causada por el uso de cigarrillos electrónicos vaporizados: Una revisión sistemática

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ABSTRACT

Objective: This systematic review aims to determine whether the use of vapor electronic cigarettes causes organic dysphonia in adults.

Materials and methods: The review follows the guidelines of the PRISMA statement and identifies databases such as PubMed, EBSCO, ScienceDirect, SpringerLink, and Scopus for document searches in order to address the research question.

Results: The document search, conducted through identification, selection, elimination, and inclusion phases, yielded 33 articles to address the research question. The review established that vapor electronic cigarettes have immeasurable detrimental effects on the voice at both structural and functional levels. The anatomical structures of the vocal apparatus are affected, leading to alterations in voice functionality. These alterations are evident in changes to voice qualities such as timbre, tone, intensity, rhythm, and prosody. Additionally, the use of vapor electronic cigarettes triggers various symptoms, including pain, irritation, and inflammation.

Conclusions: Both short-term and long-term use of electronic cigarettes significantly negatively affects the vocal health of young and older adults. This review emphasizes the detrimental influence of vapor electronic cigarettes on voice-related aspects, including dysphonia and vocal fold dysfunction.

Keywords: Electronic nicotine delivery systems, vapor e-cigarettes, vaping, dysphonia, vocal fold dysfunction, voice, phonation, vocal folds, risk factors.

RESUMEN

Objetivo: Esta revisión sistemática tiene como objetivo determinar si el uso de cigarrillos electrónicos de vapor causa disfonía orgánica en adultos**.**

Materiales y métodos: La revisión sigue las directrices de la declaración PRISMA e identifica bases de datos como PubMed, EBSCO, ScienceDirect, SpringerLink y Scopus para la búsqueda de documentos con el fin de abordar la pregunta de investigación.

Resultados: La búsqueda documental, realizada a través de las fases de identificación, selección, eliminación e inclusión, arrojó un total de 33 artículos para abordar la pregunta de investigación. La revisión estableció que los cigarrillos electrónicos de vapor tienen efectos perjudiciales inconmensurables sobre la voz tanto a nivel estructural como funcional. Las estructuras anatómicas del aparato vocal se ven afectadas, lo que provoca alteraciones en la funcionalidad de la voz. Estas alteraciones se manifiestan en cambios en las cualidades de la voz, como el timbre, el tono, la intensidad, el ritmo

y la prosodia. Además, el uso de cigarrillos electrónicos de vapor desencadena diversos síntomas, como dolor, irritación e inflamación.

Conclusiones: Tanto el uso a corto como a largo plazo de cigarrillos electrónicos tiene un impacto negativo significativo en la salud vocal de adultos jóvenes y mayores. Esta revisión hace hincapié en la influencia perjudicial de los cigarrillos electrónicos de vapor en los aspectos relacionados con la voz, incluida la disfonía y la disfunción de las cuerdas vocales.

Palabras clave: Sistemas electrónicos de administración de nicotina, cigarrillos electrónicos de vapor, *vaping*, disfonía, disfunción de las cuerdas vocales, voz, fonación, cuerdas vocales, factores de riesgo.

INTRODUCTION

Vapor electronic cigarettes were first developed in China in 2003 (1) (2). Subsequently, these vapor electronic cigarettes were introduced to the market in 2004 in the United States, becoming a safe alternative to quitting smoking conventional cigarettes, with the strategy of lowering economic expenses and in turn emphasizing the variety of flavors (6)(3). Thus, a 2014 study found that there are 466 brands and 7,764 unique flavors for vapor e-cigarettes (7)(4). In fact, in less than two decades they became very popular thanks to these marketing strategies (5).

Regarding the generations of vapor electronic cigarettes, it is important to mention that all of them have 4 basic components, which are a disposable cartridge or capsule containing the liquid, a heating element or atomizer, a rechargeable battery, and a mouthpiece to inhale the product (8). On the other hand, there is the water pipe or hookah, which is a device that contains distilled water in its base, followed by a conduit with a cavity where the addictive chemical substance is deposited, then an aluminum foil with holes in it is placed, after which a lit charcoal is placed and finally the cavity is covered to inhale the product (9)(10). Thus, the most popular vapor electronic cigarette called Juul has been established, which has the shape of a USB unit and constitutes 73% of sales in the vapor electronic cigarette market at present, although there are presentations similar to a conventional cigarette (3)(11)(10).

Electronic systems for the release of different chemical substances are also known as vaping, vapor cigarettes or electronic cigarettes. (12) On the other hand, the products included in vapor

electronic cigarettes are heated in an aerosol or vapor at an average temperature of 160°C to 230°C and thus subsequently inhaled (13)(14).

It is important to mention that the dried inflorescences, that is to say, the flowers or buds of cannabis are usually used in vapor electronic cigarettes being marijuana, likewise, cannabis hashish is made from the resin, pollen, or gum secreted by the cannabis plant, pollen or gum secreted by the plant and hashish oil is obtained through the thick oil of hashish, the latter two are even stronger and more concentrated than marijuana, then, they also prefer to use nicotine, which is a chemical substance obtained from tobacco, being an addictive psychoactive drug (12). On the other hand, the aerosol liquid contains a solvent of propylene glycol, glycerin, diethylene glycol, ethylene glycol, formaldehyde, acrolein, various heavy metals such as nickel, tin, silver, water, flavors, and tobacco derivatives such as liquid nicotine, cannabis or marijuana, which may or may not be in the device (3)(15)(13). It is essential to point out that the amount of nicotine or cannabis encapsulated in the vapor electronic cigarette in one dose is up to 59 mg per 0.7 ml of liquid, which is equivalent to a pack of conventional cigarettes (3).

It should be noted that propylene glycol and glycerol are used in different food preparations and are approved by the Food and Drug Administration (FDA) of the United States (1) (16) (10). Likewise, it should be kept in mind that the use of these chemical compounds in vapor electronic cigarettes is not regulated or approved by this agency (17) (18).

Now, as for the laws of approval or prohibition of consumption of different substances through vapor electronic cigarettes, multiple knowledge and information is depending on the country and the substance (17)(19). Regarding the use of vapor cigarettes in the United States and New Zealand, a rapid progressive increase among young and older adults has been established. On the other hand, in Canada, the increase in the prevalence of vapor e-cigarette use by 8% for the years 2013 and 2014 to 26% between 2018 and 2019 have been reported, which, is an increase of great magnitude (13)(20).

The percentage of vapor e-cigarette users in Brazil is 52%, in Croatia a percentage of 65% is presented, being the highest prevalence of consumption. Likewise, in New Zealand, the frequency and prevalence of consumption ranged from 13% to 49%, and finally, in Poland, a percentage of 45% was estimated (21)(7). Due to the increase in the use of vapor electronic cigarettes, the coun-

tries of Uruguay and Brazil banned the sale and marketing of vapor electronic cigarette products. In contrast, the United Kingdom has regulated the purchase and use of vapor e-cigarettes under general consumer protection laws (7).

On the other hand, it has been identified according to the Centers for Disease Control and Prevention in the United States that more than 263,000 young people in grades 6-12 used vapor e-cigarettes in 2013, which is three times the number reported in 2011 (22) (16). In turn, it was determined, according to studies of racial data, that white people are the most prevalent users of vapor e-cigarettes, followed by black people (10) (23).

Thus, the recreational use of cannabis for adults is legal in 15 states in the United States and, in turn, a variety of methods of administration of the product were reported, either by inhalation, ingestion, or dermal application of the product, for which the inhalation of cannabis smoke is preferred (4). Likewise, in Canada, cannabis was legalized for recreational consumption by adults in 2018, which demonstrates the different management given by countries worldwide about the use of vapor electronic cigarettes and the consumption of different substances through them. Thus, vapor e-cigarettes have the potential to benefit or harm public health worldwide (17) (19) (13).

Also, the consumption of nicotine or tobacco with a water pipe or hookah has become very popular among young adults. It is important to mention the belief that the toxins are filtered through the distilled water contained in the hookah, which is false because of this its use has been increasing. The hookah was born in the northwestern provinces of India and has spread to the United States, Europe, and other continents (24)(25). It is worth highlighting that hookahs have had greater acceptance and prevalence of use by women and vapor electronic cigarettes by men, having a correlation with the vapor electronic cigarette in which young people of college age have used this product (24) (25). Furthermore, it should be taken into account that the consumption time is 30 to 90 minutes per session, which is even longer than that of a vapor or conventional electronic cigarette. Next, it is established that this instrument fulfills the same function as the vapor electronic cigarette where its variation is found in the presentation of the style and design of the product (24)(25).

Regarding the prevalence of its use, it was established in 2011, in countries such as Lebanon at a percentage of 15%, in Syria from 9% to 12%, in Pakistan from 6%, in Jordan from 30% to 5% being the most relevant and in the United States for the year 2012-2013 it had a percentage of 3.3% (24).

Thus, the symptoms present in people are hoarseness, shortness of breath, vocal weakness, pharyngeal pain, pharyngeal globus sensation, laryngoesophageal and laryngopharyngeal reflux, sticky mucus or throat clearing, which are evidenced in dysphonia or directly aphonia in patients, whether in the short or long term that voice loss occurs and the severity of these symptoms can range from mild to severe (24) (8) (19) (24).

Regarding the anatomical damage of the structures involved in voice production, it is established that the lesion of the vocal cords at the uni or bilateral level, erythema, hypertrophy of the arytenoid cartilage, laryngeal edema, irritation of the larynx, hypertrophy of the base of the tongue, saburral tongue and asymmetries in the vocal cords. In addition, poor body posture of people during sleep or in their daily activities in conjunction with the use of vapor electronic cigarettes is reflected in the damage produced to the vocal cords (14) (26).

It is important to mention that, as a means of protection, scarring of the vocal cords is usually evidenced, which results in a functional deficit in the ability to control the flow of air for voice production, as well as the loss of mucosal flexibility; Thus, the use of vapor electronic cigarettes leads to the establishment of various serious pathologies in the voice of smokers, resulting in the loss of their ability to communicate with their environment, because some symptoms are irreversible and treatment can mitigate, but not eradicate the damage to the voice (11) (23). On the other hand, the use of vapor electronic cigarettes is correlated with problems such as psychiatric disorders, use of other drugs, negative variations in cerebral cognitive development, schizophrenia, anxiety, irritability, vascular diseases, symptoms of ageusia; as well as the presence of tinnitus, hearing loss and vestibular difficulties (11)(12). Finally, it has been considered that the use of the vapor electronic cigarette is in affinity to know and experience new flavors and aromas, in addition, it is a product that influences the initiation of conventional cigarette consumption, not to initiate smoking cessation (8).

Taking into account the information found above, the research question arises: is organic dysphonia in adults generated by the use of vapor electronic cigarettes?

MATERIAL AND METHOD

The integrative systematic review was carried out following the parameters of the PRISMA statement where, initially, the databases were identified. The criteria and variables for the search for information were defined. The different studies were selected based on the inclusion and exclusion criteria, which provide greater ease to the process of evaluation of the quality and reliability of the studies and thus allowed to answer the research question posed above.

Next, the PICO model was used to construct the research question, because it made it possible to improve the specificity and conceptual clarity of the problem to be studied, as well as to carry out the search with greater precision, which influences the adequate collection of data to answer the problem question. It is important to clarify that the comparison section does not apply to this systematic review.

The quality of the evidence was classified and the strength of recommendation was graded using the GRADE system.

Research Question

According to the PIO model and the research topic proposed in Table 1, the following research question was obtained: is organic dysphonia in adults generated by the use of vapor electronic cigarettes?

Table 1. Research Questions

Component	Description
P (patient, problem of interest)	Vaporized electronic cigarette use in young adults and older adults
I (intervention)	Organic dysphonia
C (comparison)	Not applicable
O (outcome)	Risk factors

Source: own elaboration.

Inclusion Criteria

1. Articles that include young adults and older adults with voice conditions such as dysphonia or vocal cord dysfunction.
2. Articles that include young adults and older adults with alterations at the structural and functional level of the larynx and pharynx.
3. Articles related to dysphonia caused by the use of vapor electronic cigarettes in adults.
4. Articles that include studies of three-dimensional models in humans.
5. Open access articles.
6. Articles within a time window not exceeding 10 years.
7. Articles belonging to systematic reviews, clinical case studies, cross-sectional, meta-analysis, and multicenter research articles.

Exclusion Criteria

1. Articles that include topics unrelated to dysphonia or vocal cord dysfunction.
2. Articles related to dysphonia associated with tobacco use in adults.
3. Articles without access.
4. Articles within the window of time greater than 10 years.
5. Literature about reports, press releases, newspaper and news publications, book chapters, and abstracts.

Sources of Information

Key terms were selected from the descriptors in health sciences (DECS) and medical subject headings (MESH).

Table 2. DECS and MESH Descriptors

Source	Keywords	Related terms
DECS MESH	Electronic Nicotine Delivery Systems	Electronic Nicotine Delivery System Electronic Cigarettes, E-Cigs, E Cigs, E-Cig, E Cig, E-Cigarettes, E Cigarettes, E-Cigarette, E Cigarette, Electronic Cigarette, Cigarette, Electronic, Cigarettes, Electronic.
DECS MESH	E-Cigarette Vapor	E Cigarette Vapor, Vapor, E-Cigarette, Electronic Cigarette Vapor, Cigarette Vapor, Electronic, Vapor, Electronic Cigarette
DECS MESH	Vaping	THC Vaping, THC Vapings, Vaping, THC, Vapings, THC, E-Cig Use, E Cig Use, E-Cig Uses, Use, E-Cig, ECig Use, ECig Uses, Use, ECig, Vape, Vapes, E-Cigarette Use, E Cigarette Use, E-Cigarette Uses, Use, E-Cigarette, Nicotine Vaping, Nicotine Vapings, Vaping, Nicotine, Vapings, Nicotine, Ecigarette Use, Ecigarette Uses, Use, Ecigarette, Uses, Ecigarette, Electronic Cigarette Use, Cigarette Use, Electronic, Electronic Cigarette Uses, Use, Electronic Cigarette
DECS MESH	Dysphonia	Phonation Disorders, Phonation Disorder, Organic Tremor Dysphonia, Dysphonia, Organic Tremor, Spastic Dysphonia, Neurologic Adducter, Neurologic Adducter Spastic Dysphonia, Hyperkinetic Dysphonia, Dysphonia, Hyperkinetic, Spastic Dysphonia, Dysphonia, Spastic
DECS MESH	Vocal Cord Dysfunction	Dysfunction, Vocal Cord, Dysfunctions, Vocal Cord, Vocal Cord Dysfunctions, Paradoxical Vocal Fold Motion, Paradoxical Vocal Fold Motion Disorder, Exercise-Induced Vocal Cord Dysfunction, Exercise Induced Vocal Cord Dysfunction
DECS MESH	Voice	Voices
DECS MESH	Phonation	Phonations
DECS MESH	Vocal Cords	Cord, Vocal, Cords, Vocal, Vocal Cord, Vocal Fold, Fold, Vocal, Folds, Vocal, Vocal Folds, Vocal Ligament, Ligament, Vocal, Ligaments, Vocal, Vocal Ligaments
DECS MESH	Risk Factors	Factor, Risk, Risk Factor, Social Risk Factors, Factor, Social Risk, Factors, Social Risk, Risk Factor, Social, Risk Factors, Social, Social Risk Factor, Health Correlates, Correlates, Health, Population at Risk, Populations at Risk, Risk Scores, Risk Score, Score, Risk, Risk Factor Scores, Risk Factor Score, Score, Risk Factor

Source: Information obtained through DECS and MESH.

Search Strategies

A search strategy was developed using primary databases. Subsequently, search equations were designed based on the variables obtained previously. The equations were created using the logical operators AND/OR/NOT and symbols such as " " and ( ). The search was carried out in databases such as PubMed, ScienceDirect, SpringerLink, Cochrane, SciELO, Scopus, ProQuest, Dialnet and EBSCO, using the English language.

Table 3. Search for Equations

Database	Search Algorithm
PubMed ScienceDirect SpringerLink Cochrane SciELO Scopus ProQuest Dialnet EBSCO	("Electronic Nicotine Delivery Systems OR "E-Cigarette Vapor" OR "Vaping") AND ("Dysphonia" OR "Vocal Cord Dysfunction" OR "Voice" OR "Phonation" OR "Vocal Cords")
	("Electronic Nicotine Delivery Systems") AND ("Dysphonia") AND ("Pulmonary Disease, Chronic Obstructive")
	("Electronic Nicotine Delivery Systems") AND ("Phonation") AND ("Pulmonary Disease, Chronic Obstructive")
	("E-Cigarette Vapor") AND ("Vocal Cords") AND ("Pulmonary Disease, Chronic Obstructive")
	("E-Cigarette Vapor" OR "Electronic Nicotine Delivery Systems") AND ("Voice" OR "Vocal Cord Dysfunction") AND ("Pulmonary Disease, Chronic Obstructive")
	("Electronic Nicotine Delivery Systems" OR "E-Cigarette Vapor" OR "Vaping") AND ("Dysphonia" OR "Vocal Cord Dysfunction" OR "Voice" OR "Phonation" OR "Vocal Cords")
	("Electronic Nicotine Delivery Systems") AND ("Dysphonia")
	("Electronic Nicotine Delivery Systems") AND ("Vocal Cord Dysfunction")
	("Electronic Nicotine Delivery Systems") AND ("Voice")
	("Electronic Nicotine Delivery Systems") AND ("Phonation")
	("Electronic Nicotine Delivery Systems") AND ("Vocal Cords")
	("E-Cigarette Vapor") AND ("Dysphonia")
	("E-Cigarette Vapor") AND ("Vocal Cord Dysfunction")
	("E-Cigarette Vapor") AND ("Voice")
	("E-Cigarette Vapor") AND ("Phonation")
	("E-Cigarette Vapor") AND ("Vocal Cords")
	("Vaping") AND ("Dysphonia")
	("Vaping") AND ("Vocal Cord Dysfunction")
	("Vaping") AND ("Voice")
	("Vaping") AND ("Phonation")
	("Vaping") AND ("Vocal Cords")
	("Electronic Nicotine Delivery Systems") AND ("Vocal Cord Dysfunction")
	("E-Cigarette Vapor") AND ("Voice" OR "Dysphonia")
	("Vaping") AND ("Vocal Cord Dysfunction" OR "Dysphonia")

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	("Electronic Nicotine Delivery Systems") AND ("Dysphonia" OR "Voice")
	("E-Cigarette Vapor") AND ("Vocal Cord Dysfunction" OR "Phonation")
	("Vaping") AND ("Vocal Cords" OR "Dysphonia")
	("Vaping") AND ("Vocal Cord Dysfunction OR "Voice")
	("Electronic Nicotine Delivery Systems" OR "E-Cigarette Vapor") AND ("Voice" OR "Dysphonia")
	("Vaping" OR "Electronic Nicotine Delivery Systems" OR "E-Cigarette Vapor") AND ("Vocal Cord Dysfunction" OR "Phonation") AND ("Risk Factors")
	("Electronic Nicotine Delivery Systems" OR "E-Cigarette Vapor" OR "Vaping") AND ("Dysphonia" OR "Vocal Cord Dysfunction" OR "Voice" OR "Phonation" OR "Vocal Cords") AND ("Risk Factors")
	("Electronic Nicotine Delivery Systems") AND ("Dysphonia") AND ("Risk Factors")
	("Electronic Nicotine Delivery Systems") AND ("Vocal Cord Dysfunction") AND ("Risk Factors")
	("Electronic Nicotine Delivery Systems") AND ("Voice") AND ("Risk Factors")
	("Vaping") AND ("Voice") AND ("Risk Factors")
	("Vaping") AND ("Phonation") AND ("Risk Factors")
	("Vaping") AND ("Vocal Cords") AND ("Risk Factors")
	("E-Cigarette Vapor") AND ("Dysphonia") AND ("Risk Factors")
	("E-Cigarette Vapor") AND ("Vocal Cord Dysfunction") AND ("Risk Factors")
	("E-Cigarette Vapor") AND ("Voice") AND ("Risk Factors")
	("Vaping" OR "Electronic Nicotine Delivery Systems") AND ("Voice" OR "Vocal Cords")
	("E-Cigarette Vapor" OR "Electronic Nicotine Delivery Systems") AND ("Vocal Cord Dysfunction" OR "Dysphonia") AND ("Risk Factors")
	("E-Cigarette Vapor" OR "Vaping") AND ("Phonation" OR "Dysphonia")

Source: own elaboration

Characteristics of the Studies

In this section, studies characterized by including the use of vapor electronic cigarettes or nicotine delivery systems in young adults and older adults were classified, in addition to articles showing the affectation of the vocal cords, voice, structural and functional alterations in the larynx and pharynx due to the use of vapor electronic cigarettes to develop the research topic.

Selection and Analysis

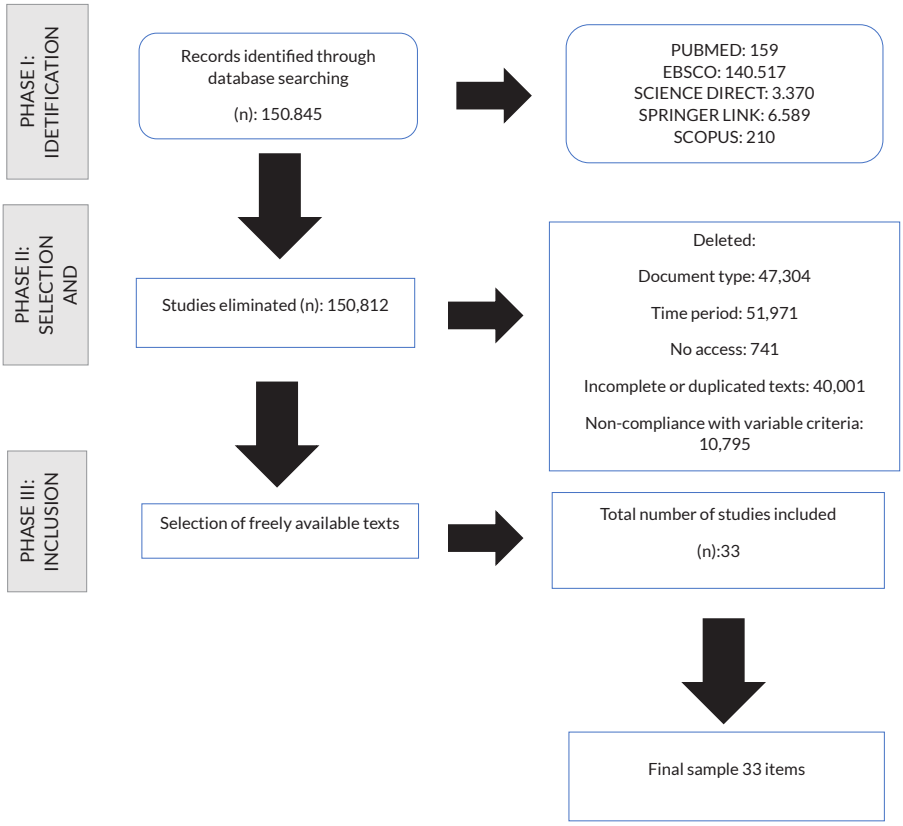
A selection of studies was considered taking into account the inclusion criteria, the characterization of the population, the type of study, the access to the article, and the year of publication of the study. Next, an article registration table in Excel, designed by the author, was organized independently, in which the key elements of each of the selected studies were established, as well as the title, authors, methodology, contribution of the study, and its references. On the other hand,

the process of study identification, study screening, eligibility, and inclusion of articles, followed and based on the structure of the PRISMA statement, was described.

GRADE pro-GDT was used through the clinical management question, including in the analysis, number of studies, study design, risk of bias, inconsistency, indirect evidence, imprecision, and the degree of certainty of the study.

RESULTS

The study eligibility criteria were determined through the order established by the methodology, developing each of the phases of the PRISMA flowchart.



Source: Bravo, 2020.

Figure. PRIMA Diagram

Table 4. Filters Applied

Data Base	Total number of articles	Type of document	Time period	Incomplete or duplicate articles	No access	Non-compliance with variable criteria	Selected articles
PUBMED	159	53	0	44	28	25	9
EBSCO	140.517	41.409	51.261	37.504	640	9.694	9
SCIENCE DIRECT	3.370	1.098	8	1.621	26	613	4
SPRINGER LINK	6.589	4.680	699	770	6	428	6
SCOPUS	210	64	3	62	41	35	5
Total	150.845	47.304	51.971	40.001	741	10.795	33

Source: own elaboration.

Selection and Elimination Phase

The initial selection of the articles for the development of the research was carried out by reading titles and abstracts, then the introduction of each article, allowing the detection of the most relevant studies about the research topic, with 33 articles. The results obtained from each cross-checking of variables in English are set out below, for the five databases PubMed, EBSCO, ScienceDirect, SpringerLink, and Scopus.

Table 5. Results of the English Language Crosses in the Databases

Variable Crossovers	PubMed	EBSCO	ScienceDirect	SpringerLink	Scopus
Electronic Nicotine Delivery Systems + E-Cigarette Vapor + Vaping + Dysphonia + Vocal Cord Dysfunction + Voice + Phonation + Vocal Cords	8	0	2	0	5
Electronic Nicotine Delivery Systems + Voice	0	0	0	2	0
Electronic Nicotine Delivery Systems + Vocal Cords	0	1	0	0	0
E-Cigarette Vapor + Vocal Cord Dysfunction	0	1	0	0	0
Vaping + Voice	0	1	0	0	0
Electronic Nicotine Delivery Systems + Dysphonia + Pulmonary Disease, Chronic Obstructive	0	1	0	0	0

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E-Cigarette Vapor + Electronic Nicotine Delivery Systems + Voice + Vocal Cord Dysfunction + Pulmonary Disease, Chronic Obstructive	0	5	0	0	0
E-Cigarette Vapor + Phonation	0	0	2	0	0
Electronic Nicotine Delivery Systems + Dysphonia					
E-Cigarette Vapor + Voice	0	0	0	2	0
Vaping + Vocal Cord Dysfunction	0	0	0	1	0
Vaping + Phonation	0	0	0	1	0
("Electronic Nicotine Delivery Systems") AND ("Voice")	1	0	0	0	0
Total	9	9	4	6	5

Source: own elaboration.

We analyzed the outcomes of the effects of the use of vapor electronic cigarettes on the voice, such as irritation and inflammation of the vocal cords, which included two studies with a moderate degree of certainty, followed by a study on low voice pitch, with a high degree of certainty; followed by a study of vocal cord injury, laryngopharyngeal reflux, saburral tongue, base of tongue hypertrophy, left arytenoid cartilage hypertrophy, erythema and laryngeal edema, yielding a moderate degree of certainty; followed by a study of hoarseness, shortness of breath and voice weakness, yielding a high degree of certainty; followed by a study of hoarseness, breathlessness and voice weakness, yielding a high degree of certainty; followed by a study of pharyngeal irritation, yielding a moderate degree of certainty; followed by a study of pharyngeal itching and dehydration, coughing and choking, yielding a high degree of certainty; followed by a study of increased fundamental frequency, shimmer, jitter and hoarseness, yielding a moderate degree of certainty; Then, there is a study about the increase of the fundamental frequency of the spoken voice, giving a moderate degree of certainty; finally, a study about the lesion of the epithelial cells of the mucosa of the vocal cords is established, giving a high degree of certainty.

Table 6. Classification of the Quality of Evidence

Certainty assessment							N°of patients		Effect		Certainty	Importance
N° Of studies	Study design	Risk of bias	Inconsistency	Indirect evidence	Imprecision	Other considerations	[intervention]	Electronic cigarettes	Relative (95% ci)	Absolute (95% ci)		
Vocal cord irritation (evaluated with acoustic voice analysis)												
1	Observational studies	Not serious	Not serious	Not serious	Not serious	Strong association		0.0%	Not estimable		⊕⊕⊕◯ Moderate	
Low voice pitch (time of exposure: range 2017 years to 2018 years; assessed with cross-sectional and multicenter survey)												
1	Observational studies	Not serious	Not serious	Not serious	Not serious	Strong association Dose-response gradient	300 patients surveyed				⊕⊕⊕⊕ High	
Vocal cord injury, laryngopharyngeal reflux, saburral tongue, hypertrophy of the base of the tongue, hypertrophy of the left arytenoid cartilage, erythema and laryngeal edema (evaluated with: Laryngoscopy).												
1	observational studies	not serious	not serious	not serious	not serious	strong association	Laryngeal and pharyngeal lesions that develop laryngopharyngeal carcinoma. In turn, they generate lesions to the anatomical structures of the voice developing dysphonia as an effect.				⊕⊕⊕◯ Moderate	
Hoarseness, shortness of breath, voice weakness (evaluated with anonymous questionnaire)												
1	Observational studies	Not serious	Not serious	Not serious	Not serious	Strong association All possible residual confounding factors could reduce the demonstrated effect	42 cases 392 Controls		not estimable	-	⊕⊕⊕⊕ High	
							-	0.0%				
Pharyngeal irritation (evaluated with randomized crossover trial)												
1	Observational studies	Not serious	Not serious	Not serious	Not serious	Strong association	16 patients evaluated.				⊕⊕⊕◯ Moderate	
Itching and dehydration of pharynx, coughing and choking (assessed by personal survey)												
1	Observational studies	Not serious	Not serious	Not serious	Not serious	Strong association Dose-response gradient	The drip method of recharging the vapor electronic cigarette generates the release of free radicals and the combustion process negatively affects the anatomical structures of the voice.				⊕⊕⊕⊕ High	
Increased fundamental frequency, shimmer and jitter, hoarseness (evaluated with voice Handicap index, subjective voice analysis PRAAT).												
1	Observational studies	Not serious	Not serious	Not serious	Not serious	Strong association			Not estimable		⊕⊕⊕◯ Moderate	
Vocal cord irritation and inflammation (evaluated by laryngoscopy)												
1	Observational studies	Not serious	Not serious	Not serious	Not serious	Strong association	17 cases 0 Controls		not estimable	-	⊕⊕⊕◯ Moderate	
							-	0.0%				
Increase of the fundamental frequency of the spoken voice (evaluated with: vocalab4)												
1	Observational studies	Not serious	Not serious	Not serious	Not serious	Strong association	0 cases 0 controls		Not estimable	-	⊕⊕⊕◯ Moderate	
							-	0.0%				
Epithelial cell injury of the vocal fold mucosa (evaluated with three-dimensional model of the human vocal fold mucosa)												
1	Observational studies	Not serious	Not serious	Not serious	Not serious	Strong association Dose-response gradient			Not estimable		⊕⊕⊕⊕ High	

Source: Retrieved from Grade System3.3.

Phase of Inclusion

The selection of the articles was made after reading the titles and summaries of the studies, which in turn, were analyzed in their entirety by performing a complete reading of each article and applying the corresponding criteria that allowed the selection, thus obtaining the studies that objectively respond to the research question initially posed, with a final selection of 33 articles.

Table 7. Selection of Studies

N	Database	Title	Author	Year	URL	Contribution
1	PUBMED	Exposure to e-cigarette vapor extract induces vocal cord epithelial injury and triggers intense mucosal remodeling.	Vlasta Lungova, Kristy Wendt, Susan L. Thibeault.	2022	(4) (accessed May 15, 2023)	Contributed to determining the chemical content of vapor e-cigarettes and the effect on the anatomical structures of the voice.
2	PUBMED	Cannabis-related side effects in otolaryngology: a scoping review.	Jobanjit S. Phulka, Joel W. Howlett, Amanda Hu.	2022	(2) (accessed May 15, 2023)	He reported the side effects produced by vapor electronic cigarettes at the structural level of the voice, such as the alteration of cell cycle regulation or the generation of rhinosinusitis.
3	PUBMED	The effect of electronic cigarettes on voice quality.	Birgül Tuhanioğlu, Sanem Okşan Erkan, Talih Özdaş, Çağrı Derici, Kemal Tüzün, Özgül Akın Şenkal.	2018	(1) (accessed May 15, 2023)	Contributed to the identification of the effects at the functional level caused by the use of vapor electronic cigarettes.
4	PUBMED	Cannabis inhalation and voice disorders: a systematic review.	Jiries Meehan-Atrash, Tetiana Korzun, Aaron Ziegler.	2019	(11) (accessed May 16, 2023)	Contributed to the knowledge of the effects and their severity on the voice caused by different cannabis derivatives.
5	PUBMED	Effects of electronic nicotine delivery system on the larynx: experimental study.	Ziya Salturk, Çağlar Çakır, Gürcan Sünnetçi, Yavuz Atar, Tolgar Lütfi Kumral, Güven Yıldırım, Güler Berkiten, Yavuz Uyar.	2021	(27) (accessed May 16, 2023)	He reported the effects of vapor e-cigarettes from vocal cord pathologies to the development of laryngeal carcinomas.
6	PUBMED	Vocal cord injury related to e-cigarette vaping: a case report.	Jérôme R. Lechien, Jean-François Papon, Christelle Pouliquen, Stéphane Hans.	2021	(14) (accessed May 16, 2023)	It contributed to establishing the damage and injuries caused at the structural level of the vocal cords in vapor electronic cigarette users.
7	PUBMED	The effect of smoking on the fundamental frequency of the spoken voice.	Marie Reine Ayoub, Pauline Larrouy-Maestri, Dominique Morsomme	2019	(21) (accessed May 18, 2023)	Reported on the alterations in the fundamental frequency produced by the consumption of different addictive chemicals in vapor electronic cigarettes.

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8	PUBMED	Cannabis use among patients with a voice disorder: a multicenter electronic survey study.	Aaron Ziegler, Tetiana Korzun, Andree-Anne Leclerc, Amanda I. Gillespie.	2023	(13) (accessed May 18, 2023)	It provided information about the gender predominance of cannabis use by vapor electronic cigarettes.
9	SCIENCE DIRECT	Electronic nicotine delivery system uses among U.S. adults, 2014.	Ralph S. Caraballo, Ahmed Jamal, Kimberly H. Nguyen, Nicole M. Kuiper, René A. Arrazola.	2014	(17) (accessed May 18, 2023)	Provided the prevalence of vapor e-cigarette use since 2014 in conventional cigarette users and adult nonsmokers.
10	SCIENCE DIRECT	Combinations of electronic nicotine delivery system device and liquid characteristics among U.S. adults.	Joanna E. Cohen, Jeffrey J. Hardesty, Qinghua Nian, Elizabeth Crespi, Joshua K. Sinamo, Ryan D. Kennedy, Kevin Welding, Bekir Kaplan, Eric Soule, Thomas Eissenberg, Alison B. Breland.	2022	(28) (accessed May 18, 2023)	Reported on the different combinations of chemicals and solvents found in vapor e-cigarettes.
11	SCOPUS	Vaping the poison: oral cavity cancer in a young adult with extensive electric cigarette use.	Klawinski Darren, Hanna Isa, Breslin, Nathaniel K. Katzenstein, Howard M. Katzenstein, Daniel J.	2020	(3) (accessed May 20, 2023)	He contributed to the identification of symptoms at the structural level that lead to pathologies such as laryngeal carcinoma caused by the use of vapor electronic cigarettes.
12	SCIENCE DIRECT	Global frequency and epidemiological profile of electronic cigarette users: a systematic review.	Martins. Beatriz Nascimento Figueiredo Lebre, Normando Ana Gabriela Costa, Rodrigues-Fernandes, Carla Isabelly, Wagner. Vivian Petersen Segundo Kowalski, Luiz Paulo Marqués, Sandra Silva, Marta, Gustavo Nader Junior, Gilberto de Castro Ruiz, Blanca Icíar Indave, Vargas Pablo Agustín Lopes, Marcio Ajudarte, Santos-Silva, Alan Roger.	2022	(8) (accessed May 20, 2023)	It contributed to the knowledge of the chemical components that reinforce the flavor and smell of the vapor electronic cigarette, as well as the percentage of its use in different countries.
13	SCOPUS	Clouds and "throat hit": effects of liquid composition on nicotine emissions and physical characteristics of e-cigarette aerosols.	Mohammad bassiria, Soha Taliha, rola salmana, Nareg Karaoghlaniana,Rawad Saleha, Rachel El Hageb, Najat Salibab, Alan Shihadeh	2017	(29) (accessed on May 20, 2023)	It contributed to the knowledge of the differences experienced by users of conventional cigarettes compared to the experience in the use of vapor electronic cigarettes.

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14	SCOPUS	A randomized trial of electronic cigarettes versus nicotine replacement therapy.	Peter Hajek, Anna Phillips-Waller, Dunja Przulj, Francesca Pesola, Katie Myers Smith, Natalie Bisal, Jinshuo Li, Steve Parrott, Peter Sasieni, Lynne Dawkins, Louise Ross, Maciej Goniewicz, Pharm. D, Qi Wu, Hayden J. McRobbie.		(6) (accessed May 21, 2023)	Contributed to the knowledge of the objective of the distribution and creation of vapor electronic cigarettes, which was to eradicate nicotine consumption.
15	PUBMED	Electronic cigarettes: a basic manual for physicians.	Hayley Nace, Michael Persky, Dennis H Kraus, Robert Peng, Milan R Amin, Ryan C Branski.	2015	(7) (accessed May 21, 2023)	I provide information about when vapor electronic cigarettes were created and distributed worldwide.
16	SPRINGER LINK	Clearing the air: protocol for a systematic meta-narrative review on the harms and benefits of e-cigarettes and vapor devices.	Marjorie McDonald,Renee O'Leary ,Tim Stockwell, Dan reist.	2016	(22) (accessed on May 21, 2023)	He reported on the general health damage caused by the use of vapor electronic cigarettes.
17	EBSCO	Electronic nicotine delivery systems.	Susan C. Walley, Brian P. Jenssen.	2015	(25) (accessed May 21, 2023)	It helped determine the increase in vapor e-cigarette use worldwide.
18	EBSCO	The dangers of vaping.	Raloff, Janet	2015	(18) (accessed on May 21, 2023)	Contributed to the identification of how the drip refill process of the vapor e-cigarette causes negative effects on people's voice due to the release of free radicals.
19	EBSCO	Concentrations of metals in liquids and aerosols from electronic cigarettes.	Olmedo P, Navas-Acien.		(30) (accessed May 21, 2023)	Contributed to the knowledge of metals found in vapor e-cigarette liquids and aerosols.
20	SPRINGER LINK	Government and public health responses to e-cigarettes in New Zealand: perspectives from vapers.	Trish Fraser, Marewa Glover, penélope Truman.	2018	(31) (accessed May 22, 2023)	It contributed to the identification of the means of regulating the use of electronic cigarettes in people and their personal opinions on the use of this device.
21	SPRINGER LINK	Motivations for use, identity and the vape subculture: a qualitative study of the experiences of Western Australian vapers.	Kahlia McCausland, Jonine Jancey, Tama Leaver, Katharina Lobo, becky Freeman, bruce maycock	2020	(9) (accessed May 22, 2023)	He reported the cause of preference for the use of vapor electronic cigarettes in adults, which is the selection and self-creation of flavors for the inhalation of the product.
22	SCIENCE DIRECT	Electronic cigarette (e-cigarette)	Erdinc Nayir, Burak KaracabeY, Bajo Kirca, Mustafa Ozdoganc.	2016	(20) (accessed May 22, 2023)	He provided information about the effects of vapor e-cigarette use without the addition of addictive chemicals.

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23	SPRINGER LINK	The effects of hookah/water pipe smoking on general health and the cardiovascular system.	Hanan Qasim, Ahmed B Alarabi, Karem H. Alzoubi, Zubair A. Karim, Fátima Z. Alshbool, Fadi T. Khasawneh.	2019	(24) (accessed May 22, 2023)	It contributed to the identification of water pipe use and the negative effects it causes on people's voices, being similar to vapor electronic cigarettes. In turn, it reported a higher percentage of prevalence of use by the female gender.
24	EBSCO	Pulmonary nontuberculous mycobacteria associated with vaping.	Chen L, Arens R. Chidambaram AG, Capponi S, Alshawa L, Claeys TA, Hayes D Jr, Robinson RT.	2021	(15) (accessed May 22, 2023)	It contributed to the knowledge of the different addictive chemical substances added to the vapor electronic cigarette and at the same time established the effects on the respiratory functions of the people who use this product.
25	SPRINGER LINK	Evaluation of two audio recording methods for remote collection of vocal biomarkers indicative of tobacco smoking harm.	Marewa Glover, Marie-France Duhamel.	2022	(32) (accessed May 22, 2023)	He reported on the damage to phonation caused by tobacco consumption in vapor electronic cigarettes, and they were evaluated by two methods to determine their efficacy.
26	EBSCO	Self-perceived disability associated with dysphonia and health-related quality of life in patients with asthma and chronic obstructive pulmonary disease: a case-control study.	Hurtado-Ruzza, Rafael Álvarez-Calderón Iglesias, Óscar Becerro-de-Bengoa-Vallejo, Ricardo Calvo-Lobo, César San-Antolín, Marta, Losa-Iglesias, Marta Elena Romero-Morales, Carlos López-López, Daniel.	2021	(16) (accessed May 23, 2023)	Contributed to the knowledge of the degree of severity of organic dysphonia in people.
27	EBSCO	An RCT of acute health effects in COPD patients after passive exposure to e-cigarette vaping.	Karin Rosenkilde Laursen, Jakob Hjort Bønløkke, Elisabeth Bendstrup, Merete Bilde, Marianne Glasius, Vibeke Heitmann Gutzke, Shamjad Puthukkadan Moosakutty, Anna-Carin Olin, Peter Ravn, Kirsten Østergaard, Torben Sigsgaard	2018	(19) (accessed May 23, 2023)	Contributed to the identification of the effects produced in people passively exposed to the aerosol emitted by the vapor electronic cigarette.

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28	EBSCO	Toxicity of electronic cigarettes: from periodontal disease to oral cancer.	Alexandra de Ágoraea, Ovidiu Dumitru Aungurencei, Ancut,de Goriuc3, Diana Diaconú Popa, Carmen Savin, Ioana-Cezara Caba, Simona T, Bianca Profire y Ioana M.	2022	(5) (accessed May 23, 2023)	It contributed to the identification of the structuring of vapor electronic cigarettes and in turn of the toxic components included in the odor and flavor solvents.
29	EBSCO	Health effects of electronic cigarette (e-cigarette) use on organ systems and their implications for public health.	Radhika Seiler-Ramadas, Isabell Sandner, Sandra Haider, Igor Grabovac, Thomas Ernst Dorner	2019	(26) (accessed May 23, 2023)	It contributed to the knowledge of the consequences at the general level on the health of individuals, as well as at the level of vocal health due to the use of vapor electronic cigarettes; and of the impact on public health of these consequences.
30	EBSCO	Effects of passive exposure to e-cigarette aerosol: a topical review.	Stuart-Aguiar, Alexandra Cervera-Rosado, Andrea Fuentes-Canto, Huchim-Lara, Oswaldo.	2022	(33) (accessed May 24, 2023)	He reported symptoms at the anatomical level caused by passive exposure to vapor e-cigarette aerosol.
31	EBSCO	Nicotine-related impurities in e-cigarette cartridges and refill e-liquids.	Flora, Jason W. Wilkinson, Celeste T. Sink, Kathleen M. McKinney, Diana L. Miller, John H.	2016	(10) (accessed May 24, 2023)	Contributed to the identification of chemical substances included in vapor electronic cigarettes, which are harmful to people's vocal health.
32	EBSCO	Vaping and Instagram: a content analysis of e-cigarette posts using the content appealing to youth (CAY) index.	Alpert JM, Chen H, Riddell H, Chung YJ, Mu YA.	2021	(23) (accessed May 24, 2023)	It contributed to the knowledge of the tastes and preferences of young adults and older adults regarding the use of vapor electronic cigarettes and the consumption of chemical substances through them.
33	SCIENCE DIRECT	The effect of marijuana on the voice: a pilot study.	Bailey Balouch, Ghiath Alnouri, Guillermo Valentino, Roberto T. Sataloff.	2022	(12) (accessed May 24, 2023)	Contributed to the identification of effects at the structural level of the vocal cords by the addition of marijuana in vapor electronic cigarettes.

Source: own elaboration.

Table 8. Characterization of Vocal Structure and Functionality by the Use of Electronic Nicotine Delivery Systems

Effect of the Use of Vapor E-Cigarettes	Structure
Hoarseness (1) (14) (3) (18) (12) Cough (33) (11) (3) (3) (24) (33) Pain (4) (11) (11) (14) (24) (12) Irritation (11) (3) (3) (18) (33) Coughing (2) (11) (11) (18) (12) Discharge (14) (3) (3) (24) (33) Dryness (2) (3) (3) (24) (12) Dysphonia (1) (14) (14) (18) (33)	True vocal cords
Coughing (33) (11) (14) (18) (12) Dryness (2) (3) (24) (33) Irritation (11) (11) (14) (14) (18) (12) Discharge (2) (14)(3) (24) (33)	Pharynx
Inflammation of epithelial cells and fibroblasts.	Vocal cord mucosa
Laryngopharyngeal carcinoma	Larynx and pharynx
Increased mass of vocal folds	Vocal cords
Hypertrophy of thyroid cartilage	Larynx
Edema	Larynx
Erythema	Larynx

Source: own elaboration.

Table 9. Characterization of Vocal Functionality by the Use of Electronic Nicotine Delivery Systems

Effect of the use of vapor e-cigarettes	Function
Voice quality, vocal weakness and low voice pitch (4) (1) (1)(11) (14) (21).	Voice qualities such as pitch, timbre, and loudness.
Fundamental frequency, Shimmer and high Jitter (4) (1) (11) (21).	Voice qualities such as pitch, timbre, and loudness.
Alteration in the elasticity of the vocal cords (4) (1) (1) (21). Vibratory changes of the vocal folds (4) (1) (11) (14) (21).	Voice qualities such as pitch, timbre, and loudness.

Source: own elaboration.

ANALYSIS AND DISCUSSION

The use of nicotine delivery systems, vaping or vapor electronic cigarettes have been rapidly accepted by young adults and older adults, who are aged 18 to 24 years and 35 to 56 years respectively, either to quit smoking or use conventional cigarettes or trying the different flavors combined with addictive chemicals such as nicotine or cannabis offered by this product, since they are attractive because of their shape, color and attractive taste like fruit or dessert (1)(3). In this way, users who use these products have not been made aware of the negative effects on health in general and even more importantly on the performance of their voice because these products have been sold to the market with the idea that they are not harmful and that they will bring positive changes in people's health. On the other hand, it is important to take into account that using vapor electronic cigarettes generates a high risk of developing laryngeal and pharyngeal diseases such as vocal carcinomas, Reinke's edema, irritation of the laryngeal mucosa, among others (6) (29)(2).

For this reason, it is necessary to identify and establish the different damages caused by the use of vapor electronic cigarettes both at anatomical and functional levels in the quality of people's voice (33)(4). Therefore, through the use of the questionnaire of vocal disability, which manages to assess the dysphonia perceived by the person, it has been possible to identify the most frequent symptoms presented by adults where it is highlighted that there is no predominance of gender; thus, the symptoms are hoarseness, chronic cough, irritation of the larynx, pain in the pharynx, dry mouth, throat clearing, increased secretions in the pharynx, shortness of breath, dryness and irritation of the pharynx and dysphonia due to muscular tension (3)(5)(9). It is important to mention that these symptoms are usually caused by uni- or bilateral vocal cord lesions, erythema, hypertrophy of the arytenoid cartilage, laryngeal edema, hypertrophy of the base of the tongue, saburral tongue or asymmetries in the vocal cords due to the use of vapor electronic cigarettes (6)(29)(8).

Similarly, it is essential to determine the consequences of vapor e-cigarettes directly on the mucosal structure of the vocal folds, which will also influence the functionality of the vocal folds; It should be kept in mind that the epithelial cells of the vocal cords are sensitive and susceptible to damage, and are also responsible for first coming into contact with harmful agents through the compact physical epithelial barrier, the production of mucus and cytokines responsible for innate

immunity against inorganic, organic and microbial pathogens, as in this case is the case of vapor electronic cigarettes (4)(9)(10)(11). In turn, they are responsible for protecting the lamina propria of the vocal cords that is located below the stratification of epithelial cells, thus, alterations in the epithelial barrier can cause inflammation of the larynx either mild or acute and likewise, will cause inflammation in the other anatomical structures of the larynx and pharynx. In this way, the alterations of the epithelial lesion to the mucosa of the vocal cords can be detected by the laryngeal maturational changes of the voice, the tendency to use more force and effort to make the voice emission (6)(29)(13).

Considering the above, exposure to e-cigarette vapor leads to the interruption of mucosal homeostasis and immune response, and epithelial erosion develops due to the accumulation of solvents in the intercellular spaces, which alters lipid metabolism and the properties of the plasma membrane of epithelial cells. Therefore, it is important to mention that active lipid production influences the maintenance of the phospholipid bilayer and vital mucosal functions (12)(14)(15)(4). Therefore, in response to the damage, an expansion of basal cells develops, and cytokeratin deposition increases, which leads to hyperplasia and thickening of the basal membrane, evidenced in the alteration of the mucosa of the vocal cords, which become thinner, but retains mucus clots on the epithelial surface as a defense mechanism (4)(13)(30).

In the same way, the vapor electronic cigarette, which contains lipid components in the solvents and are heated, adheres to the cellular surfaces of the mucosa, which generates a pathological accumulation of the various damages mentioned above, such as inflammation of the epithelial cells and fibroblasts (16)(14). Thus, the secretion of cytokines is activated proinflammatory, which is involved in allergic reactions and leads to inflammation of the mucosa of the vocal cords (4)(17). Thus, the lesions caused by the content and vapor of vapor electronic cigarettes to the vocal fold mucosa are of great magnitude, which can be identified in voice affections later on, at the same time that epithelial remodeling of the cells is to recover the optimal state of the vocal fold mucosa (27)(4)(3).

At the same time, vocal complaints such as vocal weakness and low voice tone have been detected, which have been associated with the use of cannabis or nicotine in vapor electronic cigarettes (19). It is important to mention that dysphonia can develop due to vibratory changes and alteration in the elastic properties of the vocal cords (4)(20)(4). Likewise, the darkening of the

vocal folds is due to their dryness, which is caused by irritation of the larynx affecting the free vibration of the vocal folds (2)(28)(21). Similarly, itching of the vocal folds is due to the recharging of electronic cigarettes to steam by dripping, which increases the production of free radicals, altering the production of steam and thus the quality of the voice (34)(4)(1).

In addition, acoustic analysis studies have identified that vapor electronic cigarettes have a negative influence on the acoustic and perceptual performance of the voice. Thus, 3 sustained productions of the vowel /a/ are evaluated at normal pitch and volume levels in people using vapor e-cigarettes (31)(17)(32). Thus, it has been determined that the fundamental frequency is at the upper limit of normality for people who use vapor electronic cigarettes, which indicates that the fundamental frequency is sensitive to change due to structural and physiological changes in the tension of the vocal cords (1)(21)(22). In addition to this, the increase of the mass in the vocal folds implies a load on the laryngeal muscles during a short or extended conversation; therefore, the fundamental frequency is increased in this situation (31)(32)(28).

Now, in the acoustic analysis, Jitter and Shimmer are the two measures that indicate the level of disturbance in the voice signal, likewise, they identify the variation of the frequency and amplitude, and in turn, they are related to the symptoms of hoarseness in the voice quality (31)(32). Having this clear, it is established that the Shimmer is increased when there is edema in the epithelium of the vocal cords, which reduces the glottic resistance (23)(3). As for, Jitter and Shimmer values are higher in users of vapor electronic cigarettes than in non-smokers and this is due to an asymmetric vibration of the vocal cords (24)(26)(18). Next, no negative effects on the harmonic-noise ratio are evidenced in users of electronic cigarettes vapor e-cigarettes (31)(24). However, vapor electronic cigarettes should not be established as beneficial for vocal health (27)(7)(4).

Taking into account the above, the amount of damage caused by vapor electronic cigarettes is immeasurable since, unfortunately, the anatomical structures are affected, resulting in alterations of voice functionality, evidenced precisely in alterations of voice qualities such as timbre, tone, intensity, rhythm and prosody (21)(32)(6). In addition to this, there are different symptoms of pain, irritation, and inflammation, which can trigger a laryngeal infection and in the most serious cases generate laryngeal carcinomas, which have had a fatal outcome in people who use vapor electronic cigarettes (6)(29)(33). Importantly, the risk of developing this type of cancer is

even higher in people who consume more than 3 full doses per day by vapor e-cigarette with any addictive chemical substance added (27)(25)(33)(4).

CONCLUSIONS

It has been identified and verified that, the short and long-term use of vapor e-cigarettes with different addictive substances added, negatively and greatly influence the vocal health of young adults and older adults, due to, the temperature of the vapor e-cigarette, the combustion generated in it and the different chemical substances contained in the vapor inhaled by the user, which influences the generation of different laryngeal and pharyngeal pathologies such as the development of organic dysphonia that develops into functional dysphonia and fatal diseases including laryngopharyngeal cancer. Likewise, the body posture of the person will influence the increase of the development of the pathology.

Also, it is important to keep in mind that the effect of the addictive chemical substance added to the vapor e-cigarette, whether nicotine or cannabis derivatives, impacts differently on the structures involved in voice emission. Thus, cannabis is the product that affects the laryngeal and pharyngeal structures in the greatest quantity and in the shortest time of consumption, and thus, the qualities of the voice are affected quickly, on the contrary, nicotine causes negative effects at a structural and functional level, but in a gradual manner.

The effects produced by the use of the vapor electronic cigarette can be at a structural level, thus, lesions are produced in the larynx and pharynx that cause symptoms such as irritation, inflammation, itching, and pain. In addition, there are effects at a functional level, where the values of the Shimmer, Jitter, and fundamental frequency, thus negatively modifying the qualities of people's voice.

The use of vapor electronic cigarettes increases the risk factor for the development of dysphonia in people. It should be noted that the vapor electronic cigarette over the years has had an increase in its use, taking into account that the different and varied substances added to the product make it even more attractive to users. Added to this, it has been established as a product that does not cause harm to health in general.

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