# INFLUENCE OF INTRINSIC FACTORS IN VOICE PRODUCTION OF ELEMENTARY SCHOOL TEACHERS

## *Influencia de los factores intrínsecos en la producción de la voz de docentes de educación básica primaria*

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**ABSTRACT**

**Purpose:** the aim of this study is to determine the intrinsic factors affecting the production of the voice of teachers in basic primary. **Methods:** conducted an investigation of quantitative approach, correlational non experimental design of cross-section type. Applied an instrument consisting of a questionnaire for self-registration, and the other filled out by the evaluator to 90 teachers belonging to the public school network. The statistical analysis was performed using SPSS software. **Results:** it was observed that intrinsic factor that influences the vocal production is laryngitis. Other agents are recognized as associated factors, i.e., by if alone do not cause vocal disorders. **Conclusions**: teachers are a population of difficult access and little interested in their vocal health. This study allowed identifying cofactors in the pathogenesis of vocal disorders and establishes priority intervention thereof, i.e. the approach should be aimed at the Elimination of triggers and the associated mitigation.

**KEYWORDS**: Voice; Faculty; Occupational Health; Risk Factors; Dysphonia

## INTRODUCTION

Most definitions of the voice concept fall short because they are limited to the physiological aspect of voice production, without considering the biopsychosocial factors involved. In this order of ideas, voice is defined as the *voluntary* sound produced by the vocal folds as during the process of expiration. This sound is amplified and modulated in the resonance cavities and regulated by the hearing system. The voice produced is projected according to the intention of the speech and the communication context in order to impact a receptor. This integral vision of the voice involves various intervening systems and is helpful for the understanding of etiology of voice disorders.

The voice is not only considered the most effective means for communication. For several people, the voice is also their work tool; teachers, for instance, are part of this group of professionals who work with their voice and become real voice athletes[1].

Teachers speak during long hours in classrooms packed with students where the acoustic conditions are not the best. They are exposed to various ranges of temperatures and other external factors. Furthermore, the role played by teachers consists not only in transmitting knowledge but also in the achievement of an effective teacher-student dialog. With their voice, teachers capture the attention of students[2], motivate and admonish them, if necessary. All these actions are carried out with the constant use of the voice and the various nuances given to it.

Therefore, the professional use of the voice requires adapting the functions of the larynx to the demands imposed by the events occurring at work and social levels. Each profession requires the management of the voice in different ways. Teaching requires a high level of personal strength to withstand fatigue and, contrary to other opinions[3] it requires the involvement of certain aesthetic elements.

Due to the prolonged and inadequate utilization of the vocal function, voice disorders are commonly

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Conflict of interest: non-existent

found in these professionals [4-7] being the main cause of labor-related absenteeism[8,9]. These conditions are the result of several factors[10-13] related to the integrating work of the larynx and its mechanism. The following are the factors are associated to vocal risk, according to the literature: teaching-related conditions, workplace factors (noise, temperature, classroom size, acoustic conditions, and chemicals), and intrinsic factors embodied as individual characteristics[14,15] (disease, muscle tone, posture, stress, emotions, habits).

Some studies [16-18] describe the impact of the work environment on the acquisition of vocal pathologies among teachers. However, few research works have focused on the association between individual factors [19] and the voice of teachers.

Therefore, the objective of this research project is to determine the intrinsic factors affecting the voice of elementary school teachers.

The following variables are considered in this study: age, gender, height, vocal habits, stress, personality, work history, pathological history, larynx anatomy, skeletal muscle assessment, posture, and hearing level. All these aspects are correlated to the variable dysphonia.

## METHODS

This quantitative, descriptive, and correlation study has the following stages: initially, a characterization of the intrinsic factors in elementary school teachers was conducted and then, these factors were correlated to the variable Dysphonia (YES – NO). Therefore, a non-experimental and transversal model was designed with no manipulation of variables whose observation was made during specific moments.

The population sample was selected according to the following inclusion criteria: male and/or female teachers, with or without a vocal pathology, working as teachers in public schools in the city of Bucaramanga. This research started at the Municipal Secretariat of Education where the information about registered schools was reviewed. The database corresponding to 63 public schools without discriminating its type of education was analyzed based on the records kept in this office.

Each institution was contacted in order to select only the schools with primary education. Then, the number of teachers working in this level of education was determined: 1103 teachers.

The sample size was calculated based on a confidence level of 95% and a maximum acceptable error of 10%. The proceeding yielded a sample composed by 90 teachers. The sampling error is justified by the fact that many of the teachers selected did not participate in the study due to various reasons such as lack of time, lack of interest or transportation difficulties. Therefore, the selection of the study group was conducted based on non-probabilistic sampling techniques due to convenience reasons. The author is fully aware that this type of sampling cannot be used to draw generalizations (such as inferential estimations about the population) because there is not any certainty the sample being representative because not all the individuals of this population had the same probability of being selected.

The procedure to invite teachers to participate in this study involved the academic coordinator or the principal of the school. The teachers were informed about the objectives and content of the research project and they decided whether or not they wanted to participate. The teachers showing interest in participating had to sign a written consent as the ethical criterion dictates (Articles 6,14,15, and 16 of the Resolution 8430 of 1993).

Collection of data was completed by applying a compiled and adjusted survey tailored according to the needs of the researcher. This form is divided in two parts: the first part consists of a self-registration questionnaire and the second section is completed by the evaluator.

The following information is included in the first part: full name of the participating teacher, age, and sex. The first part also includes a questionnaire about intrinsic factors, as follows:

- Height[20]: The following categories are set: short: less than 1.50 m. average: 1.51 - 1.70 m. and tall: more than 1.70 m.
- Vocal habits[21]: teachers have to answer how often they do the following: screaming, smoking, drinking alcohol, clearing their throats, singing, eating or drinking very cold food or beverages, consumption of effervescent drinks or sodas and spicy food. The Likert Scale is used to determine the frequency, as follows: Always (100%); Almost Always (75%); Often (50%); Sometimes (25%) and Never (0%).
- Stress[22]: A 33-question survey was applied based on a psychosocial risk factor questionnaire designed by the Colombian Ministry for Social Protection, with some contributions from the International Work Organization. The instrument was first subject to a pilot study and consists of questions related to the physical and emotional health, family and labor relations, and the cognitive capacity for the correct execution of the duties assigned. The teacher has to answer each questions based on the Likert Scale (1: Never; 2: Sometimes; 3: Often; 4: Almost Always; and 5: Always). The score is obtained by adding up all the answers. The interpretation is made

as follows: 33-46: No stress is present; 34-66: Eustress (appropriate motivation is required to complete a complicated test or situation). 67-99: Slight stress present. 100 – 132: Moderate stress present; 199-165: Distress (inappropriate psychophysiological activation leading to failure. Distress results from a feeling of failure before making any effort).

- Personality: Four types of personality or temperament according to Hippocrates [23] are considered. This classification allows the researcher to have an approach to the way the teacher acts or see the world and other people, in order to determine some trend associated to the presence of dysphonia. It is worth highlighting that an organized personality study requires experience and skills from a professional in this area. The classification scale according to Hippocrates is: *Sanguine:* Individuals under this category are outgoing, sociable, and energetic. *Phlegmatic.* Phlegmatic persons are introverted, sober, impartial and tranquil. *Choleric:* Choleric individuals are aggressive, impulsive and get excited easily. *Melacholic.* Melancholic individuals are serious, rigid, and non-sociable. The teacher must select the closest type to his/her personality.
- Time served: The teacher indicates the time (in years) devoted to teaching.
- Pathological History: This question is included to find out if the teacher has been diagnosed with any of the following diseases: endocrine disorders (hyperthyroidism or hypothyroidism); Vascular disorders (hypertension or hypotension); Othorhinolaryngology disorders (laryngitis vocal nodules and polyps, contact ulcers, Reinke edema, laryngeal keratosis, and otitis); respiratory diseases (sinusitis, asthma, rhinitis); Metabollic diseases (diabetes and hypoglycaemia) and gastric diseases (gastroesophagic reflux).

The following aspects are evaluated in the Second Part:

- Larynx anatomy: Upward and downward movement of the larynx during saliva deglutition by palpation. The type of movement conducted is assessed as follows: with effort, smooth, and tense. The smooth movement is normal.
- Skeletal muscle evaluation[24]:The evaluation is conducted by palpation of the following muscles: trapezium, deltoid, sternocleidomastoid, omohyoid, scalenus, anterior muscles of the neck, digastric, and milohyoid. The box corresponding to the following characteristics are marked with an X to indicate that individuals conform to the characteristic: pain during palpation; tension, and presence of masses.

This question also evaluates the bipedalism and seated postures[25]. The following aspects are considered in bipedalism: projection of the cervical vertebrae, position of the chin in relation to the neck; projection of the jaw; projection of one shoulder; projection and alignment of shoulders; vertebral column alignment; projection of the chest; alignment of the hip; distribution of weight; voice support and knees. The signs above are also considered in the seated position as well as resting on the ischial bones and the position of the feet touching the ground.

- Indirect Laryngoscopy [26]: This exam is conducted in order to check the presence and coloration of masses in the free edge of the vocal fold.
- Audiometry: A hearing screening test was conducted for the following frequency value: 500, 1000, 2000, 3000, 4000 and 8000 hz. The Rivas Scale [27] was used for the interpretation of results. This scale indicates that normal hearing ranges between 0 – 20 decibels (dB), low hypoacusia: from 20 to 40 dB, Moderate hypoacusia: 40 – 60 dB, Severe hypoacusia 60 – 80 dB and cophosis more than 80 dB.

| **To be filled out by the teacher** | | | | | |
|---|---|---|---|---|---|
| I. INDENTIFICATION | | | | | |
| Names and surnames: | | | | Age: | |
| Identification No.: | | | | | |
| Sex: Female □ | Male □ | | | | |
| Occupation: | | | | Phone: | |
| Address: | | | | | |
| INTRINSIC FACTORS | | | | | |
| **a. Height:** | | | | | |
| Height: _____ m. | | | | | |
| Short □ | Average □ | | Tall □ | | |
| Ranges: Short (≤ 1.69 m), Average (1.69 – 1.89 m) and Tall (≥ 1.90) | | | | | |
| **b. Habits:** | | | | | |
| **Check with an "X" in the appropriate box considering that: Always means 100%, Almost Always, 75%; Often, 50%; Sometimes, 25%; and Never, 0%.** | | | | | |
| How often do you do the following in a week? | Frequency | | | | |
| | Always | Almost always | Often | Sometimes | Never |
| Scream | | | | | |
| Smoke | | | | | |
| Drink alcoholic beverages | | | | | |
| Clear your throat | | | | | |
| Sing | | | | | |
| Intake very cold drinks or beverages | | | | | |
| Intake very hot drinks or beverages | | | | | |
| Drink effervescent liquids or sodas | | | | | |
| Eat spicy food | | | | | |
| **c. Stress:** | | | | | |
| How often have you felt the following symptoms? | Frequency | | | | |
| | Always | Almost Always | Often | Sometimes | Never |
| Pain in the neck | | | | | |
| Backache | | | | | |
| Gastroesophageal reflux (Acid reflux) | | | | | |
| Gastritis (Ulcer) | | | | | |
| Abdominal Distension (Distended stomach after a meal) | | | | | |
| Constipation | | | | | |
| Diarrhoea | | | | | |
| Anxiety (Increase of appetite) | | | | | |
| Loss of appetite | | | | | |
| Flu | | | | | |
| Headache | | | | | |
| Drowsiness during the day | | | | | |
| Stay awake at night | | | | | |
| Chest Heartbeats (Tachycardia) | | | | | |
| Difficult family relations | | | | | |
| Difficult relations with your peer co-workers | | | | | |
| Difficult relations with your neighbors | | | | | |
| Difficult relations with students | | | | | |
| Feeling of work overload | | | | | |
| Forget things frequently | | | | | |
| Difficult concentration | | | | | |
| Feelings of frustration | | | | | |
| Tiredness, boredom, or apathy | | | | | |
| Decrease of performance at work or low levels of creativity | | | | | |

| |
|---|
| Wishing not going to work |
| Low commitment or low interest in your tasks. |
| Difficulty to make decisions |
| Wishing change employment |
| Feelings of loneliness and fear |
| Feelings of irritability, negative attitudes and thoughts |
| Feelings of anguish, concern, or sadness |
| Intake of medication to release tension or alleviate nervousness |
| Rigid behavior, stubbornness, or obstinacy |
| **d. Personality: Check with an "X" in the box corresponding to the closest description of your personality. Please, choose one option only.** |
| **Types of personality according to Hippocrates** |
| Sanguine: The personality traits of this type are extroversion, sociability and energy |
| Phlegmatic: Phlegmatic people are introverted, impartial, calm and tranquil. |
| Choleric: Choleric people are prone to react to emotions, aggressive and impulsive |
| Melancholic: serious, rigid, and non-sociable |
| **e. Time served as a teacher** |
| Years of service As a teacher: _____ years. |
| **f. Pathological history:** |
| Check with an "X" if you have been diagnosed with these illnesses Yes No Note |
| Hypothyroidism |
| Hyperthyroidism |
| Hypertension |
| Hypotension |
| Laryngitis |
| Vocal Nodules |
| Vocal polyps |
| Contact ulcers |
| Reinke's Oedema |
| Laryngeal Keratosis |
| Otitis |
| Sinusitis |
| Asthma |
| Rhinitis |
| Diabetes |
| Hypoglycemia |
| Other. Please, specify:_____ _____ _____ _____ |
| General notes: |

| **Instrument to be completed by the evaluator** | | | |
|---|---|---|---|
| **a. Ethnicity:** | | | |
| Caucasian □ | Black □ | | Mestizo □ |
| **b. Laryngeal Anatomy:** | | | |
| Upward movement of the larynx | With effort | □ | Smooth movement □ |
| | With Tension | □ | |
| Downward movement of the larynx | With effort | □ | Smooth movement □ |
| | With Tension | □ | |
| **c. Skeletal Muscle Assessment:** | | | |

| Muscle | Pain during Palpation | Tension | Masses |
|---|---|---|---|
| Trapezium | | | |
| Deltoid | | | |
| Sternocleidomastoid | | | |
| Omohyoid | | | |
| Scalenus | | | |
| Anterior muscles of the neck | | | |
| Digastric | | | |
| Milohyoid | | | |
| Notes: _____ | | | |

| **Posture alignment during the Voice Projection:** | | | | | |
|---|---|---|---|---|---|
| **0 = Never** | **1 = Almost Never** | **2 = Sometimes** | **3 = Almost Always** | **4 = Always** | |
| ¿How often do you remain seated in your work schedule? | 0 | 1 | 2 | 3 | 4 |
| ¿How often do you remain in the standing position in your work schedule? | 0 | 1 | 2 | 3 | 4 |

| **Posture in Bipedal Position:** | |
|---|---|
| Frontward position of the cervical vertebrae | Aligned shoulders with no tension |
| Balanced head without projection of the cervical vertebrae | Vertebral column with pronounced dorsal curvature |
| Elevated chin | Feeling of overextension of the vertebral column, without tension |
| Tilt chin | Frontward projection of the chest (military chest) |
| Chin forming a 90° angle with the neck | Non-convex chest |
| Frontward projection of the mandible | Displacement of the hip to one side |
| Backward projection of the mandible | Aligned hip |
| Distended and aligned mandible | Non-uniform weight distribution |
| Anterior projection of the shoulders | Weight distributed on both feet (20 - 30 cm of aperture) |
| Posterior projection of the shoulders | Abdominal support |
| Straight shoulders with no tension | Laryngeal support |
| Backward projection of the shoulders | Blocked knees |
| Downward position of one shoulder | Free knees |
| **Seated posture:** | |
| Frontward projection of the cervical vertebrae | Aligned shoulders with no tension |
| Balanced head without projection of the cervical vertebrae | Vertebral column with pronounced dorsal curvature |
| Elevared chin | Feeling of overextension of the vertebral column, without tension |
| Tilt chin | Frontward projection of the chest (military chest) |
| Chin forming a 90° angle with the neck | Non-convex chest |
| Frontward projection of the mandible | Displacement of the hip to one side |
| Backward projection of the mandible | Aligned hip |
| Distended and aligned mandible | Abdominal support |
| Anterior projection of the shoulders | Laryngeal suppport |
| Posterior projection of the shoulders | Back with support |
| Straight shoulders with no tension | Resting on ischium bones |
| Backward projection of the shoulders | Feet touching the ground |
| Downward position of one shoulder | |

| **d. Indirect Laryngoscopy:** | | | |
|---|---|---|---|
| Closure | Normal □ | Oval Glottis □ | |
| | Closure defect : Posterior □ | Longitudinal □ | |
| Color of Vocal Folds | White □ | Pink □ | |
| | Red Edge □ | Vascular network □ | |
| Free edge | Dentate □ | Free □ | Presence of a mass □ |
| Secretion | Yes □ | No □ | |
| *Pharyngeal cavity:* | | | |

| Mucosae | Color | White □ | Pink □ | Red □ |
|---|---|---|---|---|
| | Presence of mucus | Yes □ | No □ | |

Notes: _____

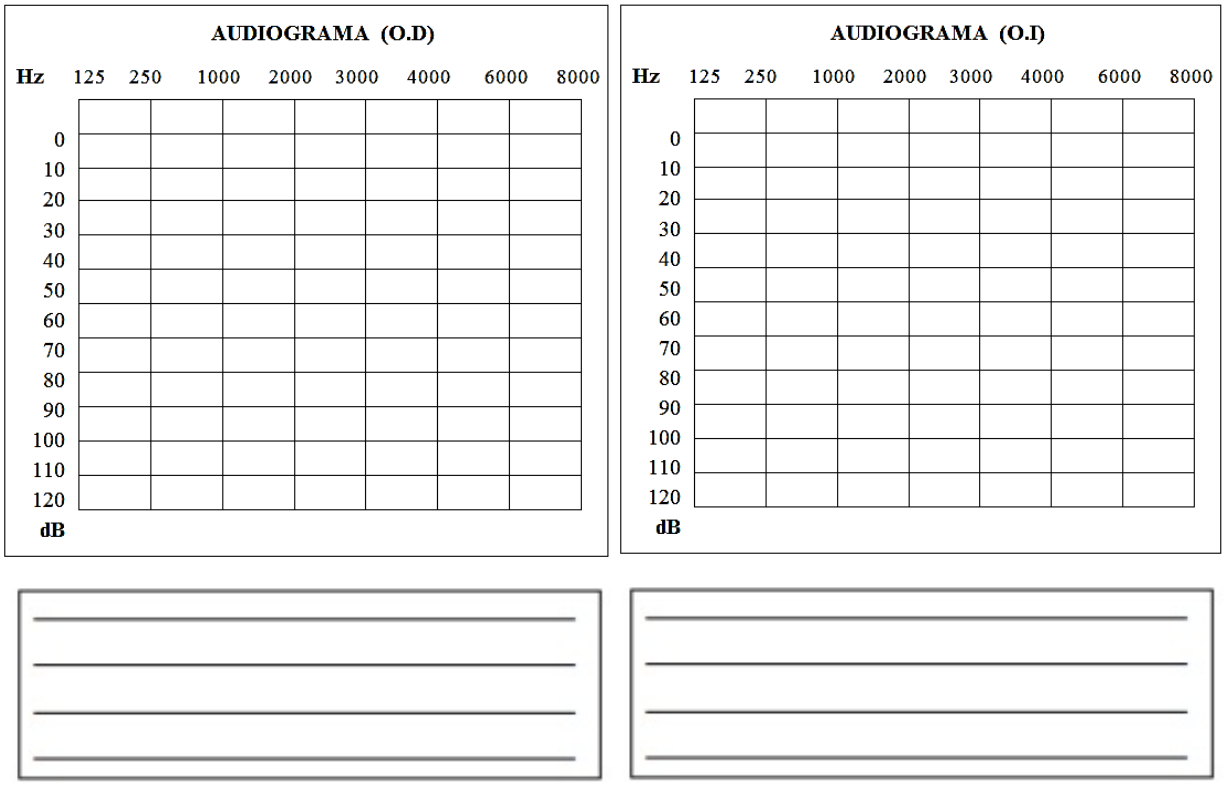
**e. Hearing:**

*Otoscopy:*

| | Right ear (OD) | Left ear (OI) |
|---|---|---|
| Color of the Tympanic membrane | Opaline □ Pink □ Hyperhemic □ | Opaline □ Pink □ Hyperhemic □ |
| Luminous cone | Absence □ Presence □ | Absence □ Presence □ |
| Tympanic membrane | Retracted □ Convex □ Normal □ | Retracted □ Convex □ Normal □ |
| Cerumen plug | Total □ Partial □ Absence □ | Total □ Partial □ Absence □ |

Notes: _____

*Audiometry:*




| Degree | Right ear (OD) | Left ear (OI) |
|---|---|---|
| 0 – 20 dB | | |
| 20 – 40 dB | | |
| 40 – 60 dB | | |
| 60 – 80 dB | | |
| Hearing aid | | |

**Figure 1 - Format for assessing intrinsic factors that influence teachers' voice**

The assessment conducted by the researcher and the completion of the self - registration form by the lecturer took 45 minutes.

Before the effective application of the instrument to the target population, a pilot test with 18 teachers was conducted in order to verify its effectiveness and practice the use of the instrument.

After all data were collected, the information was tabulated and analyzed using the PAWS (SPSS) statistical software, version 20. Central tendency measurements (mean, mode, and median) and variability measurements (rank and standard deviation) were calculated first. Then, a correlation of variables was conducted using chi-square. This test determines if there is a relation among the variables although it does not determine the degree of this relation or causality among them. The foundation is the following: if the chi – square value is greater than or equal to 0.05, the null hypothesis is accepted and the research hypothesis is discarded. This means that there is not any relation among the variables analyzed. If the value is less than 0.05, the null hypothesis is rejected thus accepting the research hypothesis. This means that there is a relation among the variables being studied.

## RESULTS

The instrument was applied to 90 basic primary education teachers who took 45 minutes to answer each survey. One teacher did not answer the Self-registration Form (this case is interpreted as a lost value). The descriptive results are presented below:

### Registration Questionnaire

The most frequent age is 52 years old (9 teachers). In average, the teachers are 50 years old and 50% of them are older than 52 years old. The deviation of data is 9.59 from the mean). These results indicate that the teachers are middle-aged adults (45-65 years old). The sex variable, 87.8 % of teachers are female and the remaining 12.2% are males. Regarding ethnicity, 71.1% of teachers are mestizo, that is, their physical appearance is a mixture of indigenous and white races that are characteristic of this region and sample. The remaining 28.9% are white. There is not any black teacher in the sample. The most common height of teachers is 1.60 m represented by 18.9% of the population. In average, the teachers are 1.59 m height and 50% of the teachers measure less than 1.60 m. The deviation of these data is 0.065 of the mean. This indicates that the teachers are average – height[20]. Regarding the vocal habits, the most repetitive information regarding vocal hygiene is “almost always” (57.8%). 40% of the teachers answered “sometimes”. There was not any teacher with answer “always” or “never”. Regarding the stress variable, the most common answer was “eustress” (66 teachers). The least frequent answer was “moderate stress” (1 teacher). There was not any teacher reporting absence of stress or distress. Regarding the personality variable, 57% of the teachers identified themselves as being sanguine; 36% reported to be phlegmatic; 1% choleric; and 6% melancholic. Regarding work history, the most repetitive value is 38 years (6 teachers). In average, the teachers have been working for 26 years and 50% of the teachers have been working for over 30 years in this profession. Data show a deviation of 10.3 of the median value. The interpretation of the “Pathological History” information (endocrine, vascular, Othorhinolaryngology, respiratory, and metabolic) a questionnaire inquires the presence or absence of these pathologies, as follows: has your doctor told you that you have this disease? (the answer can be yes or no). The detailed results are presented below. 5.6% report to have hypothyroidism while the remaining 93.3% do not have this pathology. There is not any teacher reporting to have hyperthyroidism. Regarding the vascular history, 4.4% report to have hypotension and 5.6% have hypertension. Regarding Othorhinolaryngology history, 48.9% have laryngitis; 3.3% report having been diagnosed with vocal nodules; and 2.2% report the presence of vocal polyps. One teacher says that he has been diagnosed with Laryngeal keratosis and other with contact ulcers. 48.9 of the teachers have or have had dysphonia and 13.3% otitis. Regarding their respiratory history, 16.7% report to have sinusitis, 6.7% asthma, and 30.0% rhinitis.

### Notes from the Evaluator

The laryngeal physiology variable evaluates the upward and downward movement of the larynx by direct observation and palpation. The following criteria are considered: movement with effort; smooth movement; and tense movement. The data shows predominance of the smooth upward and downward movement of the larynx (76.7% of the total population); 15.6% of the teachers have laryngeal movement with effort and 7.8% tense movement. Regarding the skeletal muscle evaluation, the researcher examines the following muscles by palpation (trapezium, deltoid, sternocleidomastoid, omohyoid, scalenus, anterior muscles of the neck, digastric, and milohyoid). Results are registered based on the following criteria: pain to palpation, tension – pain and pain and no feeling of tension or pain. The results are: Trapezium: 60%

show tension and 2.2% pain. Deltoid: 11.1% pain to palpation; and 3.3% tension upon evaluation; 85.5% do not show pain or tension. Sternocleidomastoid: 64.4% without any sign on palpation; 18.9% show no tension; 13.3% show pain during palpation; and 3.3% pain and tension. Omohyoid: most of the teachers do not show any sign of pain or tension in this muscle (85.6%). The remaining population report pain during palpation (5.6%), tension (4.4%) and pain plus tension (4.4%). Scalenus: 57.8% of teachers do not show any sign of tension or pain; 25.6% show tension; 10% pain and tension; and 5.6% pain during palpation. Anterior Muscles of the Neck: 83.3% of teacher do not have any sign of pain or tension; 8.9% pain; 6.7% tension; and 1.1% pain and tension. Digastric muscle: 92.2% of the teacher do not report any sign of pain or tension; 5.6% show tension; 1.1% pain during palpation and pain plus tension, respectively. Milohyoid muscle: 91.1% of teachers do not have any sign. 5.6% show tension; 2.2% pain during palpation; and 1.1% pain and tension.

The answers to the question "how long do you remain seated at work during your schedule?" can be: 0 = Never; 1= Seldom; 2 = sometimes; 3 = Almost Always; 4= always. The most repeated answer is 2 (sometimes). 50% of the teachers are below 2 (sometimes). In average, the teachers are allocated in 1.9 (between almost never and sometimes). These answers show a deviation of 0.6. There is not any teacher reporting to be always seated at work.

The study determines the frequency of the standing-up position during the work schedule, considering the same answer scale as above. The results indicate that the teachers remain stood up most of their working time. The most repeated answer is 3 (almost always). 50% of the teachers answered 3.0 = Almost Always. The average of the answers is 2.8 (between sometimes and almost always). The deviation in this case is 0.6. There wan not any answer 0 = never.

Regarding the posture variable, the following aspects are considered: the shoulder girdle show frontward projection with regard to the cervical vertebrae and tilt head without projection of the cervical vertebrae. In bipedalism, 86.7% of the teachers show their head balanced without projection of the cervical vertebrae. The remaining 13.3% show frontward projection of the cervical vertebrae. While in the seated position, 92.2% of the teachers show balanced head without any projection of the cervical vertebrae. The remaining teachers show frontward projection of the cervical vertebrae (7.%). *Chin.* Elevated chin is observed, deviated chin, 90-degree position of the chin and neck. During bipedalism. 83.3% of the teachers show a chin position forming a 90-degree angle with the neck; 8.9% elevated chin; and the remaining 7.8, deviated chin. In the seated position, 87.8% of the teachers show the chin forming a 90-degree angle with the neck; 7.8% show deviated chin; and the remaining 4.4%, elevated chin. *Jaw.* The criteria are: frontward projection of the jaw; backward projection of the jaw; and relaxed and aligned jaw. In bipedalism, 84.4% of teachers show a relaxed and aligned jaw; 10%, frontward projection of the jaw; and the remaining 5.6% show backward projection of the jaw. In the sitting position, 83.3% of teachers show a relaxed and aligned jaw; 12.2%, frontward projection of the jaw; and the remaining 4.4% show backward projection of the jaw. *Horizontal position of the Shoulders*. The criteria are: anterior projection of the shoulders; posterior projection of the shoulders, and neither projection nor tension in the shoulders. While in bipedalism, the predominant result is anterior projection of the shoulders (66.7%); 33.1% of the teachers show neither projection nor tension in the shoulders; and the remaining 2.2% show posterior projection of the shoulders. In the sitting position, 74.4% of the teachers show anterior projection of the shoulders and this position is the most frequent observation; the remaining 25.6% show neither projection nor tension in the shoulders. There was not any teacher showing posterior projection of the shoulders in the sitting position. *Vertical position of the Shoulders.* The criteria in this case are: upward projection of the shoulders; downward position of one shoulder; and aligned shoulders without tension. In bipedalism, the most frequent finding is the downward position of one shoulder (73.3%); 21.1% show aligned shoulders with no tension; the remaining 5.6% show upward projection of the shoulder. In the sitting position, the most frequent finding is the downward position of one shoulder (67.8%); the remaining population show aligned shoulders with no tension (31,1%) and upward projection of the shoulders (1.1%). *Vertebral Column.* The criteria are: excess of dorsal curvature; and feeling of extension of the vertebral column with no tension. In bipedalism, the most frequent finding is this feeling of extension of the vertebral column, with no tension (81.1%); the remaining 19.9% show vertebral column with excess of dorsal curvature. While seated, the most frequent finding is the feeling of extension of the vertebral column, with no tension (72.2%). The remaining 27.8% of teachers show vertebral column with excess of dorsal curvature. *Chest.* The criteria are: frontward projection of the chest (military chest) and non-projected chest. In bipedalism, the most frequent finding is non-projected chest (93.3%); the remaining 6.7% show frontward projection of the chest (military chest). While seated,

the most frequent finding is non-projected chest (95.6%) and the remaining 4.4% show frontward projection of the chest. *Hip.* the criteria in this case is displacement of the hip to one side and aligned hip while in bipedalism. In this case, the most frequent finding is aligned hip (84.4%) of the total population; the remaining 15.6% show displacement of the hip to one side. *Knee.* The criteria are blocked knees and free knee in bipedalism. In this case, 56.7% of the teachers show blocked knees in bipedalism and the remaining 43.3% show free knees. *Resting on Ischion bones:* This variable is evaluated in the sitting position, reporting if it is present or absent. 78.9% of the teachers rests on the ischion bones while seated and the remaining 21.1% do not rest on the ischion bones. *Feed touching the ground.* The survey evaluates if the teacher touches or do not touch the ground while seated. 86.7% put their feet on the ground while seated while 13.3% do not put their feet on the ground while seated.

The results of the indirect laryngoscopy were: visibility of the larynx is possible in 48.9% of the teachers; no visibility was possible in the remaining 51.1% due to the following reasons: 36.7% show anticipated nausea reflex (34 teachers). 6.7% show narrow laryngeal cavity; 5.6% showed high and rolled tongue; 1.1% reported irritation and pain during the examination. Finally, the hearing level was analyzed based on the examination of the air pathways with a frequency ranging from 500 to 8000 Hz. The results obtained are: Right Ear: the most frequent PTA (Pure Tone Average) is 8 Db (15 teachers). In average, the teachers show a hearing level of 13 Db and 50% of them show a hearing level below 12 Db. The deviation for these data is 7.9 of the median and this indicates that the lecturers are located in the normal hearing range (0 to 20 Db). 6 teachers show slight hearing loss. Left ear: The most frequent PTA is 7, 12, and 15 Db with 15 teachers for each tone (multimodal sample). In average, most of the teachers show a hearing degree of 14 Db and 50% show a hearing level below 12 Db. The deviation of this data is 11.2 of the mean and this indicates that the teachers are located within the normal hearing range (0-20 db). Four teachers show slight hearing loss; 3 teachers show moderate hearing loss and 1 teacher shows severe hearing loss. However, 82 teachers (91.11%) show conserved audition level, in other words, within the normal range.

**Inferential Analysis**

After the descriptive analysis, the most significant factors were selected to be correlated to the variable Dysphonia (YES – NO) using the chi – square test. The results are outlined below.

The relation between age and its options young adults (20-44 years old); middle – age adults (45-65 years old) and old adults (older than 65 years old) and dysphonia with the options Yes or No is shown in Table 1. The value is 0.489 (see Table 1) which indicates that the null hypothesis is accepted and the research hypothesis is rejected. Therefore, there is no relation between age and dysphonia according to these results. Two teachers did not write their age.

**Table 1 - Relationship between age and presence of dysphonia**

| | | Presence of dysphonia | | | |
|---|---|---|---|---|---|
| | | **YES** | **NO** | **Total** | ***p value** |
| **Age** | Young adult | 11 | 9 | 20 | 0.489 |
| | Middle-aged adult | 31 | 35 | 66 | |
| | Old adult | 1 | 0 | 1 | |
| **Total** | | 43 | 44 | 87 | |

* Chi-square Test

The relation of personality (with the options sanguine, phlegmatic, melancholic, and choleric) to Dysphonia (with the options yes or no) is determined (Table 2). The value is 0.407 (Table 2) which indicates that the null hypothesis is accepted and the research hypothesis is rejected. Therefore, there is no relation between personality and dysphonia according to these results.

**Table 2 - Relationship between personality and presence of dysphonia**

| | | Presence of dysphonia | | | |
|---|---|---|---|---|---|
| | | YES | NO | Total | *p value |
| Personality | Sanguine | 21 | 26 | 47 | 0.407 |
| | Phlegmatic | 20 | 15 | 35 | |
| | Melancholic | 2 | 4 | 6 | |
| | Choleric | 1 | 0 | 1 | |
| Total | | 44 | 45 | 89 | |

* Chi-square Test

The relation of stress with the options eustress (34-66), slight stress (67-99), moderate stress (100-132) and distress (165-199) to Dysphonia (with the options yes or no) is determined (Table 3). The value is 0.540 (Table 3) which indicates that the null hypothesis is accepted and the research hypothesis is rejected. Therefore, there is no relation between stress and dysphonia according to these results.

**Table 3 - Relationship between stress and presence of dysphonia**

| | | Presence of dysphonia | | | |
|---|---|---|---|---|---|
| | | YES | NO | Total | *p value |
| Stress Degree | Mild stress | 34 | 32 | 66 | 0.54 |
| | Moderate stress | 10 | 12 | 22 | |
| | Distress | 0 | 1 | 1 | |
| Total | | 44 | 45 | 89 | |

* Chi-square Test

The relation of the height of teachers (with the options tall, average, and short) to Dysphonia (with the options yes or no) is determined (Table 4). The value is 0.154 (Table 4) which indicates that the null hypothesis is accepted and the research hypothesis is rejected. Therefore, there is no relation between the height of teachers and dysphonia according to these results. One teacher did not write his height.

**Table 4 - Relationship between height and presence of dysphonia**

| | | Presence of dysphonia | | | |
|---|---|---|---|---|---|
| | | YES | NO | Total | *p value |
| Height | Low | 2 | 0 | 2 | 0.153 |
| | Mid | 42 | 44 | 86 | |
| Total | | 44 | 44 | 88 | |

* Chi-square Test

The relation of laryngitis (with the options yes or no) to Dysphonia (with the options yes or no) is determined (Table 5). The value is 0.000 (Table 5) which indicates that the research hypothesis is accepted and the null hypothesis is rejected. Therefore, there is relation between laryngitis and dysphonia according to these results.

**Table 5 - Relationship between presence of laryngitis and dysphonia**

| | | Presence of dysphonia | | | |
|---|---|---|---|---|---|
| | | YES | NO | Total | *p value |
| Record of laryngitis | YES | 31 | 13 | 44 | 0 |
| | NO | 13 | 32 | 45 | |
| Total | | 44 | 45 | 89 | |

* Chi-square Test

## DISCUSION

Voice disorders and their cause have been studied extensively. It is well known that a high percentage of teachers have health problems related to their voice and vocal cords. These problems, in turn, are determined by individual factors (age, sex, vocal habits, wrong voice use, and utilization of inefficient efforts in order to be heard). These factors are added to structural factors like: homework or assignments, noise, classroom acoustics, inappropriate conditions of moisture, temperature and ventilation, dust, age of students, amount of students per class, class schedule, stress, and lack of specific training[28]. Therefore, an association is established between these factors and oral pathologies. However, the conditions affecting the voice resulting in vocal disorders in teachers are not clearly identified.

Age is recognised as one of the agents impacting the general organic function. Voice changes occur during several stages of our life and this is due to development factors induced by hormonal changes. During maturity or adulthood, the voice characteristics developed after puberty and adolescence change until they reach their final condition. However, as time passes, the vocal folds lose elasticity and collagen, especially in women that experience the loss of high pitch tones and tend to lower the tones of their voice. In men, the voice tends to be kept in a better condition than in women[29]. Furthermore, some compensation mechanisms such as the supraglottal contraction are reported. The older the person, the more hypertension occurs in the voice mechanism. This fact is more frequent in females than in males[30]. Other paper[31] concludes that there is prevalence for voice disorders in old adults. Despite these findings, this research did not show correlation between age and sex to dysphonia. It is important to highlight that most of the teachers in the sample population were women. Very few men had signs of dysphonia.

Few research papers [32,33] link morphological traits (length of vocal folds, vocal tract, and height of person) to the vocal characteristics. Even though the morphological measurements do not allow a definite prediction regarding the voice classification, it is true that the general morphological characteristics vary according to ethnicity. It is likely that these variations represent an impact on the voice production mechanism, thus modifying voice qualities. However, our study does not show any relation between the height of a teacher and his/her ethnicity to the presence of dysphonia. It is worth highlighting the measurement of the ethnicity variable was conducted by conducting a comparative observation with a pattern. In this sense, future studies must include more specific measurements of anthropometric and craneometric features in order to classify participants in a more objective manner.

Smoking and having coffee or tea are risk factors for the appearance of vocal disorders[34]. In addition, frequent singing and the professional vocal work increase the risk for alterations of voice qualities. A review publication [35] dated August 2013 about the implication of caffeine as the cause or aggravating factor of countless otorhinolaryngological disorders such tinnitus, Ménière syndrome, laryngopharyngeal reflux, pharyngeal globe and dysphonia. There is little or no scientific evidence indicating that dysphonias are associated to caffeine consumption and, therefore, recommendations about avoiding the intake of caffeine must be changed.

The study "*Impact on Life Quality of Teachers after prevention actions designed to prevent voice disorders*" [36] states that educational actions have a positive impact on vocal quality of teachers. These actions include the orientations toward an appropriate practice of vocal hygiene: hydration during the work schedule, eating apples (they act as astringent agents on the vocal tract mucosae), vocal rest, avoiding bad habits for the voice such as talking with interference, screaming, clearing the throat, overload talking, use of mentol-based sprays or tablets, and constant ingestion of cold beverages. This program also included a vocal training program [36]. Vocal hygiene habits such as avoiding clearing the throat, hydration during voice exercise, vocal rest, avoiding the intake of cold beverages, wearing clothes protecting the throat against sudden temperature changes are positive actions for the voice [37].

It is therefore important to make changes to the vocal hygiene habits to include the strategies stated above. These good habits by themselves do not guarantee the maintenance of vocal quality and, conversely, their absence does not result in the presentation of vocal disorders. This information is consistent to the result of our study where no direct relation between bad vocal habits and dysphonia is found. Most teachers showed good habits and despite of that, half of them have experienced dysphonia.

Stress has been associated to the presence of vocal disorders [38]. A documentary review completed in March 2013 about the impact of stress on the voice, it was concluded that the effect of the fundamental frequency can explain the main findings related to the effect of exposition to stress. However, the review article proposes some guidelines for future studies[39]. Furthermore, a case and control study whose objective was to prove the association between voice disorders and work stress among public school teachers in Sao Paulo showed that there is a strong relation between stress and vocal disorders [40]. This conclusion differs from the findings in our study. This study included the application of two questionnaires: first, the conditions for voice production in teachers (PVC-P) is appropriate to characterize the conditions of the school environment and the vocal profile of the teacher. Secondly, the scale of stress at work (JSS) is an instrument that evaluates the dimension of the demand, control, and support tasks related to the sources of stress in the psychosocial work environment and the wearing – out resulting from the interaction. These questionnaires were applied by the evaluator. At present, there are many validated tools that determine the stress levels. It is important to select the tools that adjusts to the population the most so no bias is generated in the answers and in the registration section. Several authors state that there is a very close relation between certain characteristics of personality and certain modifications to voice qualities. If the voice expresses emotions, these can alter the voice. In addition, some symptoms of anxiety and depression have been observed in women suffering from functional dysphonia.

It has been discovered that the voice is a powerful predictor of the personality of the individual. Some authors think that it is possible to discover the personality of a person just by listening to him/her during 30 seconds. Hippocrates expressed that emotional factors influenced on the equilibrium of human beings in a great deal and he included this concept in his Humoral Theory: black bile, phlegm, yellow bile, and blood show correspondence to specific emotions. In fact, intervention programs, such as the psychogenic vocal therapy, have been designed that propose the identification and elimination of emotional and psychosocial problems associated to the initiation or continuation of the vocal problem. An intervention model is being developed since several years ago focusing on the field of voice psychology. This model orientates the treatment, not only to vocal technique work strategies but also including therapy to counteract anxiety, stress, depression, or contribute to the elimination of internal conflicts affecting vocal emission directly. Despite of these techniques, there are few structured reports to understand the manner by which phonoaudiologists evaluate the voice from its psychological component. It is reasonable to expect that psychologists and psychiatrists understand the terminology used by laryngologists and speech therapists because they work together.

No studies were found establishing an association between posture and voice disorders. However, there are some studies focusing on functional dysphonia rehabilitation based on posture control.

Considering the research results and the contrast made to available publications, a differentiation among risk factors and their incidence must be made. A risk factor is a condition or action that can cause a disease. Therefore, during the course of disease, several risk factors are recognized according to their action. The main or triggering factors in this case are those whose presence or absence can determine the appearance of vocal alterations. The associated factors act by modulating the main risk factor. The associated factors include the teacher's health related factors such as individual physical constitution, clinical history, and toxic habits; the risk factors related to the professional profile and environment – related risk factors[3]. Therefore, the intrinsic factors of teachers are not directly related to the presence of dysphonia. They are associated elements that cannot generate vocal disorders by themselves, except laryngitis that is considered as a triggering factor. The lack of voice techniques is one of the possible main factors for dysphonia in teaching professionals[3]. This study has contributed to the identification of co-factors in the ethiopathogenesis of vocal disorders and the establishment of priority intervention of these disorders, i.g., the objective of the approach must be the elimination of triggering factors and the mitigation of associated factors.

## CONCLUSIONS

The results of this research work whose objective is to determine the intrinsic factors intervening in voice production of elementary school teachers,

it is concluded that laryngitis is the intrinsic factor affecting vocal production in the studied population. The other agents are recognized as associated factors, that is, they do not cause vocal disorders by themselves.

Regarding descriptive data, this study concludes that the prevalent age is middle adulthood and that females are prevalent over males.

Most of the teachers have good vocal hygiene habits and eustress.

In average, teachers have been working in this field for 26 years.

Regarding the posture, the teachers tend to remain standing during phonation for long periods of time with a tendency toward correct posture. During the evaluation of the laryngeal structure by indirect laryngosopy, the larynx was not visible in half of the population studied.

Most of the teachers have hearing levels that falls between normal parameters.

**RESUMEN**

**Objetivo:** el objetivo de este estudio es determinar los factores intrínsecos que influyen en la producción de la voz de los docentes de básica primaria. **Métodos:** se llevó a cabouna investigación de enfoque cuantitativo, tipo correlacional con un diseño no experimental de corte transversal. Se aplicó un instrumento constituido por un cuestionario de autoregistro y otro diligenciado por el evaluador a 90 docentes pertenecientes a la red de escuelas públicas. El análisis estadístico se realizó mediante el software SPSS. **Resultados:** se observó que el factor intrínseco que influye en la producción vocal es la laringitis. Los otros agentes son reconocidos como factores asociados, es decir, por si solos no causan desórdenes vocales. **Conclusiones:** los docentes son una población de difícil acceso y poco interesados en su salud vocal. Este estudio permite identificar los cofactores en la etiopatogenia de los desórdenes vocales y establecer la intervención prioritaria de los mismos, es decir, el abordaje debe tener como objetivo la eliminación de los factores desencadenantes y la mitigación de los asociados.

**DESCRIPTORES:** Voz; Docentes; Salud Laboral; Factores de Riesgo; Disfonía

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Received on: July 10, 2013
Accepted on: December 22, 2013

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