

# Survey of Voice Acoustic Parameters in Iranian Female Teachers

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**Summary: Objectives.** Teachers are one of the professional voice users. Voice problems are common among them. Female teachers are known to have more voice problems than male ones. Furthermore, there are only few studies on the voice of Iranian female teachers. The present study investigated the acoustic parameters of voice in Iranian female teachers and compares them with nonteachers.

**Methods.** In this cross-sectional study, 90 Iranian female elementary teachers, 30–50 years old, and 90 Iranian female nonteachers in the same age were assessed between May 2010 and October 2011. Data collection was carried out, using the *Dr. Speech* software (subprogram: vocal assessment Version 4.0 from Tiger Electronics) at the speech therapy clinic under a comfortable phonation. Normal voice in practitioners was judged by the perceptual evaluation by a voice therapist and indirect laryngoscopy examination by an otorhinolaryngologist. Voice characteristics were assessed with GRBAS scale. The speech sample was sustained /â/ using habitual and constant vocal for 10 seconds. Three tokens from each subject were obtained. Then, each subject was asked to read a standard passage in Farsi. Eventually, the difference measures of  $F_0$ , jitter, shimmer, harmonic to noise ratio (HNR), and maximum of phonation time (MPT) between two groups were investigated by statistics software *SPSS 19.0* (IBM corp.2010).

**Results.** Results showed that the values of  $F_0$  were higher in teachers (210.03 Hz) than in nonteachers (194.11 Hz;  $P < 0.001$ ). In addition, the values of perturbation measures were greater in teachers (jitter 0.32% and shimmer 4.63%) than those in the control group (jitter 0.22% and shimmer 3.15%;  $P < 0.001$ ), but in HNR and MPT values, nonteachers showed higher levels ( $P < 0.001$ ). The value of HNR in teachers was ( $18.84 \pm 1.56$ ) but it was ( $21.3 \pm 1.73$ ) in non-teachers and MPT value in teachers was ( $16.83 \pm 3.65$ ) and in non-teachers was ( $22.5 \pm 5.2$ ).

**Conclusions.** It can be concluded that vocal overuse, abuse, or misuse during teaching over a period of time result in achievement of inadequate phonatory pattern with excessive musculoskeletal tension, and the possible result is tissue changes in teacher's voice. In addition, acoustic analysis of voice parameters for teachers may significantly contribute to the objective voice examination of this group.

**Key Words:** Voice acoustic parameters— $F_0$ —Jitter—Shimmer—MPT—HNR—Teachers' voice.

## INTRODUCTION

The term “professional voice user” means those people who depend on a consistent, special, or appealing voice quality as a primary tool of trade, and those who are afflicted with dysphonia or aphonia would generally be discouraged in their jobs and seek alternative employment.<sup>1</sup> Thus, teachers as professional voice users are thought to be at a higher risk of voice problems.<sup>2</sup> Various studies have reported that voice problems are common among teachers.<sup>2,3</sup> According to many questionnaire studies, 50–80% of teachers experienced voice problems,<sup>4,5</sup> and teaching constitutes one of the 10 occupations that often require medical help for voice difficulties.<sup>6</sup> Roy et al<sup>2</sup> reported the prevalence of lifetime voice disorders to be significantly higher among teachers (57.7%) than in nonteachers (28.8%). In Spain, the prevalence of clinically diagnosed vocal disorders was 57%,<sup>7</sup> and 79% of teachers reported symptoms of vocal alteration, and 20% reported a confirmed diagnosis of laryngeal injury. The incidence was

3.9 new cases per year per 1000 teachers. In Finland, laryngeal evaluation detected alterations in 51% of the teachers.<sup>8</sup>

Voice use in teaching profession is highly demanding, and the hazardous factors are teaching often at high voice output level because of the presence of background noise, poor classroom acoustics, and poor working posture, long speaking distance, poor quality of air ventilation, stress, and nonavailability of or poor-quality aids. Noise is one important factor. Markides and Pekkarinen reported that background noise and reverberation time are higher than acceptable limits in many classrooms. In a noisy classroom, teacher does not notice that she has raised her voice but she has done it unconsciously.<sup>9</sup> Loud speaking and increase of voice straining may lead to vocal fatigue and to vocal fold tissue damage.<sup>10,11</sup> Contributing cofactors are individual endurance, gender, living habits, vocal experiences, and so forth. Majority numbers of elementary schools teachers are women. Many studies reported that the voice disorders are twice in female teachers compared with their male peers.<sup>11,12</sup> Voice complaints apart from being a problem for teachers can also reduce their professional effectiveness.<sup>13,14</sup> In a study investigating the effect of the teacher's voice quality on the pupil's ability to process spoken language, it was observed that children performed better when recalling the words presented by a female teacher with a normal voice, as opposed to a female teacher with a dysphonic voice.<sup>14</sup> Voice problems are therefore not only detrimental to the teacher concerned but also to their pupils and employers.

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There are a few studies about voice changes induced by vocal loading. Fundamental frequency ( $F_0$ ), sound pressure level, jitter, shimmer, and long-time average spectra have been used for documenting vocal changes. Many studies reported common result that  $F_0$ , jitter, and shimmer rise after loading.<sup>10,15</sup> In a field study conducted by Rajasudhakar and Savithri in five elementary school teachers, reported after 6 hours of teaching, fundamental frequency of phonation, jitter, and speaking fundamental frequency were increased compared with the preteaching condition. There is a lack of data on some acoustic measures such as noise-to-harmonics ratio in teachers, which may be one of the best acoustic predictors of perceptual qualities.<sup>16,17</sup> In one study, teachers who have more professional teaching showed lower level of HNR.<sup>18</sup>

There are only few studies on the Iranian voice. In one study that performed on the Iranian voice, Mohseni et al<sup>19</sup> compared the  $F_0$  and intensity between 200 normal adult Iranian men and women. Their result showed that the value of  $F_0$  and intensity in Iranian female were significantly higher than men. In another study, Dehghan and Scherer<sup>20</sup> studied 15 male and 15 female teachers and found that female Iranian teachers seem to be more susceptible to voice stability change than the male ones. Furthermore, the incidence of vocal disorders is twice in female teachers compared with their male peers.<sup>21</sup> Thus, we planned to investigate the acoustic parameters of voice only in Iranian female teachers in much more samples (90 Iranian female teachers and 90 Iranian female nonteachers) and in a different area.

## METHODS AND MATERIALS

### Participants

Ninety Iranian female teachers of elementary school in the age range of 30–50 years with 8–23 years of teaching experience volunteered to participate in this study. The control group consisted of 90 Iranian female nonteachers in the age range of 30–50 years. All of them were housewife and did not have heavy vocal loading. The number of classes taken by teachers per day was six and duration of each class was about 1 hour. The average number of students in each class was 20–28. The exclusion criteria were previously treated dysphonia, smoking or alcohol habits, neurologic or endocrine disease, psychiatric disturbances, acid reflux, multiple medical complaints, vocal fold lesion as polyps, paralysis, papillomas, or severe dysphonia requiring urgent intervention, allergies, asthma, and other recurrent upper respiratory tract diseases, singing training and

speech, language, and hearing or voice problems. None of them were at menstrual period.

Normal voice in practitioner was judged by the perceptual evaluation by a voice therapist and indirect laryngoscopy examination by an otorhinolaryngologist. All the subjects had normal larynx. Both two groups were assessed for voice characteristics with the GRBAS scale, which stands for grade, roughness, breathiness, asthenicity, and strain.<sup>22</sup> Voice sampling was on spontaneous speech for 1 minute. Those with ratings higher than 0, even if it was on only one measure, were excluded from the study. All subjects spoke Farsi and were from the same dialectal region. The voice samples were performed in a sound-treated room with the subjects in a seated position.

### Instrumentation

Data collection was performed, using the *Dr. Speech* software (Tiger Electronics Inc) (subprogram: vocal assessment Version 4.0 from Tiger Electronics) at the speech therapy clinic. The voice was recorded by a microphone (type: ECM-717 electret condenser microphone; Sony Corporation, Japan) placed on a stand at 10 cm from the mouth. We used the Real Analysis program of *Dr. Speech* software for determining the mean of fundamental frequency ( $F_0$ ), jitter (%), shimmer (%), and the HNR (dB).

### Voice sample

Data collection took place between May 2010 and October 2011. Before recording the samples' voices, the experimental and control groups were informed about the aims of the survey. The voice sample consisted of (1) sustained vowel for assessing jitter (%), shimmer (%), HNR (dB), and MPT (seconds) and (2) reading a standard passage in Farsi for assessing  $F_0$ . The procedure of data collection was the same for both groups. The participants were asked to produce vowel /â/ in a comfortable and habitual way, for 10 seconds and three tokens from each subject were obtained.<sup>23</sup> A mid-5-second segment of each vowel prolongation was subjected to the acoustic analyses. Another part of data collection was reading from a standard passage in Farsi. The passage contained 138 commonly used words. All 23 consonants and six vowels in Farsi were involved in the passage. Before testing, all subjects were asked to practice the reading passage to induce the fluency of the voice. All subjects were asked to read the Farsi passage in a comfortable and habitual way.

**TABLE 1.**  
**Results of  $F_0$ , Jitter, Shimmer, HNR, and MPT for Female Teachers and Nonteachers**

Participant	$F_0$ (Hz)	Parameters			
		Jitter (%)	Shimmer (%)	HNR (dB)	MPT (s)
Teachers	210.03 ( $\pm$ 25.65)	0.32 ( $\pm$ 0.307)	4.63 ( $\pm$ 1.86)	18.84 ( $\pm$ 1.56)	16.83 ( $\pm$ 3.65)
Nonteachers	194.11 ( $\pm$ 20.81)	0.22 ( $\pm$ 0.1)	3.15 ( $\pm$ 0.85)	21.3 ( $\pm$ 1.73)	22.5 ( $\pm$ 5.2)

Notes: Student *t* test;  $P < 0.001$ .

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