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Original Research Article

Impact of hydration on vocal loading using phonetogram measures

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ABSTRACT

Background: Vocal loading is a phenomenon that affects the vocal folds and voice parameters. Prolonged vocal loading may cause vocal fatigue. Hydration is one of the easiest precautions to reduce the effect of vocal loading. Voice range profile is an analysis of a participant's vocal intensity and fundamental frequency ranges. Speech range profile is a graphical display of frequency intensity interactions occurring during functional speech activity. Phonetogram software can analyse VRP and SRP.
Methods: Total sixty normophonic participants (thirty male and thirty female) were included in this study. Phonetogram, version 4.40 by Tiger DRS, software used to measure the voice range profile and speech range profile. For VRP, participants were asked to produce vowel /a/ and a passage reading task was given for SRP measurement.
Results: All sample recording were done at pre vocal loading task, VLT and after hydration. Parameter that were used to measure the effects were Fo-range, semitone, max-F, min-F, SPL range, max-I, min-I, area (dB). Result showed that after VLT all other parameters like Fo-range, semitone, max-F, min-F, SPL range, max-I, min-I, area (dB) in VRP and SRP were reduced except min-F VRP in male, min-I VRP and min-I SRP in both male and female participants. After hydration all other parameters were improved except max-F VRP and min-F VRP in female, max-I VRP, min-F VRP and area VRP.
Conclusions: This study concluded that vocal loading has negative impact on vocal fold tissue and mass.

Keywords: Vocal loading, Vocal loading task, Phonetogram, Voice range profile, Speech range profile, hydration

INTRODUCTION

Voice is an auditory perceptual term that means the audible sound produced by the larynx, which embodies such parameters as pitch, loudness, quality, and variability.[1] Vocal loading is defined by prolonged voice use and additional loading factors (e.g. background noise, acoustics and air quality) affecting the fundamental frequency, type and loudness of phonation, or the vibratory characteristics or the external role of larynx.[2] The four distinct phases involved in vocal loading are: warm up (adapting to the voicing task), performance (continuation of the voicing task), vocal fatigue (perceived increase of physical effort associated with voicing; physical changes to the larynx), and rest.[3] Several authors stated that vocal loading task affects the following voice parameters like jitter, shimmer, fundamental frequency, maximum phonation time.

Stemple, Stanley, and Lee (1995)[4] stated that there was significant change of fundamental frequency (Fo) after the vocal loading task. Laukkanen and Kankare mentioned that significant increase happens in perturbation parameters.[5] Boucher reported that vocal loading task can increase the voice tremor.[6] Vocal loading tasks (VLTs) that are designed to induce vocal fatigue, can be used to further understand the development process and mechanisms behind vocal fatigue. These tasks are used to describe the changes in voice during prolonged use. Although they have been commonly used, the patterns of VLTs have not been standardized to be differentiated in terms of loading task and experimental environment. Some studies observed the effect of vocal loading using a prolonged and loud reading.[7,8] A study reported that vocal recovery has three sub domains.[9] First physiological factors that are cell structure of lamina propria, external muscles of larynx, internal muscles of larynx, physical coping skills, breathe support and resonance. Second one is psychological factors including mental coping skills, personal traits, and stress and third one is contextual factors like communication context, physical context, cognitive load, time.

The phonetogram is also known as the ‘voice profile’, the ‘voice field’, the ‘voice area’ and the ‘Fo-SPL profile. It shows the phonatory capabilities of the voice with respect to fundamental frequency (Fo) and sound intensity. These values are plotted on a frequency-by-intensity graph. Kent et al had established phonetogram as an international tool for voice analysis.[10] The concept of a voice range profile (VRP) was first introduced by Wolf and Sette.[11] An acoustic interpretation of the voice range profile shape was presented by Titze.[12] Study was focused mainly on the co-variation of intensity (I) and fundamental frequency. The automatic voice VRP was first mentioned in the early 1980s. Ma et al concluded that speech range profile (SRP) would be an acceptable alternative to traditional VRP for screening the presence of dysphonic patient in a busy clinic where quick screening results are desirable.[13]

Aim

Current study was aimed to measure the effect of vocal loading and its recovery effect with hydration using phonetogram with reference to voice range profile and speech range profile.

METHODS

In this study, multiple baseline research design was used. The Study was done from July 2019 to January 2020 at Ali Yavar Jung national institute for speech and hearing disabilities (Divyangjan), regional centre, Kolkata. A total 30 males and 30 females in age ranged from 18 years to 30 years were participated in this study. To choose participants for this study, the inclusion criterias were no vocal problems and had normal speech, any type of vocal pathologies which were excluded by using Strobovideolaryngoscopy (Laryngeal strobe, Model 9400, KayPENTAX) and real voice analysis (Dr. Speech, version 4.0, Tiger DRS), non menstruating females, screened subjects/participants using GRBAS scale (Hirano, 1981), normal hearing participants who were defined by pure tone threshold at frequency from 0.25 to 8 KHz (≤ 25 dB HL), participants within age range of 18-30 years and native speaker and reader in Bangla language. The exclusion criterias were participants who had any family history of voice disorder, suffering from frequent cold and cough, under any medication at the time.

The instruments were used in this study that were, Phonetogram version 4 software (developed by Tiger DRS, designed by Daniel Zaoming Haung, Cindy Chen, and David Yuan) was used for registering the phonetogram and a Proton Boom-815 Super unidirectional electret condenser microphone was used for the purpose of recording, sound level meter (RadioShack USA model no: 33-2055) containing a dB (A) weighting network was used for calibrating the phonetogram, two Sony SRS-XB10 extra bass speaker has been used to present the multitalker speech babble at 75 dB SPL via an HP pavilion 14 laptop with windows 8.1 software version, Two stories were randomly chosen from native Indian language, Bangla newspaper storyline. No emotional content were present in the selected stories and both the stories had simple sentences and easy to spell words.

Ethical consideration has been obtained from all the participants before the data collection procedure for vocal loading task and for hydration in terms of recovery. All the subjects were asked not to drink water 60 minutes before the data collection procedure. All voice recording has been done at speech science laboratory, AJYNISHD, Kolkata. A unidirectional electret condenser microphone (Proton Boom-815) with a minimum sensitivity of 60 dB was used for the voice recording purpose. Those voice sample recording has been done in sound treated chamber and surrounding noise did not exceeded 35 dB (A) as per guided by ANSI (1999). SLM was used to control the noise level. Microphone placement was at an angle of 45 degree with distance of the 30 cm from the speaker’s mouth in order to maintain high signal to noise ratio. Phonetogram software has been used to measure the VRP and SRP. While measuring the VRP all the participants were asked to produce vowel/a/from low to high pitch. Before initiating this task, all the participants were demonstrated the task. Performance was recorded to analyse the voice range profile. Then the participants were asked to read out the passage in comfortable intensity to record the speech range profile. After that, vocal loading task was given to the participants by reading out a passage. They were then asked to produce vowel/a/ and VRP was measured. Finally the participants were asked to read a passage in their comfortable intensity to record the SRP. The participants underwent

VLT after a gap of 7 days from the date of previous data collection. They were asked to produce vowel/a/from low to high pitch and that was recorded to measure the VRP. The participants were then asked to read the passage in comfortable intensity to record the SRP. The subjects were then instructed to drink 1000 ml of normal water at room temperature within 20 minute after the VLT. The participants were asked to produce vowel/a/to measure VRP and read the passage for measuring the SRP. All VRP and SRP data were collected in form of parameters like Fundamental frequency range (Fo-range), semitone, maximum fundamental frequency (Max-F), minimum fundamental frequency (Min-F), sound pressure level range (SPL range) maximum intensity (Max-I), minimum intensity (Min-I), and area (dB).

Statistical analysis

Statistical analysis was done by collecting data were compiled in an excel sheet. Parameters were arranged according to the test hypothesis and different conditions like Pre VL, after VLT and hydration. Descriptive statistical analysis was done to measure the effect of vocal loading and hydration by using R- programming software (version 3.5.2). ANOVA test was done to measure the significant difference across Pre vocal loading, after vocal loading task and after hydration for evaluating VRP and SRP conditions. Paired t-test was then done between pre vocal loading and after vocal loading task, after vocal loading task and after hydration, pre vocal loading task and after hydration.

RESULTS

Data of thirty male and thirty female participants were collected. To measure the VRP and SRP the eight parameters were analysed, they were fundamental frequency range (Fo-range), semitone, maximum frequency (Max-F), minimum frequency (min-f), sound pressure level range (SPL range) maximum intensity (Max-I), minimum intensity (Min-I), and area (dB). To prove the research hypothesis in respect to the three different conditions pre vocal loading (Pre VL), after vocal loading task (VLT) and after hydration in VRP, ANOVA test was done and after that Paired t test was carried out to measure the statistical significance after different conditions.

DISCUSSION

Prolong vocal loading leads to physiological changes in the vocal folds. In this study vocal loading task was given to measure the effect of vocal loading in VRP and SRP. It was, however, believed that during phonation, collision of the folds brings about an interstitial transfer that pushes fluid away from the area of vocal fold contact.[14] As a result, increased stress gradients were formed. These stress gradients were exacerbated in dehydrated tissue.[15] Dehydration negatively influences the voice parameters. Hydration helps to improve the viscoelastic property of the vocal fold tissues.[16] A study reported that frequent hydration maintained regular phonatory functions and also helped to prevent vocal fold lesions which might occur due to the stress gradients during phonation. In the current study participants were asked to drink water at room temperature for measuring the hydration effect over vocal loading in terms of recovery.[17] Studies have been also suggested that vocal loading has negative impact on vocal folds that was analysed through VRP and SRP measures using phonetogram. After hydration task the targeted parameters of VRP and SRP were markedly improved.

Table 1: Demographic data of the study.

Age range of participants (in years)	No. of male participants	No. of female participants
18-20	4	2
20-22	3	1
22-24	2	3
24-26	3	2
26-28	3	4
28-30	1	2

The results showed that for the male participants, Fo range of VRP decreased ($p=4.1\times10^{-10}$) which was depicted that ($p<0.05$) after vocal loading task as compared to pre vocal loading , thus significant changes was taken place (Table 4). Due to vocal loading there was a significant amount of reduction in the contact area between two vocal folds contributed to the reduction of the fundamental frequency range (Fo range). Fo range was increased after hydration ($p=6.2\times10^{-8}$) which was depicted that ($p<0.05$) as compare to vocal loading task. After the hydration, viscoelastic property, stress and resistance between the two vocal folds were decreased (Erath, Zanartu, Peterson). Thus the formation of mucosal wave became easy which was further augmented to improve the Fo range. In female participants after vocal loading, the Fo range was decreased, $p=2.4\times10^{-11}$ which was less than 0.05. It is to be also noted that moistening effect after hydration may vividly alter Fo range which may less evident in dehydration.

In SRP, Fo range was reduced in both the male and female participants and significant changes were observed as statistical $p=2\times10^{-16}$ for male and $p=2\times10^{-16}$ for female participants which were less than 0.05 after vocal loading. Hence, vocal loading was not only reducing the fundamental frequency range in voice range profile but also in speech range profile as well. After hydration there was a visible increase in Fo range on SRP with reference to the change in viscoelastic properties of the vocal folds. Prolonged vocal loading causes dehydration in vocal fold tissues. Miri, Barthelat, and Mongeau suggested that dehydration increases stress-strain gradient and it mainly affects the stretching response of the vocal fold tissues.

Table 2: ANOVA test values for each parameters of VRP on pre VL, after VLT and after hydration in male and female participants.

Parameters	Pre VL		After VLT		After hydration		P value	
	Male	Female	Male	Female	Male	Female	Male	Female
Fo-range VRP	139.1	212.8	99.97	168.5	132.7	194.0	9.16×10^{-11}	5.44×10^{-11}
Semitone VRP	14.10	14.43	9.8	10.53	13.43	13.87	3.41×10^{-8}	3.14×10^{-11}
Max-f VRP	255.6	381.8	211.6	340.2	245.0	362.8	2.81×10^{-8}	0.00126
Min-f VRP	118.1	190.4	111.7	171.7	115.6	171.3	0.239	0.00086
SPL range VRP	21.57	18.74	14.87	14.78	18.47	17.10	1.29×10^{-10}	0.0141
Max I VRP	111.3	113.3	104.3	107.1	109.3	109.7	8.99×10^{-8}	0.0204
Min I VRP	90.16	93.19	89.7	91.83	90.62	92.80	0.738	0.82
Area (dB) VRP	122.8	105.65	79.12	79.88	108.90	90.79	1.73×10^{-8}	0.00021

Table 3: ANOVA test values for each parameters of SRP on pre VL, after VLT and after hydration in male and female participants.

Parameters	Pre VL		After VLT		After hydration		P value	
	Male	Female	Male	Female	Male	Female	Male	Female
Fo-range VRP	811.1	1008.5	469.7	546.5	670.7	828.9	2×10^{-16}	$<2\times10^{-16}$
Semitone VRP	35.17	32.57	22.57	20	30.10	28.47	$<2\times10^{-16}$	$<2\times10^{-16}$
Max-f VRP	929.7	1193	585.3	745.4	791.8	1019.9	$<2\times10^{-16}$	$<22\times10^{-16}$
Min-f VRP	118.6	188.8	115.7	199.7	115.7	189.9	0.768	0.142
SPL range VRP	32.08	32.50	21.99	24.73	26.92	30.83	4.45×10^{-9}	2.26×10^{-5}
Max I VRP	112.3	112.4	105.2	103.2	110.6	113.0	3.04×10^{-8}	0.00447
Min I VRP	80.22	79.52	89.7	91.83	83.62	79.95	6.55×10^{-9}	7.64×10^{-5}
Area (dB) VRP	412.9	410.2	214.7	276.6	356.9	408.0	5.56×10^{-10}	0.00022

Table 4: Paired t test in parameters of VRP between pre VL and after VLT in male and female participant.

Parameter	Pre-VL		After VLT		Paired t-test	
	Male	Female	Male	Female	Male	Female
Fo range VRP	139.1	212.8	99.97	168.5	4.1×10^{-10}	2.4×10^{-11}
Max-F VRP	255.6	381.8	211.6	340.2	4.1×10^{-8}	0.00082
Min-F VRP	-	190.4	-	171.7	-	0.0028
Semitone VRP	14.10	14.43	9.8	10.53	1.1×10^{-7}	2×10^{-10}
SPL range VRP	21.57	18.74	14.87	14.78	5.3×10^{-11}	0.011
Max-I VRP	111.3	113.3	104.3	107.1	9.2×10^{-8}	0.017
Min-I VRP	-	90.62	-	93.19	-	4.2×10^{-9}
Area(dB) VRP	122.8	105.65	79.12	79.88	1.4×10^{-8}	0.00013

Vintturi et al suggested that surface hydration in terms of water intake could improve the viscoelastic properties of vocal folds. In contradiction to this study Selby and Wilson reported that no significant change was visible after hydration in Fo range.[18] Vocal loading induces the dehydration in vocal fold tissues. Hamdan et al did a study on effect of fasting on male voice.[19] Study showed that fasting improvised dehydration in the body and epithelial cells as well as mucosal waves of vocal folds. This phenomenon markedly imposed lowering the habitual pitch.

This present study revealed that during the measurement of VRP and SRP semitones were decreased after vocal loading task for both male and female participants. This findings may be attributed to the fact that the vibration of vocal folds in each contact area of the vocal folds helps to produce different notes as per the 16 mass model of Titze.[20] During vocal loading, increment of Fo was observed due to the reduction of contact area between two vocal folds.[21] Phonetogram measures can contribute to define musical scales by exploring different music notes ranges like G/G1#/A1/A1#/B1/C/c1/c1#/d1/d1#/e1/f1/f1#/…/c2…/c3…g3 and the frequency ranges within 49 Hz to 1568 Hz.[22] As the contact area between two vocal folds were reduced and due to vocal loading the semitones or the smallest musical intervals between the two notes were also reduced. Hydration in vocal fold tissue helps to reduce stress gradient during vocal fold vibration.

Hydration task helps to reduce vocal tiredness. After Hydration number of semitones on voice range profile and speech range profile were markedly improved (Table 5, 8). From the present study Max-F in VRP for both male and female participants after vocal loading was reduced. Statistical p values were less than 0.05 and it proclaimed the reduction in Max-F after vocal loading task. Due to the loading effect the stressed vocal folds failed to reach the high octave notes in both VRP and SRP so it limits the results. Similar findings were achieved by Echternach et al and suggested that after vocal loading for both male and female participants, Max-F was reduced but no statistical significance were found (p=0.915 and p=0.843 which showed that p>0.05).[23] On SRP, Max-F got reduced after VLT and hence, the statistical p value was less than 0.05. It was the posited that marked reductions were visible in Max-f after vocal loading task. For female participants Max-F in VRP scores were lower after vocal loading task and the same were improved after hydration. Due to loading effect, female participants were unable to maintain the low octave pitch. After hydration moist vocal folds performs better low octave pitch in female participants. For SRP, Max-F was increased after vocal loading and no such changes were observed after hydration. Contradiction was also deliberated by Stemple et al who were reported that no significant changes were found to be present in Max-F after vocal loading.

Table 5: Paired t test in parameters of VRP between after VLT and after hydration conditions in male and female participants.

Parameter	After VLT		After hydration		Paired t-test	
	Male	Female	Male	Female	Male	Female
Fo range VRP	99.97	168.5	132.7	194.0	6.2×10^{-8}	3.4×10^{-5}
Max-F VRP	211.6	340.2	245.0	362.8	1.6×10^{-5}	0.0845
Min-F VRP		171.7		171.3		0.0028
Semitone VRP	9.8	10.53	13.43	13.87	4×10^{-6}	1.8×10^{-8}

Table 6: Paired t test in VRP Parameters between pre VL and after hydration in male and female participants.

Parameter	Pre VLT		After Hydration		Paired t-test	
	Male	Female	Male	Female	Male	Female
Fo range VRP	139.1	212.8	132.7	194.0	0.23	0.0012
SPL range VRP	14.87	14.78	18.47	17.10	0.00015	0.16
Max-I VRP	104.3	107.1	109.3	109.7	7.1×10^{-5}	0.234
Area(dB) VRP	79.12	79.88	108.90	90.79	5.3×10^{-5}	0.0721
Max-F VRP	255.6	381.8	245.0	362.8	0.13	0.0867
Min-F VRP		190.4		171.3		0.943
Semitone VRP	14.10	14.43	13.43	13.87	0.35	0.28
SPL range VRP	21.57	18.74	18.47	18.78	0.00057	0.221
Max-I VRP	111.3	113.3	109.3	109.7	0.089	0.207
Area (dB) VRP	122.8	105.65	108.90	90.79	0.041	0.0302

Table 7: Paired t test in SRP Parameters between pre VL and after VLT in male and female participants.

Parameter	Pre VL		After VLT		Paired t-test	
	Male	Female	Male	Female	Male	Female
Fo range SRP	811.1	1008.5	469.7	546.5	2×10^{-16}	$<2\times10^{-16}$
Max-F SRP	929.7	1193	585.3	745.4	$<2\times10^{-16}$	$<2\times10^{-16}$
Semitone SRP	35.17	32.57	22.57	20	$<2\times10^{-16}$	$<2\times10^{-16}$
SPL range SRP	32.08	32.50	21.99	24.73	1.9×10^{-9}	3.2×10^{-5}
Max-I SRP	112.3	112.4	105.2	103.2	4.4×10^{-8}	0.0113
Min-I SRP	-	79.52	-	91.83	-	0.00033
Area(dB) SRP	412.9	410.2	214.7	276.6	6.3×10^{-10}	0.00093

Table 8: Paired t test in parameters of SRP, between after VLT and after hydration in male and female participants.

Parameter	After VLT		After Hydration		Paired t-test	
	Male	Female	Male	Female	Male	Female
Fo range SRP	469.7	546.5	670.7	828.9	1.1×10^{-9}	3.4×10^{-11}
Max-F SRP	585.3	745.4	791.8	1019.9	6.6×10^{-10}	3.7×10^{-11}
Semitone SRP	22.57	20	30.10	28.47	2.3×10^{-9}	1.7×10^{-12}
SPL range SRP	21.99	24.73	26.92	30.83	0.0012	0.00082
Max-I SRP	105.2	103.2	110.6	113.0	1.7×10^{-5}	0.0096
Min-I SRP	89.7	91.83	83.62	79.95	7.5×10^{-5}	0.00036
Area(dB) SRP	214.7	276.6	356.9	408.0	3.1×10^{-6}	0.00093

Table 9: Paired t test of parameters of SRP between Pre VL and after hydration in male and female participants.

Parameter	Pre VL		After Hydration		Paired t-test	
	Male	Female	Male	Female	Male	Female
Fo range SRP	811.1	1008.5	670.7	828.9	5×10^{-6}	4.1×10^{-6}
Max-F SRP	929.7	1193.0	791.8	1019.9	8.3×10^{-6}	5×10^{-6}
Semitone SRP	35.17	32.57	30.10	28.47	1.5×10^{-5}	1.7×10^{-12}
SPL range SRP	32.08	32.50	26.92	30.83	0.0012	0.3185
Max-I SRP	112.3	112.4	110.6	113.0	0.13	0.8455
Min-I SRP	80.22	79.52	83.62	79.95	0.017	0.887
Area(dB) SRP	412.9	410.2	356.9	408.0	0.045	0.951

Min-F had no such significant statistical changes for male participants in VRP and SRP after vocal loading task. Statistical p value was 0.239 which was greater than 0.05 ($p>0.05$). In female participants Min-F VRP has decreased after vocal loading. Loaded vocal folds were unable to achieve more low frequency notes as compared to unloaded vocal folds. After hydration no significant changes were observed in Min-F with respect to VRP and SRP. There were no supporting findings in this regard though dissonant findings were documented by Remacle, Finck, Roche, and Morsomme as Min-F was increased after vocal loading on both VRP and SRP measures.[24]

In male participants SPL ranges with respect to VRP and SRP were decreased after vocal loading (Table 3, 4) and significant statistical value was found ($p=1.29\times10^{-}10$) for VRP & p=0.011 for SRP<0.05). SPL range was increased after hydration ($p=0.00015$) which was depicted that ($p<0.05$). During phonation high sub-glottal pressure have been required to achieve higher intensities. Vocal loading effect may induce vocal tiredness as result participants were unable to maintain high sub glottal pressure after vocal loading. As a result the SPL range was reduced after vocal loading. No significant effect was observed after hydration in SRP. Females were more prone to have vocal loading effects as stated by most of the authors. Vintturi stated that female participants had more effect than males which is in agreement of the findings of present study. It was also found that hydration did not show any significant effect on SPL range.

In this study Max-I with respect to VRP and SRP in male participants got decreased after vocal loading task as depicted. Due to vocal tiredness and dehydration male participants were unable to produce higher vocal intensity during both voice and speech range profile task. Lamina propria and vocalis muscles were affected due to loading effect. As a result it showed that participants were unable to achieve higher intensity levels after vocal loading than Pre vocal loading. Several authors proposed that aerodynamic mechanism of voice production were affected after vocal loading.[25] Sundarrajan, Huber, and Sivasankar stated that respiratory and laryngeal changes were followed after vocal loading thus supported the findings of present study.[26]

After hydration both VRP and SRP Max-I values were increased $p=7.1\times10^{-5}$ and $p=1.7\times10^{-5}$ which were depicted that $p>0.05$. This could have been attributed with reference to perceived phonatory effort (PPE). Similar findings were reported by Tanner et al as PPE was increased after dehydration and statically significant improvement was seen soon after hydration.[27] In case of female participants Max-I was reduced *p=0.017 and p=0.0113 which were revealed that $p>0.05$ after vocal loading both in VRP and SRP. Hydration did not play any significant role ($p>0.05$) in Max-I with respect to VRP and SRP. Verdolini et al suggested that rehydration did not have positive impact on perceived phonatory effort.[28]

In Min-I (dB) VRP, both male and female participants did not have any changes after vocal lading and after hydration. On SRP for both male and female participants, significant changes were observed after VL (Table VII) and after hydration (Table 8). For female participants hydration had more positive impact on Min-I (dB) than male participants. Echternach did a study on one hundred and one school teachers and found that after vocal loading Min-I increased ($p<0.001$) which is opposite to the findings of the present study and further there is an immense need to explore its' evidences. Dearth of literatures may not contribute the fact vividly and it may be a limitation of the present study.

After vocal loading area (dB) with respect to VRP and SRP were decreases. Due to vocal loading effect PPE and laryngeal discomfort increased gradually contribute to reduction of vocal intensity level.[29] After hydration, area (dB) increased in both male and female participants $p=5.3\times10^{-5}$ for VRP in male, $p=3.1\times10^{-6}$ for SRP in male and $p=0.00093$ for SRP in female participants which were depicted that $p<0.05$. In females no changes were observed after hydration in VRP ($p=0.0721$ which was depicted that $p>0.05$. Vintturi stated that there is difference in vocal loading and hydration effects in males and females due to their anatomical differences in vocal folds. The overall impression of this study stated that vocal loading was adversely impacted on physiology of vocal folds and in different parameters with respect to VRP and SRP. Through the phonetogram the effect of vocal loading were measured and significant changes were observed in the study. Hydration has important role in moisten the vocal folds and in prevention of hyper functions of vocal folds that arise after vocal loading. Thus the present study set the hydration in form of water intake and connoted the inverse relationship between water intake and vocal loading which means water has efficient effect to reduce the vocal loading.

Limitations

Limitations of current study were this study lacks gender effect on VRP and SRP were did not measured and did not incorporate the impact of humidity on participants.

CONCLUSION

Vocal loading is a phenomenon that affects the vocal folds and voice parameters. Prolonged vocal loading may cause vocal fatigue. Hydration is one of the easiest precautions to reduce the effect of vocal loading. Water intake is the most efficient and cost effective way too moist the vocal folds. Phonetogram software can measure the effect of vocal loading and effect of hydration in terms of recovery. This study was aimed to measure the impact of hydration over vocal loading effect. Lastly, after overall the study we concluded that hydration has a positive impact over vocal loading in voice parameters but not for all parameters.

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