



## THE VOICE QUALITY OF RAFTING INSTRUCTORS

### Speech & Hearing

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### ABSTRACT

**Background-** Rafting is done in an open, noisy atmosphere; thus, it is necessary for instructors to use their vocal folds to communicate with their teammates. Excessive use of the voice can result in phonotrauma. when an instructor uses their voice at a high volume for a prolonged period without rest during a rafting session, or when they forcefully close their glottis to increase vocal loudness in response to poor signal-to-noise ratios in the river for giving commands. **Objective-** both subjective Voice handicap inventory- Hindi (VHI-H) and objective measures (acoustic) were used to evaluate the voice quality of rafting instructors. **Method-** A total of 40 rafting instructors were participated in this study. There were two methods utilized to gather the data for the two separate seasons: (1) On season and Off season. VHI-H were used for the subjective assessment of voice analysis during Off and On season. Total three domains of VHI-H (Emotional, Physical and Functional) were assessed. The PRAAT Program was used to collect and evaluate recordings of the phonation of the vowels and voiceless to voiced sound ratio. Results-Results revealed there were no statistical difference between the rafting instructors' acoustic voice quality Off and On rafting season but increased subjective VHI-H scores in all three were reported. **Conclusion-** The observation showed that all activities were held in open environments, and the weather conditions varied, involved heat, sun, wind and rain. Rafting instructors utilize their voices for motivation, command and guiding of the team, as well as for communication, direction, instructions, and information. attracting attention, making inquiries, and correcting players. They typically speak loudly and strongly. These vocal uses were possible cause of change in voice of instructors.

### KEYWORDS

• Voice quality • White water rafting • Rafting instructors • Acoustic analysis • VHI

### INTRODUCTION

Vocal professionals, or those who depend on their voice for any type of professional performance, experience voice problems more frequently than non-professional voice users. Due to the vast and demanding tasks that vocal professionals subject their voices to during the course of their employment, they use their voices in a "athletic" manner. According to earlier studies (Smith, Lemke, Taylor, Kirchner & Hoffman, 1998), 50–90% of vocal professionals had experience dysphonia or vocal fatigue over the course of their careers, and more recent data (Byeon, 2017) confirms that vocal professionals are the group most at risk of developing a voice disorder. Rafting is a thrilling water sport that thrill-seekers all around the world participate in (Hunter, I.R, 2007). White-water rafting has experienced tremendous growth in popularity as an adventure activity over the past few decades. Rafting is a wonderful way to feel more a part of nature, take in breathtaking scenery, and feel a special feeling of accomplishment. (Wilkinson, 1984) People looking for adventure and adrenaline rushes are drawn to the excitement of successfully navigating rough waters while cooperating as a team. Rafting guide or commonly known as rafting instructor is the person who had gone through proper training of handling the raft. A rafting instructor's job is essential since they have to ensure that participants have a fun and educational experience while navigating groups safely over difficult rapids. (Myers, T.M et al 1999). Although technical know-how and river expertise are crucial qualities in a qualified guide, excellent communication is absolutely crucial to pleasant and successful rafting trips. Throughout the season they have to communicate with the team and also had to give instruction for maintaining the raft.

A rafting instructor's job is centered on effective communication. They assist participants in understanding safety protocols, paddle skills, and teamwork dynamics by providing clear and straightforward instructions. Additionally, knowledgeable guides create a fun and engaging environment that improves participants' overall rafting experiences. In emergency situations, communication is especially essential since it enables guides to react quickly and efficiently to possible dangers (Flore, D.C, 2003).

The effect of this daring sport on Rafting instructor's voice health is frequently ignored, between all the fun and excitement. The intense physical activity, exposure to cold water, and loud environmental noises can all contribute to voice strain and damage. Excessive use of the voice can also result in phonotrauma. when an instructor uses their voice at a high volume for a prolonged period of time without rest during a rafting session, or when they forcefully close their glottis to increase vocal loudness in response to poor signal-to-noise ratios in the river for giving commands.

Long-term exposure to vocally taxing physical situations may also increase this danger to vocal health (Cielo, Ribeiro & Hoffmann, 2015). According to Trout & Mccoll, 2007; Penteado & Bernardi da Silva, 2014, Rafting instructors frequently experience symptoms of vocal fatigue and dysphonia, have little knowledge of voice and vocal hygiene, do not care for the health of their voice, and have certain habits that can negatively affect their vocal health.

Although rafting can be an exciting and adventurous activity, it's crucial to be aware of any concerns it may present to rafting instructors. Voice analysis has been used to study human behavior and communication patterns in a number of disciplines, including psychology, linguistics, and marketing. We may learn more about how that impacts the experiences of instructors by paying closer attention to the pitch, tempo, loudness, and other voice characteristics.

There are various causes of the vocal health problems that rafting instructors faces such as:

1. Rafting is done in an open, noisy atmosphere; thus, it is necessary for instructors to use their vocal folds to communicate with their teammates. The vocal folds are put under a great deal of strain when shouting over the sound of flowing water and high gusts, which could result in vocal fatigue and hoarseness. Speaking out loud or yelling at a great distance or in a noisy environment, using your voice excessively while exercising, or being under stress at work are all examples of loud speaking and shouting (O'Neill & McMenamin, 2014).

2. Prolonged Exertion: Depending on the route, rafting adventures might endure for hours or even days. Extended vocal use can lead to overuse injuries, which can cause discomfort and damage to the vocal folds. (Colton, Casper, & Leonard, 2006; Gotaas & Starr, 1993; Kitch & Oates, 1994; Stemple, Glaze, & Klaben, 2000).

3. Communication and Safety: Safety on rafting trips depends on effective and clear communication. To guarantee a smooth travel, Instructors must swiftly convey instructions, cautions, and replies. However, they may be at risk for developing vocal dysfunction due to the constant pressure this demanding environment places on the voice. (Smith E gray, S D Dove, H kirchner, 1997)

The objective of this study is to determine if rafting instructors have measurable voice changes during rafting season and if rafting instructors are aware or not of these changes. The research therefore proposed that there would be a statistically significant difference between the acoustic characteristics of Rafting instructor's voices between the Off-season and On-season. A trained professional who is capable of leading commercial white-water rafting is known as a raft guide. The majority of raft guides are seasonal employees and work during the summer months when rivers are flowing at their best levels.

## METHOD AND MATERIAL

### Data collection

For every participant instructor, there were two methods utilized to gather the data for the two separate seasons in 2022- 2023(1) On season (March-June) and (2) Off season (July -February) The Off season was selected based on the theory that there is little or no rafting activity in the area during this time and instructors have at least seven to eight to months of rest period. In contrast, the On-season was selected based on the hypothesis that there is a 7-8 trips/day of rafting-related activity during this season remains at peak for these three to four months. Two distinct methods were used to collect the data i.e. subjective and acoustic data measurement. The first step involves the participant themselves filling out the Voice Handicap Index in Hindi (VHI-H) (Datta et al., 2011), followed by voice acoustic measurement such as F0, SNR (signal to noise ratio) and HNR (harmonic to noise ratio) was obtained on rafting instructor in both Off season and On season.

### Participant

A total of 40 Hindi speaking male rafting instructors, having median age of 28.5 years and age range from 18 to 50 years, who had been working as an instructor for at least four years and were still employed were randomly selected in the study. There are no female instructors taking part in rafting or related activities. Hence no female instructors were participated in study. On average, participant instructors in the On-season lead 5-6 trips per day. The shortest trips are at least 9 km long, while the longest trips are 25 km per day. Shortest trip needed at least 30 minutes, and the longest trip needed at least 90 minutes. Instructors did not report any vocal or other health-related issues while taking part in the study. None of the participant instructors, by their own admission, had received any voice abuse, education or had used any voice abuse prevention techniques. A written consent was taken from all the participant instructors.

### Inclusion criteria

Participants with age range from 18-50 with no habit of tobacco chewing and alcohol drinking were included in the study. Participant instructors who do not have any voice related history and had more than 4 years of experiences been included in study. Individuals who had history of voice disorders and habit of tobacco chewing and alcohol drinking were excluded from the study.

### Subjective data measurement

The Voice Handicap Index- Hindi (VHI-H) is a participant-based self-assessment tool and is regarded as the most pertinent, patient-friendly, and adaptable tool currently available to assess the voice-related quality of life. (Francic, D. M., et al, 2005). The functional, physical, and emotional domains each include ten items in this tool, which has a total of 30 items in total. The Agency of Healthcare Research and Quality recognized the VHI-H as a valid and acceptable diagnostic tool (Biddle, et al, 2002). Each participant was given the VHI-H for the purpose of collecting subjective data throughout both the off- and on-seasons. The participating rafting instructors received printed VHI-H forms to complete on their own. Participant instructors completed VHI-H for 2 times. One at the end of on-season and one at the end of

off-season. The findings were compared with voice measurements based on acoustics measures.

## Objective data measurement

### Voice measures

Regarding the stated goal of the study, the following conventional objective voice measurements (Naufel de Felipe, Grillo, & Grechi, 2006) were chosen: Harmonic-to-Noise Ratio (HNR, in dB), Fundamental Frequency (F0, in Hz), Jitter (JITT, in%), Shimmer (SHIMM, in dB), obtained in both Off- and On-season samples were taken for each of the chosen parameters. The prolonged phonation of the vowels /a/, /i/, and /u/ and voiceless to vocal speech sound ratio, i.e., s/z were obtained using the digital recorder TASCAM DR-05, with the microphone positioned 15 cm from the mouths of each participant.

The stimulus was recorded using TASCAM DR-05 digital voice recorder which had a sampling rate of 44.1kHz and bit rate of 16kbps along with the automated noise cancellation facility. The microphone was placed 7-10cms away from the individual's mouth. The recordings of each participant were acoustically analyzed on PRATT software and following parameter extracted (1) Formant frequency- F1 and F2 of vowels /a/, /i/ and /u/, (2) Fundamental frequency - F0 range and average F0, (3) Intensity range and average.

### Data Processing

The latest version of Adobe Audition 1.5 computer application was used to arrange recorded samples of the sustained phonation for additional acoustic analysis, using a sampling rate of 44100 Hz and a dynamic range of 16 bits. Using the PRAAT program, acoustic analysis of the five-second midsection of the organized individual voice samples was conducted (Boersma & Weenink, 2018). The mean, minimum, and maximum values of F0, JITT, SHIMM, and HNR, as well as the S/Z ratio, were measured as part of the acoustic study. The acquired acoustic data were then subjected to statistical analysis. Descriptive analysis came first, then testing for normality of distribution (using the Shapiro-Wilk test), and nonparametric test were used to see whether acoustic data collected during off-season and on-season differed. The statistical analysis was conducted at a significance level of  $p < 0.005$ .

## RESULTS AND DISCUSSION

### Descriptive statistics

The subjective assessment was carried out in term of VHI-H, which contains the domains such as Emotional, Physical, and Functional aspects of voice. Here we have shown the results of the OFF and ON season's VHI-H scores in below figures 1 and 2 respectively.

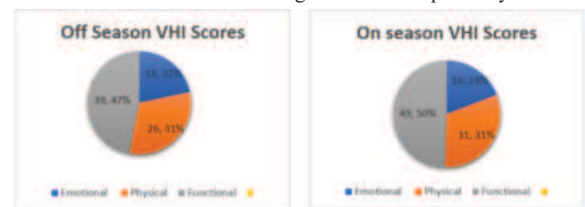


Fig 1 Off season VHI scores of rafting instructors. Fig 2 On season VHI scores of Rafting instructors

Even though there was no such rafting activity occurring from their end, Figure 1 demonstrates that replies from rafting instructors during the OFF season were somewhat reduced. The domains such as Physical and Emotional aspects of voice was not much more affected compared to Functional domain. This might be due to they have more vocal use on daily basis as well as for such long period of duration vocal usage. Figure explains rafting instructors have increased VHI-H scores in all three domains i.e. emotional, physical and functional respectively. The observation showed that all activities were held in open environments, and the weather conditions varied, involved heat, sun, dust, wind and rain. Rafting instructors utilize their voices for motivation, command and guiding of the team, as well as for communication, direction, instructions, and information. attracting attention, making inquiries, and correcting players. They typically speak loudly and strongly. There is no usage of amplification technology. (Penteado, R. Z., & Silva 2014).

Descriptive statistics of Objective assessment was carried out in form of acoustic measurements which includes Mean and standard deviation of Fundamental frequency (Fo), Jitter (JITT), Shimmer (SIMM) and Harmonics to noise ratio (HNR). Tables 1 and 2

represents the results of descriptive analysis of the observed acoustic voice measures of On and OFF rafting seasons. Prior to the rafting (OFF season) for Instructors, mean values for all of the observed acoustic voice measures (apart from the F0, which was evaluated in relation to gender) appear to be normal to little deviated as shown in (Table 1). The little Degradation in the acoustic measure of the instructors might be due to long term effect of vocal abuse and effect of high vocal usage. One possible reason for the degraded acoustic measures could be life style and habits such as cigarette smoking and alcohol consumption, which we did not considered for this study.

Table 1: The acoustic voice measures obtained during OFF season

Gender	AM	M	Min	Max	SD
Males (N=40)	F01 (Hz)	106.29	98.260	143.048	18.52
	JITTER1 (%)	0.035	0.012	0.097	0.260
	SHIMMER1 (dB)	0.059	0.029	0.078	0.050
	HNR1 (dB)	31.19	20.82	36.46	3.150

N= the number of the participants; AM= acoustic measures; M=mean; Min=minimum value; Max=maximum value; SD=standard deviation

The individual entries in Table 1 provide more specific information about the participant's voice quality prior to the training, though: SHIMM1 and HNR1, two acoustic measurements for male instructors, had diverging results, with SHIMM1 somewhat higher than the reference value of 0.35 dB and HNR1 slightly lower than the reference value of 20 dB (Boersma & Weenink, 2018) for some instructors. We have also reported decreased HNR1 readings for some males. While the observed JITT1 values for the majority of the sample of 40 individuals are within the normal range for few instructors, one instructor deviates from the reference SHIMM1 value (Fernand, 2012; in Botha, Ras, Abdoola & Van der Linde, 2017). On the basis of comparison in psychoacoustical correlates of pitch, loudness and harmonics to noise ratio, it was observed that there is no significant difference in OFF season across the instructors. After the OFF season acoustic voice measurements, we have recorded and analyzed the ON season voice measurements. The average values for the majority of the recorded acoustic voice measurements declined (Table 2)

Table 2: The acoustic voice measures obtained during ON season.

Gender	AM	M	Min	Max	SD
Males (N=40)	F02 (Hz)	94.806	83.672	126.012	21.52
	JITTER2 (%)	0.484	0.244	0.510	0.130
	SHIMMER2 (dB)	0.047	0.022	0.062	0.050
	HNR2 (dB)	35.51	26.18	39.92	4.520

N= the number of the participants; AM= acoustic measures; M=mean; Min=minimum value; Max=maximum value; SD=standard deviation

The measures such as F02 and HNR2 shows deterioration in scores of the instructors. But it was observed that the score was not up to significant level and seems inconclusive. Upon closer examination, it was again observed that many individuals did not differ in score from the standard values throughout the ON season. Even though the instructors did not displayed deviations in recorded acoustic voice measurements (F02, JITT2, SHIMM2, and HNR2), but 04 instructors displayed greater deviations than the others on two of the recorded acoustic voice measurements (HNR and F02), and only a small number of instructors recorded little or no variation in the recorded acoustic voice measurements (HNR or SHIMM) during the ON season.

To comparison between Off and On season in change of acoustic related difference in participant. Test of normality was applied to find out the normal distribution of data. Shapiro-wilk test represented that data was not normally distributed. Hence, we further applied the Wilcoxon signed rank test. Table 3 represents the findings acoustic voice measurements recorded during the ON and OFF seasons.

Table 3: The testing of differences in the observed acoustic voice measures during OFF and On season.

OFF season vs ON season	z	p
F01 Vs F02	1.121	0.345
JITT1 Vs JITT2	0.072	0.269
SHIM1 Vs SHIM2	1.256	0.345
HNR1 Vs HNR2	0.878	0.427

These findings demonstrate that there were no statistically significant ( $p < 0.005$ ) changes of the mean F01 vs F02, JITT1 vs JITT2, SHIMM1 vs SHIMM2, and HNR1 vs HNR2 during both seasons. Although the findings of the Signed Test are not significant, there can be some patterns noticed in some instructors, and it is important to take into account intraindividual differences among instructors. The

acoustic voice measurements during the ON season showed individual changes that merit attention because they reflect the vocal strain that most of instructors typically experience while rafting for giving commands and instructions. Additionally, these differences among the instructors can be significant because they have the potential to have a significant impact on the quality of voices in the coming years (Buckley, O'Halloran & Oates, 2011). These specific acoustic voice changes that occur throughout ON season are noteworthy, but they may also lay the foundation for future, more severe acoustic voice changes that could manifest as a variety of voice-related disorders (Dallaston & Rumbach, 2015).

**CONCLUSION**

Whitewater rafting is a fantastic outdoor adventure activity that is fulfilling for both the instructors and the participants. It is far too common to disregard the significant problem of vocal health. Rafting instructors participates in various activities during rafting such command, instructions follow ups in open environment. Such environment may have wind noise or water noise which may have interferences during the giving instruction and this interference leads to vocal abuse Such voice abuse further progresses to strain in voice, breathiness, vocal fatigue, hoarseness harshness, vocal trauma, polyp, palsy, nodules or others voice related. Preventive measures must be done right away if an instructor feels that their voice is being damaged by overuse.

The use of voice amplification devices enables instructors to speak at a normal volume, and the earlier-mentioned pedagogical suggestions can minimize or even completely eliminate the necessity for voice projection. In order to prevent further harm, instructors who suspect they already have vocal fold damage should see a doctor and think about consulting a speech-language pathologist. However, instructors should try to prevent a vocal issue from being so bad. "An ounce of prevention is worth a pound of cure" is a saying, particularly relevant in the field of voice projection and rafting.

**Limitations**

Our aim of the study was to find out the changes in voice of such rafting instructors who use their voice as vocal users. We examined the voice of such voice users in both OFF and ON seasons. However, more has to be learned about how instructors' acoustic measures affect their voice over the long term. While performing the study we faced some shortcomings these includes, One, study only included a limited number of participant instructors to account for any individual variances, Two, it did not explore any potential links between instructors' habits and lifestyle changes and acoustic voice characteristics. Three, the study did not examine the amount of working hours each day or any other sickness or condition (such as heart disease, otolaryngology disorders, or systemic diseases). Four, limitation in measurement of voice acoustical analysis such as Dr. Speech, Electrolottography (EGG) Multidimensional Voice Profile (MDVP). Five, the study was confined to location specific i.e. Rishikesh, it would have been performed in various rafting sites across India.

**Future Directions**

Rafting activates takes place in various part of world but more often it is place specific due to that rafting instructor left out by sight of researchers. The finding of the study suggested that there are no significant changes in acoustical measures (objectively) but it handicapping instructors (subjectively). In future this study can be done in continuation to find out more specifics voice related changes in terms of both (subjective and objective) among the such vocal users.

**REFERENCES**

- Biddle, A. K., Watson, L. R., Hooper, C. R., Lohr, K. N., & Sutton, S. F. (2002). Criteria for determining disability in speech-language disorders. *Evidence report/technology assessment (Summary)*, (52), 1-4.
- Boersma, P. (2011). Praat: doing phonetics by computer [Computer program]. <http://www.praat.org/>.
- Bučević, A., Bonetti, A., & Bonetti, L. (2018). The voice quality of sports coaches. *Logopedija*, 8(1), 1-5.
- Buckley, K., O'Halloran, P., & Oates, J. (2011). Voice and vocal health in elite sports coaching: considerations for elite football coaching staff. *British Journal of Sports Medicine*, 45(4), 337-338.
- Byeon, H. (2017). Occupational risks for voice disorders: evidence from a Korea national cross-sectional survey. *Logopedics Phoniatrics Vocology*, 42(1), 39-43.
- Casper, J. K., & Leonard, R. (2006). *Understanding voice problems: A physiological perspective for diagnosis and treatment*. Lippincott Williams & Wilkins.
- Cielo, C. A., Ribeiro, V. V., & Hoffmann, C. F. (2015). Vocal symptoms of future professional voice users. *Revista CEFAC*, 17, 34-43.
- Dallaston, K., & Rumbach, A. F. (2016). Vocal performance of group fitness instructors before and after instruction: Changes in acoustic measures and self-ratings. *Journal of voice*, 30(1), 127-e1.

9. Datta, R., Sethi, A., Singh, S., Nilakantan, A., & Venkatesh, M. D. (2011). Translation and validation of the voice handicap index in Hindi. *Journal of Laryngology and Voice*, 1(1), 12.
10. Fiore, D. C. (2003). Injuries associated with whitewater rafting and kayaking. *Wilderness & environmental medicine*, 14(4), 255-260.
11. Franic, D. M., Bramlett, R. E., & Bothe, A. C. (2005). Psychometric evaluation of disease specific quality of life instruments in voice disorders. *Journal of Voice*, 19(2), 300-315
12. Gotaas, C., & Starr, C. D. (1993). Vocal fatigue among teachers. *Folia Phoniatrica et Logopaedica*, 45(3), 120-129.
13. Hunter, I. R. (2007). An analysis of whitewater rafting safety data: risk management for programme organizers. *Journal of Adventure Education & Outdoor Learning*, 7(1), 21-35.
14. Kitch, J. A., & Oates, J. (1994). The perceptual features of vocal fatigue as self-reported by a group of actors and singers. *Journal of Voice*, 8(3), 207-214.
15. Lee, L., Stemple, J. C., Glaze, L., & Kelchner, L. N. (2004). Quick screen for voice and supplementary documents for identifying pediatric voice disorders.
16. Myers, T. M., Becker, C. C., & Stevens, L. E. (1999). *Fateful Journey: Injury and Death on Colorado River Trips in Grand Canyon*. Red Lake Books.
17. O'Neill, J., & McMenamin, R. (2014). Voice use in professional soccer management. *Logopedics Phoniatrics Vocology*, 39(4), 169-178.
18. Penteado, R. Z., & Silva, N. B. (2014). Voice and work conditions of soccer coaches and physical trainers. *Distúrbios Comun*, 26(4), 790-9.
19. Smith, E., Gray, S. D., Dove, H., Kirchner, L., & Heras, H. (1997). Frequency and effects of teachers' voice problems. *Journal of voice*, 11(1), 81-87.
20. Trout, J., & McColl, D. (2007). Vocal health for physical educators. *Journal of Physical Education, Recreation & Dance*, 78(8), 12-50.
21. Wilkinson, K. (1984). Whitewater rafting in eastern Canada. *The Physician and Sportsmedicine*, 12(6), 198-205.