RESEARCH

Knowledge, attitude, and practice toward vocal fatigue among occupational voice users: a cross-sectional study

Zhou Zhou[1], Yanlu Lyu[1], Ming Yang[1], Min Yan[1] and Zhaoyang Ke[1*]

Abstract

Background Occupational voice users frequently face the challenge of vocal fatigue, impacting their overall well-being and job performance. This study aimed to investigate the knowledge, attitude, and practice (KAP) toward vocal fatigue among occupational voice users.

Methods This web-based cross-sectional study was conducted among occupational voice users between July and October 2023 in Shenzhen People's Hospital, utilizing a self-administered questionnaire to examine the KAP of vocal fatigue. A total of 920 valid questionnaires were collected with 248 males and 672 females, with 34.35% aged between 21 and 30 years.

Results The mean (standard deviation) scores were 15.1 (5.3) for knowledge (range: 0–24), 31.6 (3.6) for attitude (range: 8–40), and 45.0 (7.5) for practice (range: 13–65). A graduate degree or higher was positively associated with knowledge (odds ratio [OR] = 1.596, $P = 0.007$). Negative associations with knowledge included being a salesperson (OR = 0.342, $P < 0.001$) or a lawyer (OR = 0.150, $P = 0.001$). Knowledge was positively linked to attitude (OR = 1.211, $P < 0.001$), while being a medical professional was negatively linked (OR = 0.390, $P = 0.018$). Positive associations with practice included knowledge (OR = 1.076, $P < 0.001$), attitude (OR = 1.106, $P < 0.001$), age 21–30 years (OR = 1.955, $P = 0.011$), age 31–40 years (OR = 2.123, $P = 0.034$), having one child (OR = 2.501, $P = 0.016$), and having two or more children (OR = 2.324, $P = 0.030$). Negative associations included being a medical professional (OR = 0.458, $P = 0.046$), being married (OR = 0.465, $P = 0.031$), former smoking (OR = 0.317, $P < 0.001$), and speaking 6–10 h daily (OR = 0.736, $P = 0.048$).

Conclusion Occupational voice users had moderate knowledge, neutral attitude and moderate practice towards vocal fatigue. To alleviate fatigue and prevent the aggravation of vocal problems, recommendations include implementing tailored educational programs, conducting awareness campaigns, and fostering collaboration with medical professionals.

Keywords Knowledge, Attitude, Practice, Occupations, Occupational voice users, Vocal fatigue, Cross-sectional study

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*Correspondence:
Zhaoyang Ke
szent@foxmail.com
[1]Department of Otolaryngology-Head and Neck Surgery, Shenzhen People's Hospital, (The Second Clinical Medical College, Jinan University; The First Affiliated Hospital of Southern University of Science and Technology), No.1017, Dongmen North Road, Shenzhen, Guangdong 518020, China

Background

Vocal fatigue refers to the subjective experience of exertion and discomfort caused by prolonged or intense vocal use [1]. Teachers, call center workers, singers, actors, and other professionals who are required to use their voice extensively in demanding environments, are particularly vulnerable to the negative consequences of vocal fatigue [2–6]. Previous studies have indicated a high proportion of various professional voice users experiencing vocal fatigue [7–9]. For example, 41% of professors, 37.8% of university teachers, and 33–68% of call center operators reported vocal fatigue. Besides, 74% of treatment-seeking population exhibit vocal pathology, with vocal nodules and muscle tension dysphonia being the most frequently diagnosed conditions [3]. Moreover, teachers are three times more likely to report vocal fatigue and over three times more likely to experience physical voice discomfort compared to healthy controls [5]. Persistent vocal fatigue can lead to psychosocial voice impairment and alterations in acoustic parameters, adversely affecting career development [10–12].

Despite the vocal fatigue has been commonly reported, the vocal hygiene and the voice-related quality of life (V-RQOL) differ significantly across different populations, even under the similar working intensity. The discrepancy may underscore the role of knowledge, attitude, and practice (KAP) in shaping the efficacy of prevention and treatment among occupational voice users [13]. The KAP model has been widely employed to assess the understanding, beliefs, and actions of individuals or communities in relation to specific health issues [14]. The model operates on the assumption that knowledge influences attitudes, which in turn shape behaviors [15]. In the practices of vocal hygiene, maintaining hydration, avoiding vocal misuse or overuse, and incorporating vocal warm-up exercises are effective strategies to mitigate the risk of vocal fatigue and maintain optimal vocal health [16–18]. Additionally, engaging in vocal relaxation exercises and seeking guidance from speech therapists or vocal coaches contribute to vocal health maintenance [19]. Besides, knowledge and attitude towards practice are essential for cultivating motivation and addressing challenges in vocal healthcare, such as delay in identifying vocal fatigue and hesitancy in seeking medical care [20]. Previous KAP studies related to vocal fatigue have provided evidence regarding the gaps in healthcare of vocal fatigue. For instance, one study conducted in India revealed singers exhibited sound understanding and positive attitude towards vocal health care, and tended to rely more on home remedies rather than seeking medical assistance [21]. Another cross-sectional study from South Africa found that 61% of occupational voice users had received vocal health education, but 40% considered this training insufficient [6]. To our knowledge, limited evidence has been available on the KAP regarding vocal fatigue among Chinese occupational voice users. The scarcity in research can greatly impede the promotion in vocal hygiene in China, ultimately undermining their V-RQOL.

Therefore, this study aimed to investigate the KAP towards vocal fatigue among occupational voice users, to identify potential gaps in understanding vocal fatigue among participants, and to pinpoint areas for improvement in preventive and treatment measures. We hypothesized that participants' knowledge can positively influence their attitudes and practice towards vocal fatigue, and their attitude can contribute to the enhanced practice. Our findings can provide empirical data on the KAP of occupational voice users, which can facilitate interventions to improve awareness and management for vocal fatigue.

Methods

Study design and participants

The cross-sectional study was conducted at Shenzhen People's Hospital between July and October 2023, enrolling occupational voice users. Occupational voice users are defined as those who use their voice more than 3 h a day at work based on previous literature and occupational status in China [22]. The inclusion criteria for participation required individuals to be at least 18 years of age and to have a minimum of one year of professional experience in a voice-intensive occupation. This criterion was established to ensure that participants had adequate exposure to the demands of their vocations, allowing for a more meaningful assessment of knowledge, attitudes, and practices related to vocal fatigue. Conversely, individuals who provided incomplete or inconsistent questionnaire responses were excluded from the study, as were those unable to provide informed consent due to cognitive or communicative impairments.

Ethical protection

Strict ethical protocols were adhered to ensure the protection of participants' rights and welfare. Informed consent was obtained from all participants prior to their completion of the questionnaire. This process involved clearly explaining the study's purpose, procedures, potential risks, and the voluntary nature of participation. Participants were assured that their involvement was entirely voluntary and that they could withdraw from the study at any point without any consequences. To maintain confidentiality, we implemented measures to ensure that all responses were anonymized. Personal identifying information was not collected, and data were stored securely to prevent unauthorized access. The study received ethical approval from the Ethics Committee of Shenzhen People's Hospital (Approval No: LL-KY-2023123-01).

Questionnaire

The questionnaire utilized in this study was developed based on relevant literature [23–25]. Expert opinions were sought to ensure the questionnaire's validity, and guarantee the removal of redundant or repetitive questions and clarifications of certain statements. Before the official launch, a small-scale pilot study was conducted involving 39 participants. The internal consistency of the questionnaire was assessed using Cronbach's α coefficient, and yielded a value of 0.810, indicating high internal consistency. The confirmatory factor analysis indicated a comparative fit index (CFI) of 0.90 (values>0.8 are considered acceptable), an incremental fit index (IFI) of 0.90 (values>0.8 are considered acceptable), a root mean square error of approximation (RMSEA) of 0.047 (values<0.08 are considered acceptable), and a chi-square value/degrees of freedom (CMIN/DF) of 3.062 (values between 3 and 5 are considered good, with values closer to 3 being excellent) (Fig. 1).

The final version of the questionnaire (**Supplement file**) encompassed the following dimensions: (1) Demographic information includes 11 items, including gender, age, education, occupation, marital status, presence of children, number of children, taking care of children personally, smoking status, average daily speaking time, and diagnosis of the following chronic diseases. (2) The knowledge dimension comprises 8 questions, totaling 12 items. Participants were allocated 2 points for demonstrating a high level of familiarity, 1 point for displaying partial awareness, and 0 points for lacking clarity. (3) Attitude dimension, consisting of 8 questions. A five-point Likert scale ranging from very positive (5 points) to very negative (1 point) was employed. (4) Practice dimension, encompassing 13 questions. Similarly, a five-point Likert scale was used, ranging from always (5 points) to never (1 point). Higher scores indicated greater knowledge, more positive attitude, and more proactive practice. Based on the scores in each dimension, participants were categorized into three levels based on Bloom's cut-off point: good knowledge, positive attitude, and appropriate practice (80–100%); moderate knowledge, neutral attitude, and moderate practice (60–79%); and inadequate knowledge, negative attitude, and inappropriate practice (below 60%) [26].

Data collection and quality control

The research team aimed to gather a diverse sample of occupational voice users, including individuals in music schools, law firms, and sales groups through convenient sampling. To facilitate the recruitment process, a WeChat-based questionnaire was developed using the "Questionnaire Star" mini-program. The online questionnaire was distributed via a QR code, which participants could scan with their WeChat app to access the survey.

Prior to completing the questionnaire, participants were informed about the purpose of the study. To ensure the quality of the data, all items in the questionnaire were made mandatory. The research team monitored the data collection process, and meticulously reviewed each completed questionnaire for completeness, internal coherence, and rationality.

Sample size

The formula for calculating the sample size required was as follows [27]:

$$n = \left(\frac{Z_{1-\frac{\alpha}{2}}}{\delta} \right)^2 \times p \times (1-p)$$

In the formula, "n" represents the sample size for each group, "α" represents the type I error, which is typically set at 0.05. In this case, $Z_{1-\frac{\alpha}{2}} = 1.96$. "δ" represents the allowable error, typically set at 0.05, and "p" denotes expected prevalence, and is set at 0.5 in the study (as setting it at 0.5 maximizes the value and ensures a sufficiently large sample size). The calculated sample size "n" is 384. Considering an estimated questionnaire response rate of 80%, the final plan is to collect 480 valid questionnaires.

Statistical analysis

The statistical analysis was conducted using Stata 17.0 (Stata Corporation, College Station, TX, USA). Continuous variables were expressed as means (standard deviations, SD), while categorical variables were presented as frequencies and percentages. Student's t-test was employed for comparisons between two groups with normally distributed data, while the Mann-Whitney U test was used for skewed distributed data. ANOVA was utilized for continuous variables involving three or more groups with normal distribution and equal variances. Pearson correlation analysis was employed to examine the associations between knowledge, attitude, and practice scores. Logistic regression analysis was conducted for knowledge, attitude, and practice. The cut-off value was set at 60% of the score distribution [28]. In the multivariable logistic regression analysis, variables with $P < 0.05$ in the univariate analysis were included. Two-sided $P < 0.05$ was considered statistically significant.

Results

Demographic characteristics

Out of 1145 subjects, 1012 completed the questionnaire, resulting in a response rate of 88.4%. Out of the total 1012 collected questionnaires, 92 (9.09%) were excluded due to empty responses or uniform choices throughout the questionnaire, resulting in 920 (90.91%) valid questionnaires for formal analysis. Among the participants,
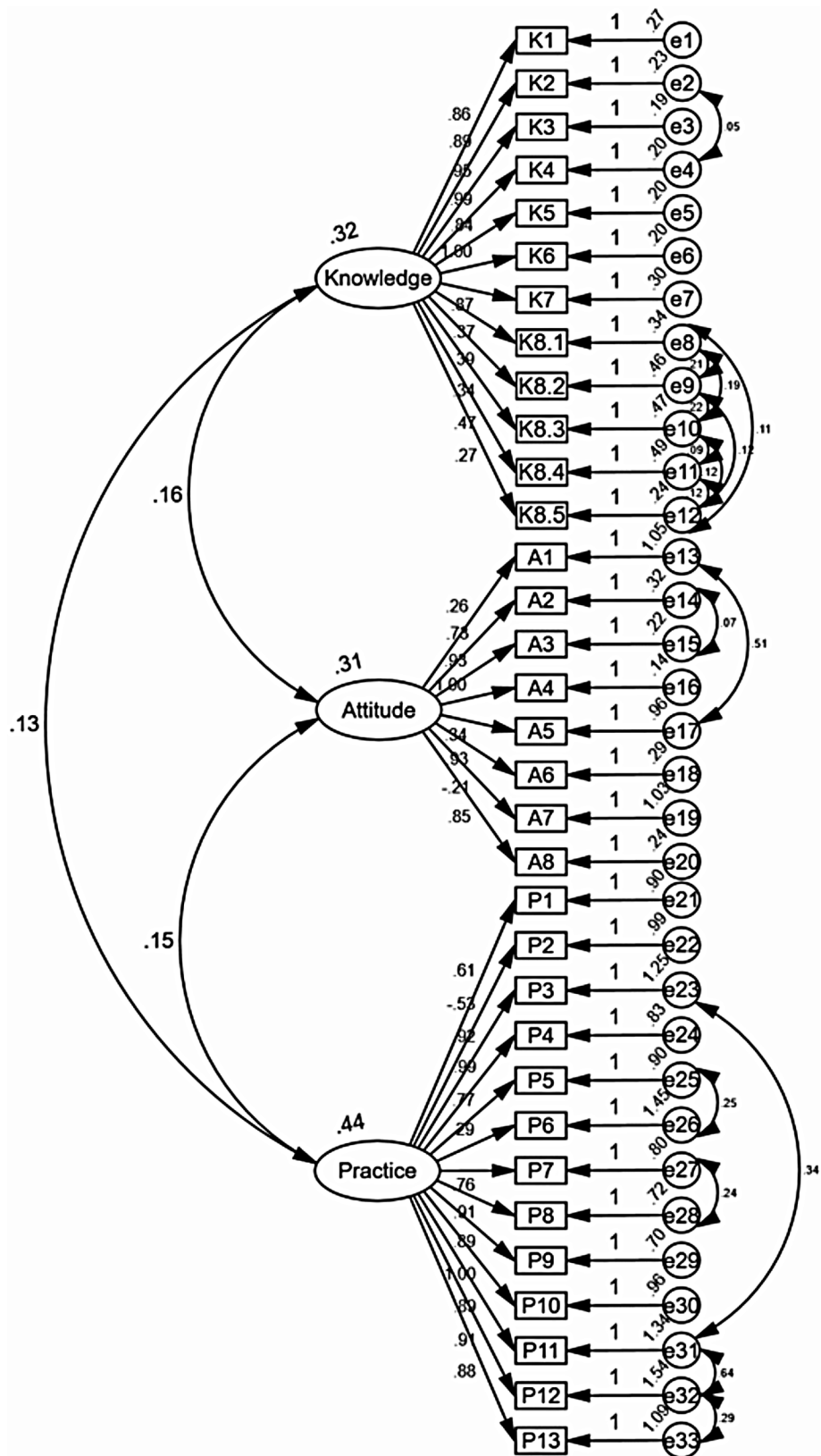
Fig. 1 The structural equation model (SEM) showing the associations between KAP scores. Rectangles show observed variables, ellipses indicate potential variables, and circles represent residual terms

34.35% fell within the age range of 21–30 years. The majority were female (73.04%), held college or undergraduate degrees (74.67%), were unmarried (52.72%), had no children (58.04%), and were non-smokers (84.78%). The average daily speaking time of participants was predominantly distributed in the ≤5 h range (45.98%), while 11.20% of participants reported speaking demands exceeding 10 h per day. Additionally, a significant proportion of participants (30.54%) reported experiencing pharyngitis (Table 1).

Knowledge

Participants achieved a mean (SD) knowledge score of 15.1 (5.3) (possible range: 0–24) (Table 1). Higher knowledge scores were observed among participants who identified as female ($P<0.001$), aged over 40 years ($P=0.007$), holding a graduate degree or above ($P<0.001$), being married ($P=0.010$), having children ($P=0.009$), having only one child ($P=0.012$), not personally caring for their children ($P=0.032$), and never smoking ($P=0.035$). Significant differences in knowledge scores were observed among occupations, with broadcasters scoring the highest, followed by medical personnel and singers ($P<0.001$). The knowledge assessment encompassed diverse items, and demonstrated varying correct rates ranging from 13.48 to 90.22% (Table S1). Besides, the item with the lowest correct rate (13.48%) was related to recognizing vocal fatigue as an indicator of potential vocal fold disorders (K2). Besides, the item with the second lowest correct rate (15.43%) pertained to understanding the increased susceptibility of women during menstruation, pregnancy, childbirth, menopause, and older individuals to vocal fatigue (K7). Conversely, a high percentage of participants (90.22%) correctly identified unhealthy lifestyle habits contributing to vocal fatigue, such as heavy smoking, excessive alcohol consumption, and staying up late (K8.5) (Table S1).

Attitude

The participants exhibited an attitude score of 31.6 (3.6) (possible range: 8–40) (Table 1). Higher attitude scores were noted among female participants ($P<0.001$), those with a graduate degree or higher ($P<0.001$), and non-smokers ($P=0.011$). Attitude scores varied significantly among different occupations, with singers scoring the highest, followed by medical personnel and broadcasters ($P<0.001$). Positive attitude rates (including "Strongly agree" and "Agree") ranged from 45.96 to 93.15%. A considerable proportion of participants (93.15%) expressed a positive attitude towards the role of adequate hydration through regular water intake in preserving vocal health (A2). In contrast, only 45.96% of participants disagreed with the notion that vocal fatigue was a typical occupational phenomenon that required minimal intervention,

and a two-day period of rest was sufficient (A1) (Table S2).

Practice

The practice score exhibited a mean (SD) value of 45.0 (7.5) (possible range: 13–65) (Table 1). Higher practice scores were identified among participants aged above 40 years ($P<0.001$), holding a graduate degree or above ($P=0.045$), being married ($P=0.002$), having children ($P=0.001$), having only one child ($P=0.002$), personally caring for their children ($P=0.002$), and never smoking ($P<0.001$). Practice scores showed significant differences among different occupations, with broadcasters scoring the highest, followed by teachers and medical personnel ($P<0.001$). Of note, participants demonstrated varying levels of adherence to recommended practice, with proportions ranging from 36.85 to 74.35%. The majority of participants (74.35%) actively abstained from smoking and avoided secondhand smoke (P3). However, only 36.85% of the total sample reported avoiding spicy and irritating food (P13). Moreover, a mere 38.04% expressed willingness to drink water when not thirsty (P6) (Table S3).

Correlation analysis

As presented in Table 2, knowledge score was positively correlated with attitude ($r=0.504$, $P<0.001$) and practice score ($r=0.303$, $P<0.001$). Additionally, a positive correlation was observed between attitude and practice score ($r=0.334$, $P<0.001$).

Multivariable logistic regression

Multivariable logistic regression analysis revealed that a graduate or higher education (OR=1.596, 95% CI: 1.134–2.246, $P=0.007$) was positively associated with knowledge, whereas being a salesperson (OR=0.342, 95% CI: 0.215–0.545, $P<0.001$) or a lawyer (OR=0.150, 95% CI: 0.051–0.444, $P=0.001$) was negatively associated with knowledge (Table 3). Knowledge (OR=1.211, 95% CI: 1.168–1.255, $P<0.001$) was positively associated with attitude, while being medical personnel (OR=0.390, 95% CI: 0.179–0.853, $P=0.018$) was negatively associated with attitude (Table 4). Positive associations with practice included knowledge (OR=1.076, 95% CI: 1.041–1.113, $P<0.001$), attitude (OR=1.106, 95% CI: 1.055–1.158, $P<0.001$), age being 21–30 years (OR=1.955, 95% CI: 1.166–3.279, $P=0.011$), age being 31–40 years (OR=2.123, 95% CI: 1.060–4.251, $P=0.034$), having one child (OR=2.501, 95% CI: 1.190–5.255, $P=0.016$), and having two or more children (OR=2.324, 95% CI: 1.085–4.976, $P=0.030$). Negative associations with practice were found for being medical personnel (OR=0.458, 95% CI: 0.212–0.987, $P=0.046$), being married (OR=0.465, 95% CI: 0.232–0.931, $P=0.031$), being a former smoker

Table 1 Demographic characteristics

Variables	N (%)	Knowledge Score		Attitude Score		Practice Score	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Total	920	15.1 ± 5.3		31.6 ± 3.6		45.0 ± 7.5	
Gender			< 0.001		< 0.001		0.090
Male	248(26.96)	13.9 ± 6.1		30.8 ± 3.9		44.3 ± 7.1	
Female	672(73.04)	15.5 ± 5.0		32.0 ± 3.5		45.3 ± 7.6	
Age, years			0.007		0.836		< 0.001
≤ 20	172(18.70)	14.6 ± 5.2		31.7 ± 3.7		43.4 ± 7.8	
21–30	316(34.35)	14.4 ± 5.7		31.5 ± 3.8		44.5 ± 7.3	
31–40	222(24.13)	15.7 ± 4.9		31.7 ± 3.4		45.6 ± 7.4	
> 40	210(22.83)	15.7 ± 5.1		31.7 ± 3.5		46.6 ± 7.1	
Education			< 0.001		< 0.001		0.045
High school and below	35(3.80)	14.5 ± 6.0		29.5 ± 4.2		43.9 ± 7.3	
College/Undergraduate	687(74.67)	14.6 ± 5.3		31.5 ± 3.6		44.7 ± 7.5	
Graduate and above	198(21.52)	16.7 ± 4.9		32.7 ± 3.4		46.1 ± 7.5	
Occupation			< 0.001		< 0.001		0.001
Teacher	314(34.13)	16.1 ± 4.7		32.3 ± 3.3		46.3 ± 7.2	
Singer	127(13.80)	16.5 ± 4.7		32.8 ± 3.3		44.5 ± 7.4	
Broadcaster	12(1.30)	18.3 ± 4.1		32.5 ± 4.5		47.3 ± 8.9	
Online streamer	8(0.87)	14.1 ± 5.4		29.6 ± 3.1		43.9 ± 9.2	
Salesperson	155(16.85)	11.6 ± 5.9		29.9 ± 3.9		42.9 ± 7.6	
Lawyer	30(3.26)	12.8 ± 4.7		31.4 ± 3.1		43.8 ± 7.3	
Medical personnel	34(3.70)	18.2 ± 4.1		32.7 ± 3.0		45.7 ± 6.8	
Others[*]	240(26.09)	14.8 ± 5.2		31.2 ± 3.7		45.0 ± 7.5	
Marital status			0.010		0.566		0.002
Unmarried	485(52.72)	14.6 ± 5.5		31.6 ± 3.8		44.3 ± 7.6	
Married	435(47.28)	15.5 ± 5.1		31.7 ± 3.5		45.8 ± 7.3	
Presence of children			0.009		0.545		0.001
Yes	386(41.96)	15.6 ± 5.0		31.7 ± 3.4		46.0 ± 7.3	
No	534(58.04)	14.7 ± 5.5		31.6 ± 3.8		44.3 ± 7.5	
Number of children			0.012		0.538		0.002
0	534(58.04)	14.7 ± 5.5		31.6 ± 3.8		44.3 ± 7.5	
1	235(25.54)	15.9 ± 5.2		31.9 ± 3.4		46.1 ± 7.4	
≥2	151(16.41)	15.1 ± 4.6		31.5 ± 3.5		45.9 ± 7.2	
Taking care of children personally			0.032		0.827		0.002
Yes	276(30.00)	14.7 ± 5.5		31.7 ± 3.4		46.2 ± 7.2	
No	110(11.96)	15.5 ± 5.0		31.7 ± 3.5		45.6 ± 7.6	
Smoking			0.035		0.011		< 0.001
Never smoked	780(84.78)	15.2 ± 5.3		31.8 ± 3.6		45.6 ± 7.4	
Former smoker	140(15.22)	14.2 ± 5.7		30.9 ± 3.9		41.8 ± 7.2	
Average daily speaking time			0.233		0.632		0.263
3–5 h	423(45.98)	15.1 ± 4.9		31.6 ± 3.5		45.4 ± 7.2	
6–10 h	394(42.82)	15.3 ± 5.6		31.7 ± 3.8		44.6 ± 7.6	
> 10 h	103(11.20)	14.2 ± 5.9		31.9 ± 3.8		44.7 ± 7.8	
Diagnosis of the following chronic diseases (Multiple choices)							
Rhinitis	275(29.89)	15.6 ± 5.3		31.8 ± 3.6		45.1 ± 7.4	
Pharyngitis	281(30.54)	16.4 ± 4.8		32.1 ± 3.5		45.7 ± 7.2	
Gastritis	121(13.15)	16.4 ± 4.4		32.6 ± 3.5		45.0 ± 7.6	
None	449(48.80)	14.2 ± 5.6		31.3 ± 3.7		44.7 ± 7.7	

Note * Other professions mainly include e-commerce operation, audio book recording, telephone operator, film and television industry

Table 2 Pearson correlation analysis of knowledge, attitude and practice dimensions among participants

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.504 (P < 0.001)	1	
Practice	0.303 (P < 0.001)	0.334 (P < 0.001)	1

(OR = 0.317, 95% CI: 0.200-0.501, *P* < 0.001), and having an average daily speaking time of 6–10 h (OR = 0.736, 95% CI: 0.543–0.998, *P* = 0.048) (Table 5).

Discussion

The primary aim of this study was to evaluate the KAP of occupational voice users with respect to vocal fatigue. In the study, occupational voice users exhibited moderate knowledge, a neutral attitude, and moderate practices concerning vocal fatigue. Furthermore, significant positive correlations were found among their KAP scores.

Table 3 Univariate and multivariable logistic regression analysis of knowledge dimension

Variables	Univariate logistic regression analysis		Multivariable logistic regression analysis	
	OR (95%CI)	*P*	OR (95%CI)	*P*
Gender				
Male	Ref.		Ref.	
Female	1.405(1.038 1.901)	0.027	1.156(0.832 1.607)	0.388
Age, years				
≤ 20	Ref.			
21–30	1.177(0.801 1.728)	0.407		
31–40	1.352(0.898 2.035)	0.149		
> 40	1.410(0.933 2.133)	0.103		
Education				
High school and below	1.239(0.624 2.464)	< 0.001	1.380(0.679 2.806)	0.374
College/Undergraduate	Ref.		Ref.	
Graduate and above	1.792(1.303 2.464)	< 0.001	1.596(1.134 2.246)	0.007
Occupation				
Teacher	Ref.		Ref.	
Singer	1.042(0.690 1.574)	0.845	1.149(0.755 1.748)	0.516
Broadcaster	1.436(0.446 4.621)	0.544	1.492(0.455 4.888)	0.509
Online streamer	0.615(0.145 5.620)	0.511	0.583(0.135 2.525)	0.471
Salesperson	0.288(0.186 0.448)	< 0.001	0.342(0.215 0.545)	< 0.001
Lawyer	0.158(0.054 0.463)	0.001	0.150(0.051 0.444)	0.001
Medical personnel	1.465(0.715 3.004)	0.297	1.421(0.688 2.932)	0.342
Others*	0.615(0.447 0.848)	0.003	0.654(0.462 0.926)	0.017
Marital status				
Unmarried	Ref.			
Married	1.192(0.916 1.551)	0.191		
Presence of children				
Yes	Ref.			
No	1.177(0.902 1.535)	0.231		
Number of children				
0	Ref.			
1	1.358(0.996 1.850)	0.053		
≥ 2	0.936(0.645 1.357)	0.726		
Smoking				
Never smoked	Ref.			
Former smoker	0.770(0.530 1.118)	0.170		
Average daily speaking time				
3–5 h	Ref.			
6–10 h	1.212(0.917 1.601)	0.176		
> 10 h	0.905(0.580 1.413)	0.661		

Note * Other professions mainly include e-commerce operation, audio book recording, telephone operator, film and television industry

Table 4 Univariate and multivariable logistic regression analysis of attitude dimension

Variables	Univariate logistic regression analysis		Multivariable logistic regression analysis	
	OR (95%CI)	P	OR (95%CI)	P
Knowledge Score	1.214(1.174 1.256)	< 0.001	1.211(1.168 1.255)	< 0.001
Gender				
Male	Ref.		Ref.	
Female	1.556(1.150 2.106)	0.004	1.324 (0.929 1.889)	0.121
Age, years				
≤ 20	Ref.			
21–30	0.952(0.654 1.385)	0.798		
31–40	0.898(0.600 1.344)	0.602		
> 40	0.970(0.646 1.457)	0.883		
Education				
High school and below	0.519(0.239 1.124)	0.096	0.483(0.207 1.126)	0.092
College/Undergraduate	Ref.		Ref.	
Graduate and above	1.726(1.256 2.373)	0.001	1.304(0.905 1.880)	0.155
Occupation				
Teacher	Ref.		Ref.	
Singer	1.301(0.859 1.968)	0.214	1.340(0.848 2.119)	0.210
Broadcaster	1.436(0.446 4.621)	0.544	1.115(0.311 3.992)	0.867
Online streamer	0.342(0.068 1.720)	0.193	0.469(0.086 2.554)	0.381
Salesperson	0.333(0.217 0.511)	< 0.001	0.717(0.436 3.786)	0.190
Lawyer	0.898(0.424 1.901)	0.778	1.683(0.748 0.786)	0.208
Medical personnel	0.635(0.307 1.313)	0.220	0.390(0.179 0.853)	0.018
Others[*]	0.615(0.437 0.867)	0.005	0.766(0.526 1.117)	0.166
Marital Status				
Unmarried	Ref.			
Married	0.941(0.724 1.223)	0.649		
Presence of children				
Yes	Ref.			
No	1.069(0.820 1.393)	0.624		
Number of children				
0	Ref.			
1	1.068(0.784 1.454)	0.678		
≥ 2	0.757(0.521 1.100)	0.144		
Smoking status				
Never smoked	Ref.			
Former smoker	0.860(0.595 1.241)	0.420		
Average daily speaking time				
3–5 h	Ref.			
6–10 h	1.064(0.805 1.405)	0.663		
> 10 h	1.249(0.810 1.925)	0.314		

Note * Other professions mainly include e-commerce operation, audio book recording, telephone operator, film and television industry

Demographic factors such as education, age, occupation, and parental status were linked to KAP scores, indicating the potential for targeted interventions aimed at improving vocal health in specific subgroups. Our findings can provide empirical data on the KAP of occupational voice users, which can facilitate interventions to improve awareness and management for vocal fatigue.

Comparison with earlier results

In contrast to our findings, a study conducted in India indicated that many teachers often overlook vocal health issues or resort to home remedies [29]. Similarly, a Turkish study highlighted significant deficiencies in knowledge regarding vocal hygiene and its practical application among professional voice users [30]. Although our study indicated a moderate level of knowledge and practice regarding vocal health, there is still a need for targeted educational programs, given the proven benefits of

Table 5 Univariate and multivariable logistic regression analysis of practice dimension

Variables	Univariate logistic regression analysis		Multivariable logistic regression analysis	
	OR (95%CI)	P	OR (95%CI)	P
Knowledge Score	1.110(1.080 1.141)	< 0.001	1.076(1.041 1.113)	< 0.001
Attitude Score	1.154(1.110 1.201)	< 0.001	1.106(1.055 1.158)	< 0.001
Gender				
Male	Ref.			
Female	1.264(0.940 1.701)	0.121		
Age, years				
≤ 20	Ref.		Ref.	
21–30	1.611(1.087 2.387)	0.018	1.955(1.166 3.279)	0.011
31–40	1.979(1.304 3.004)	0.001	2.123(1.060 4.251)	0.034
> 40	2.616(1.715 3.990)	< 0.001	2.423(1.134 5.180)	0.022
Education				
High school and below	1.167(0.590 2.308)	0.658		
College/Undergraduate	Ref.			
Graduate and above	1.358(0.989 1.864)	0.059		
Occupation				
Teacher	Ref.		Ref.	
Singer	0.542(0.354 0.829)	0.005	0.902(0.511 1.593)	0.723
Broadcaster	1.382(0.430 4.448)	0.587	2.493(0.667 9.328)	0.175
Online streamer	0.329(0.065 1.656)	0.178	0.526(0.097 2.847)	0.456
Salesperson	0.543(0.365 0.807)	0.003	1.124(0.699 1.808)	0.629
Lawyer	0.494(0.224 1.088)	0.080	0.701(0.303 1.624)	0.408
Medical personnel	0.611(0.296 1.263)	0.184	0.458(0.212 0.987)	0.046
Others[*]	0.864(0.617 1.210)	0.394	1.196(0.822 1.741)	0.349
Marital Status				
Unmarried	Ref.		Ref.	
Married	1.476(1.136 1.918)	0.004	0.465(0.232 0.931)	0.031
Presence of children[#]				
Yes	Ref.			
No	0.598(0.459 0.779)	< 0.001		
Number of children				
0	Ref.		Ref.	
1	1.762(1.293 2.402)	< 0.001	2.501(1.190 5.255)	0.016
≥ 2	1.542(1.072 2.219)	0.020	2.324(1.085 4.976)	0.030
Smoking status				
Never smoked	Ref.		Ref.	
Former smoker	0.344(0.227 0.520)	< 0.001	0.317(0.200 0.501)	< 0.001
Average daily speaking time				
3–5 h	Ref.		Ref.	
6–10 h	0.731(0.554 0.965)	0.027	0.736(0.543 0.998)	0.048
>10 h	0.900(0.584 1.387)	0.633	1.068(0.653 1.749)	0.793

Note * Other professions mainly include e-commerce operation, audio book recording, telephone operator, film and television industry

Due to collinearity issues with the number of children, it was not included in the multivariable analysis

education in promoting vocal healthcare. Notably, 26% of individuals in occupations not traditionally associated with voice use reported experiencing vocal fatigue [30]. This suggests that as communication requirements increase, reliance on vocal skills is extending into non-traditional voice-related fields. While our study did not originally include these occupations, the high prevalence of voice fatigue noted among participants points to a rising concern across diverse sectors. Furthermore, our research revealed a notable incidence of pharyngitis among occupational voice users. These findings emphasize the urgent need for effective vocal health interventions tailored specifically to the requirements of individuals in vocally demanding professions.

Knowledge

The item with the lowest correct rate, involving the recognition of vocal fatigue as an indicator of potential vocal fold disorders, indicated a lack of awareness about the potential implications of vocal fatigue on vocal health. This finding was concerning as timely recognition is crucial for preventive measures and appropriate management of vocal fold pathology [31]. Besides, the item with the second lowest correct rate, which referred to the understanding of increased vulnerability of women during certain periods to vocal fatigue, highlighted the knowledge gap in recognizing the specific factors that might exacerbate vocal fatigue in occupational voice users. This underscored the importance of targeted education and awareness campaigns to address misconceptions and promote better vocal health practice among vulnerable groups within crucial periods [32, 33]. On a positive note, the high percentage of participants correctly identifying unhealthy lifestyle habits contributing to vocal fatigue indicated good level of awareness in this regard. This finding was encouraging as it suggested that many participants were aware of the role of lifestyle choices in maintaining vocal health. By addressing these knowledge gaps, we can empower occupational voice users to make informed decisions regarding their vocal health and adopt proactive measures to prevent vocal fatigue and related disorders. This, in turn, can contribute to the overall well-being and long-term sustainability of occupational voice users' careers [34].

Attitude

The majority displayed positive attitude concerning the importance of regular water intake to maintain vocal integrity. This outcome was highly favorable as it indicated strong awareness among occupational voice users regarding hydration's role in preserving healthy vocal fold. Proper hydration is crucial in keeping the vocal fold well lubricated, thereby reducing the risk of vocal strain and fatigue [35]. Interestingly, participants' attitudes toward vocal fatigue as a typical occupational phenomenon requiring minimal intervention were less consistent. Less than half of participants disagreed with this notion, suggesting that a considerable number of occupational voice users might not fully comprehend the potential severity of vocal fatigue and its impact on their vocal health. Vocal fatigue is a prevalent issue faced by occupational voice users due to the demands of their profession and should not be trivialized as a typical or minor occupational concern [36]. Rest alone may not sufficiently address the root causes of vocal fatigue; thus, appropriate preventive measures and vocal care are necessary to mitigate its impact.

Practice

In the dimension of practice, the majority actively refrained from smoking and secondhand smoke exposure. Smoking and exposure to secondhand smoke can cause inflammation, irritation, and damage to the vocal fold, therefore negatively affecting voice quality and overall vocal health [37–39]. The high proportion of participants adhering to this practice suggested widespread awareness of the importance of avoiding smoking to preserve vocal well-being. However, the results also revealed worrying aspects in the practice dimension. Less than half of the subjects reported avoiding spicy and irritating foods. This finding indicated that a substantial number of participants may not fully comprehend the impact of diet on vocal health. Spicy and irritating foods can lead to acid reflux and throat irritation, and pose risks to the vocal fold [40, 41]. Moreover, a limited proportion expressed the willingness to drink water when not thirsty. Adequate hydration is crucial for vocal health as it ensures well-lubricated vocal fold and reduces the risk of vocal strain [42]. The low percentage of participants willing to hydrate when not thirsty suggested a potential lack of awareness regarding the importance of consistent hydration for vocal health. Overall, the findings underscored the necessity for targeted behavioral interventions to enhance occupational voice users' adherence to recommended practice for vocal health. By providing comprehensive knowledge about the effects of smoking, diet, and hydration on their vocal fold, occupational voice users can make informed decisions about their vocal habits and take proactive measures to maintain optimal vocal health.

Influential factors of KAP

Correlation analysis and multivariable logistic analysis demonstrated positive associations between KAP scores, which could be potentially attributed to the influence of knowledge on attitude towards vocal fatigue. These findings aligned with the theory of planned behavior, which proposes that attitudes are shaped by knowledge of behavior consequences [43]. As individuals gained deeper understanding of the benefits of specific practice in preventing and treating vocal fatigue, their attitude became more positive, and their adherence to management of vocal fatigue enhanced.

In the multivariable logistic analysis, participants with graduate's degree or higher education showed significantly higher knowledge scores. Higher education could provide more exposure to relevant information, encourage critical approach to learning, and foster better understanding of vocal health [44]. Age also played a significant role in participants' vocal health practice. Those between 21 and 40 years of age exhibited higher practice scores compared to younger participants (20 years or younger).

Also, participants above 40 years of age demonstrated elevated practice scores. Age-related awareness of vocal strain and fatigue might prompt proactive measures to preserve vocal health. Broadcasters demonstrated the highest knowledge scores, which may be attributed to their rigorous training and the technical nature of their work. Singers exhibited the highest attitude scores towards vocal fatigue, followed by medical personnel and broadcasters. The heightened awareness and proactive attitudes among singers can be explained by the direct impacts of vocal health on their professional performance and career longevity. Besides, the prominence of broadcasters and teachers in practicing vocal care may reflect the high vocal demands of their daily routines and the structured environments that facilitate the implementation of vocal health practices. Moreover, participants with an average daily speaking time between 6 and 10 h had significantly lower practice scores than those speaking ≤ 5 h daily. This finding implied that prolonged speaking time without adequate vocal rest and care could negatively influence participants' vocal health practice.

Strengths and limitations
This research represented the first assessment of KAP regarding vocal fatigue among a diverse population of occupational voice users in China. Our study provided comprehensive insights into the unique challenges faced by individuals whose work relies heavily on vocal performance. Besides, the methodological rigor employed throughout the data collection and analysis processes enhanced the reliability and validity of our findings.

This study had some limitations. Firstly, it was conducted at a single center with a relatively small sample size, which possibly restricted the generalizability of the findings. Nevertheless, these results can provide a useful basis for assessing the effectiveness of future educational interventions aimed at reducing vocal fatigue among occupational voice users. Secondly, the KAP findings might be influenced by social desirability bias, and potentially lead to an overestimation of scores, as participants might provide socially desirable answers rather than their actual behaviors [45]. Thirdly, culture-specific factors were not collected such as food intake, work nature, and job demands specific to the study region, thus potentially masking the understandings of their impacts on KAP towards vocal fatigue.

Recommendations for future research
Future longitudinal studies are essential to examine the changes of KAP over time, offering valuable insights into how education, workplace policies, and social determinants impact vocal health awareness and practices among occupational voice users. Additionally, the design of targeted educational interventions should be prioritized to enhance vocal health behaviors. These interventions should be customized to meet the specific needs of different professional groups, considering variables such as age, gender, and years of experience in vocally intensive occupations. Furthermore, investigating the link between vocal health education and actual vocal health outcomes is critical, as it can provide evidence to guide policy development and the allocation of resources in this field.

Conclusion
In conclusion, our study identified that occupational voice users exhibited moderate knowledge, neutral attitudes, and moderate practices concerning vocal fatigue. Significant positive correlations were observed among KAP scores. These findings highlight the need for targeted educational interventions to enhance vocal health awareness and behaviors.

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