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Validity and Reliability of the Arabic Cough Severity Index

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ABSTRACT

Objectives: This study aimed to translate and validate the Cough Severity Index (CSI) into Arabic (A-CSI) and to evaluate its validity and reliability among patients with chronic cough.

Methods: This cross-sectional descriptive questionnaire-based validation study was conducted at two tertiary hospitals in Riyadh, Saudi Arabia, between December 2023 and August 2024. The CSI was translated from English into Arabic using the forward-backward method. Its reliability was assessed using Cronbach's alpha and test-retest reliability. Its construct validity was assessed using exploratory factor analysis (EFA), and its internal consistency was assessed using Cronbach's alpha. Its discriminant validity was determined using the Mann-Whitney *U* test, and its reproducibility was evaluated using the intraclass correlation coefficient (ICC).

Results: Data were collected from 100 participants, 50 with chronic cough and 50 healthy controls. The mean age was 41.56 ± 14.28 years in the chronic cough group and 35.48 ± 10.02 years in the healthy control group. The A-CSI exhibited high reproducibility (ICC = 0.896) and excellent internal consistency (Cronbach's alpha = 0.966). EFA identified three factors explaining 66.41% of the variance, with all items having communalities > 0.3. The A-CSI exhibited significant discriminant validity between the chronic cough and healthy control groups ($p < 0.001$).

Conclusion: The A-CSI is a reliable and valid tool for assessing chronic cough in Arabic-speaking patients, making it suitable for both clinical practice and research.

Level of Evidence: Level 3.

1 | Introduction

Cough is a common medical condition that often leads to outpatient visits. Coughing normally serves to prevent aspiration by functioning as a protective reflex. However, for some individuals, it may become severe, prolonged, and debilitating [1]. A cough lasting more than 8 weeks is classified as chronic [2], while most coughs lasting less than 3 weeks are typically due to

acute irritants or upper respiratory infections [3]. Approximately 40% of individuals will experience a chronic cough at some point in their lives, with women being affected more frequently than men [4]. Chronic cough is a significant global issue, impacting 8%–12% of patients seeking ambulatory care in the US and Australia [5, 6]. Furthermore, one study in the US reported that 5% of participants reported having a chronic cough within 1 year [7].

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The various indicators of patient-reported outcomes showed that a chronic cough has a significant impact [8]. It decreases quality of life [9] and is frequently associated with psychological distress [10]. Research indicates that 53% of patients with a chronic cough score positively on questionnaires assessing depressive symptomatology. Patients with chronic coughs often display depression symptoms [10]. Conversely, patients with a prior diagnosis of anxiety or depression typically report more severe chronic cough symptoms [11]. Chronic cough can also impact voice quality; indeed, up to 40% of individuals with dysphonia also have a persistent cough [12]. Furthermore, since the larynx is involved in breathing and swallowing, a chronic cough may lead to dysfunction in these processes [13].

To address the need for an effective assessment tool for cough, the Cough Severity Index (CSI) was developed to measure a patient's upper airway-originating persistent cough symptoms in the clinic [14]. However, there is currently no instrument specifically designed for upper-airway chronic cough in the Arabic language. Therefore, this study aimed to translate the CSI into Arabic (A-CSI) and assess its validity and reliability. It also aimed to assess the impact of chronic cough on voice quality. This newly validated tool will hopefully enable clinicians to accurately quantify the severity of a patient's chronic cough and, thus, evaluate treatment outcomes and enhance patient care and satisfaction.

2 | Materials and Methods

2.1 | Ethical Considerations

This study followed the ethical criteria outlined in the Declaration of Helsinki. All participants provided informed consent, ensuring strict confidentiality of participant data and the right to withdraw from the study at any time. The Institutional Review Board, King Saud University, Riyadh, Saudi Arabia approved this study on December 25, 2023 (reference number: 23/0948/IRB).

2.2 | Study Design

This descriptive cross-sectional translation and validation study administered a questionnaire at two tertiary hospitals—King Abdulaziz University Hospital and King Khalid University Hospital—in Riyadh, Saudi Arabia, between December 2023 and August 2024. It included patients who were fluent in Arabic, had a chronic cough for at least 8 weeks, were aged >18 years, and consented to participate in this study. It excluded patients with neurological, cognitive, or psychiatric disorders.

This study included two groups of 50: cough group (CG) and healthy control group (HCG). Recruitment was conducted on-site at the two hospitals' pulmonology clinics. The research team interviewed potential participants, explaining the study's objectives, assuring confidentiality, and obtaining informed consent. The enrolled participants then completed the A-CSI questionnaire. The A-CSI was re-administered 2–14 days after the initial

completion to evaluate test–retest reliability. The original cough severity index development and validation study's reproducibility data were utilized to determine the instrument's variability for the sample size calculation [14]. The following settings were applied: 90% test power, a threshold for statistical significance of 5%, and a correlation coefficient of 0.83. The minimal sample size that was determined was 11 individuals who had a chronic cough. Once the target sample size was reached, the survey concluded, and the data were securely uploaded to a server for analysis and storage.

2.3 | Brief CSI Description

The CSI is a concise tool that can be utilized to assess chronic cough in daily clinical practice. It consists of 10 items to determine the various impacts of chronic cough on the patient's life, including social, emotional, physical, and voice effects. Each question is scaled from 0 (never) to 4 (always). It is a valid, statistically reliable, and clinically useful tool that can be used to assess the effectiveness of treatment for persistent cough.

2.4 | Translation Process

The CSI was translated into Arabic following a standardized forward-backward translation process to ensure conceptual equivalence. Two independent translators with medical backgrounds translated the original CSI into Arabic. The translations were reconciled into a single version, which was then back translated into English by a third independent translator unaware of the original CSI. A team of otolaryngologists, and phoniatricians (medical specialists in treating swallowing, voice, communication, and pediatric hearing disorders [15]), was assembled to evaluate the A-CSI for inconsistencies and assess its cultural relevance and clarity. The team then developed the final version of A-CSI (Appendix A).

2.5 | Pilot Testing

The face validity and comprehensibility of the A-CSI were initially tested by administering it to 10 randomly selected native Arabic speakers who did not have a known chronic cough. Their feedback was used to make the necessary adjustments to improve the A-CSI.

2.6 | Statistical Analysis

All statistical analyses were performed using SPSS software (version 28; IBM Corp., Armonk, NY, USA), and a p -value of <0.05 was considered statistically significant. The quantitative variables are presented as the mean \pm standard deviation, minimum and maximum, and median with the first and third quartiles. The qualitative variables are presented as the frequency (percentage). The normality of each variable's distribution was assessed using a Kolmogorov Smirnov test. These tests showed that the variables were non-normally distributed. Therefore, non-parametric tests were used in the statistical analyses.

TABLE 1 | Participants' characteristics.

Group	N	Age (mean ± SD)	Age (SEM)	Males (N, %)	Females (N, %)
CG	50	41.56 ± 14.28	2.02	19 (38.0%)	31 (62.0%)
HCG	50	35.48 ± 10.02	1.42	27 (54.0%)	23 (46.0%)
Total	100	—	—	46 (46.0%)	54 (54.0%)

Abbreviations: CG, patients with chronic cough; HCG, healthy controls; SD, standard deviation; SEM, standard error of the mean.

TABLE 2 | Responses to the Arabic-Cough Severity Index (A-CSI) Items by Group.

Item no.	Item description	Group	Never (%)	Almost never (%)	Sometimes (%)	Almost always (%)	Always (%)	Total (%)
1	My cough is worse when I lie down	CG	24.0	6.0	12.0	26.0	32.0	100.0
		HCG	88.0	8.0	2.0	2.0	0.0	100.0
2	My coughing problem causes me to restrict my personal and social life	CG	26.0	12.0	26.0	20.0	16.0	100.0
		HCG	94.0	6.0	0.0	0.0	0.0	100.0
3	I tend to avoid places because of my cough problem	CG	30.0	18.0	20.0	12.0	20.0	100.0
		HCG	94.0	4.0	0.0	2.0	0.0	100.0
4	I feel embarrassed because of my coughing problem	CG	26.0	18.0	26.0	12.0	18.0	100.0
		HCG	92.0	4.0	2.0	2.0	0.0	100.0
5	People ask, “What’s wrong?” because I cough a lot.	CG	12.0	20.0	10.0	8.0	50.0	100.0
		HCG	96.0	2.0	2.0	0.0	0.0	100.0
6	I run out of air when I cough.	CG	14.0	22.0	14.0	28.0	22.0	100.0
		HCG	96.0	2.0	2.0	0.0	0.0	100.0
7	My coughing problem affects my voice.	CG	16.0	18.0	26.0	10.0	30.0	100.0
		HCG	98.0	0.0	2.0	0.0	0.0	100.0
8	My coughing problem limits my physical activity	CG	20.0	18.0	18.0	8.0	36.0	100.0
		HCG	96.0	2.0	2.0	0.0	0.0	100.0
9	My coughing problem upsets me.	CG	30.0	10.0	20.0	8.0	32.0	100.0
		HCG	94.0	4.0	2.0	0.0	0.0	100.0
10	People ask me if I am sick because I cough a lot.	CG	10.0	24.0	20.0	6.0	40.0	100.0
		HCG	96.0	0.0	4.0	0.0	0.0	100.0

Note: The items in the Arabic-Cough Severity Index (A-CSI) were originally developed in Arabic. Abbreviations: CG, chronic cough group; HCG, healthy control group.

Exploratory factor analysis (EFA) was conducted using all 10 elements of the scale. Bartlett's test of sphericity was used to assess the adequacy of correlations between the original variables for EFA. An initial Kaiser–Meyer–Olkin (KMO) analysis was performed to determine the sampling adequacy for EFA. Factors were extracted using principal component extraction with varimax rotation. Factor loadings ≥ 0.3 were considered acceptable. The number of factors was determined using parallel analysis

and a scree plot. A community investigation was conducted to assess how well the extracted components accounted for the variance in each item. Internal consistency was assessed using Cronbach's alpha; a value of 0.7–0.8 was deemed satisfactory, 0.8–0.9 was deemed good, and > 0.9 was deemed excellent.

Reproducibility was assessed based on the agreement between the two test–retest administrations. The intraclass correlation

TABLE 3 | Construct validity of the Arabic-Cough Severity Index.

Item	Factor load	h^2	Eigen values	Variance explained (%)	Cumulative variance (%)
Item 8	0.767	0.615	2.52	25.25	25.25
Item 2	0.754	0.728	—	—	—
Item 6	0.703	0.645	—	—	—
Item 3	0.68	0.587	—	—	—
Item 9	0.665	0.462	—	—	—
Item 1	0.587	0.568	—	—	—
Item 4	0.483	0.503	—	—	—
Item 10	0.727	0.862	2.14	21.42	46.67
Item 5	0.721	0.885	—	—	—
Item 7	0.634	0.786	1.97	19.74	66.41

TABLE 4 | Internal consistency of the Arabic-Cough Severity Index.

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
Item 1	0.68	8.385	0.904	0.963
Item 2	0.80	10.245	0.866	0.964
Item 3	0.76	9.166	0.804	0.965
Item 4	0.72	8.451	0.931	0.961
Item 5	0.80	9.714	0.931	0.960
Item 6	0.80	9.714	0.931	0.960
Item 7	0.82	10.314	0.682	0.968
Item 8	0.80	9.714	0.931	0.960
Item 9	0.78	9.726	0.843	0.963
Item 10	0.78	9.155	0.969	0.958

coefficient (ICC) was used to evaluate the extent to which participants' responses agreed with each other. Discriminant validity analysis compared CG and HCG, while the Mann-Whitney U test was used to compare independent groups.

3 | Results

This study interviewed 117 participants from the pulmonology clinic, of whom 50 complained of a chronic cough and were included in the CG. The remaining 67, who did not have chronic cough, were excluded. Additionally, 50 ostensibly healthy participants from the general population were interviewed and included in the HCG.

3.1 | Participants' Characteristics

The participants were divided equally into the CG and HCG. The mean age was 41.56 ± 14.28 years in the CG and 35.48 ± 10.02 in

the HCG. Regarding the sex distribution, 54% of the participants were female, and 46% were male (Table 1).

3.2 | Characterization of A-CSI Responses

3.2.1 | Cg

The CG's responses to the items in the A-CSI indicated that participants selected the option "always" more often for items 1 (32.0%), 5 (50.0%), 7 (30.0%), 8 (36.0%), 9 (32.0%), and 10 (40.0%). Interestingly, more participants selected the "never" option for item 3 (30.0%) and the "almost always" option for item 6 (28.0%) (Table 2).

3.2.2 | HCG

The HCG's responses to the items in the A-CSI primarily indicated a low level of cough severity, with a high percentage of

participants selecting “never.” Specifically, 88.0% chose “never” for item 1, 94.0% for item 2, and 96.0% for items 6, 8, and 10 (Table 2).

3.3 | Construct Validity

An EFA was conducted to assess the dimensionality of the new cough-specific A-CSI. The KMO value was 0.722, indicating

satisfactory sampling adequacy, and Bartlett's test of sphericity was significant ($p < 0.001$), supporting the suitability of the data for EFA. The EFA analysis revealed three factors with eigenvalues > 1 . All items loaded onto specific factors: Factor 1 comprised items 1, 2, 3, 4, 6, 8, and 9, accounting for 25.25% of the total variance; Factor 2 comprised items 5 and 10, explaining 21.42% of the total variance; and Factor 3 comprised item 7, explaining 19.74% of the total variance. Each item demonstrated communalities (h^2) > 0.3 (Table 3).

TABLE 5 | Discriminant validity of the Arabic-Cough Severity Index (A-CSI).

Item no.	Item statement	Group	Mean	SD	Min	Max	Median (Q1–Q3)	Mann–Whitney U	Z	p value
1	My cough is worse when I lie down	CG	2.36	1.57	0.00	4.00	3.00 (0.75–4.00)	363.50	−6.76	1.37×10^{-11}
		HCG	0.18	0.56	0.00	3.00	0.00 (0.00–0.00)			
2	My coughing problem causes me to restrict my personal and social life	CG	1.88	1.42	0.00	4.00	2.00 (0.00–3.00)	353.50	−7.00	2.57×10^{-12}
		HCG	0.06	0.24	0.00	1.00	0.00 (0.00–0.00)			
3	I tend to avoid places because of my cough problem	CG	1.74	1.51	0.00	4.00	2.00 (0.00–3.00)	428.50	−6.50	7.80×10^{-11}
		HCG	0.10	0.46	0.00	3.00	0.00 (0.00–0.00)			
4	I feel embarrassed because of my coughing problem	CG	1.78	1.43	0.00	4.00	2.00 (0.00–3.00)	400.50	−6.59	4.38×10^{-11}
		HCG	0.14	0.53	0.00	3.00	0.00 (0.00–0.00)			
5	People ask, “What’s wrong?” because I cough a lot.	CG	2.64	1.55	0.00	4.00	3.50 (1.00–4.00)	173.50	−8.17	3.12×10^{-16}
		HCG	0.06	0.31	0.00	2.00	0.00 (0.00–0.00)			
6	I run out of air when I cough.	CG	2.22	1.39	0.00	4.00	2.50 (1.00–3.00)	202.00	−7.94	1.98×10^{-15}
		HCG	0.06	0.31	0.00	2.00	0.00 (0.00–0.00)			
7	My coughing problem affects my voice.	CG	2.20	1.46	0.00	4.00	2.00 (1.00–4.00)	219.50	−7.90	2.71×10^{-15}
		HCG	0.04	0.28	0.00	2.00	0.00 (0.00–0.00)			
8	My coughing problem limits my physical activity	CG	2.22	1.58	0.00	4.00	2.00 (1.00–4.00)	278.00	−7.51	6.12×10^{-14}
		HCG	0.06	0.31	0.00	2.00	0.00 (0.00–0.00)			
9	My coughing problem upsets me.	CG	2.02	1.65	0.00	4.00	2.00 (0.00–4.00)	412.50	−6.64	3.12×10^{-11}
		HCG	0.08	0.34	0.00	2.00	0.00 (0.00–0.00)			
10	People ask me if I am sick because I cough a lot.	CG	2.42	1.47	0.00	4.00	2.00 (0.00–4.00)	164.00	−8.17	3.08×10^{-16}
		HCG	0.08	0.40	0.00	2.00	0.00 (0.00–0.00)			

Note: The items in the Arabic-Cough Severity Index (A-CSI) were originally developed in Arabic.

Abbreviations: CG, Chronic Cough Group; HCG, Healthy Control Group; SD, standard deviation; Q1, first quartile; Q3, third quartile.

3.4 | Reproducibility

The reproducibility of the A-CSI was evaluated by measuring its test–retest reliability using the ICC. The obtained ICC was 0.896, with a confidence interval of 0.688 to 0.965, signifying a substantial level of reproducibility ($p < 0.001$).

3.5 | Internal Consistency

The internal consistency of the A-CSI was excellent, with a Cronbach's alpha of 0.966 for the 10 items. The corrected item-total correlations ranged from 0.682 to 0.969. When items were deleted, Cronbach's alpha ranged from 0.958 to 0.968 (Table 4).

3.6 | Discriminant Validity

Discriminant validity was assessed using the Mann–Whitney U test. All items showed significant differences between the CG and HCG ($p < 0.001$), indicating that the A-CSI effectively distinguishes individuals with and without a chronic cough (Table 5).

4 | Discussion

Our study translated and validated the CSI into Arabic and assessed its reliability among patients with a chronic cough in Riyadh, Saudi Arabia. The CSI is a valid tool for quantifying the symptoms associated with chronic upper airway cough and measuring treatment outcomes [14].

The high reproducibility of the A-CSI, as evidenced by an ICC of 0.896, confirms its reproducibility and reliability. This finding is consistent with the original CSI [14], which had a test–retest reliability of 0.83, and Ribeiro et al. [16], who reported a reproducibility of 0.909, representing the consistency of the measured data under comparable circumstances at different times. These findings demonstrate that the A-CSI produces reliable results.

Regarding discriminant validity, the Mann–Whitney U test was significant for all items ($p < 0.001$; Table 5), indicating that the A-CSI can distinguish individuals with and without a chronic cough. These findings are consistent with previous studies validating the CSI in other languages and populations [16, 17].

Our study described the effects of a chronic cough on psychological traits and quality of life, indicating a high level of psychological distress. Specifically, 32% of participants in the CG reported that their chronic cough always upsets them, consistent with previous studies. For example, Slinger et al. [9] reported that patients with a chronic cough experienced a decrease in quality of life, and Dicipinigitis et al. [10] found that 53% of patients with a chronic cough tested positive for depression symptoms. Our results align with prior research and underscore the importance of utilizing reliable instruments in clinical settings, such as the CSI.

Chronic cough is closely related to voice dysfunction, an important aspect of the A-CSI, as highlighted by item 7, where 30% of the participants reported that coughing always causes

problems with their voice. A previous study suggested that chronic cough may cause or exacerbate dysphonia [18]. This result aligns well with a previous study [12], where 40% of individuals with dysphonia also reported a chronic cough. These results support the focus of our study on the effects of a chronic cough on voice quality, emphasizing the connection between these two conditions.

According to our results, the validated A-CSI appears to provide healthcare providers with a robust tool for assessing patients with a chronic cough. Healthcare providers can utilize this instrument to tailor specific treatments to address the patient's concerns, thereby increasing their quality of life and evaluating treatment outcomes. Moreover, the A-CSI discriminated well between participants in the CG and HCG, highlighting its potential use in clinical research.

A major strength of our study is the meticulous translation and validation of the CSI, ensuring a reliable cultural and linguistic tool for Arabic-speaking patients. However, our study also had limitations. Firstly, its participants were recruited at only two hospitals, potentially limiting its generalizability. Secondly, due to its cross-sectional design, it is challenging to establish causal relationships regarding changes in chronic cough over time. Future longitudinal studies must explore the A-CSI's sensitivity to changes in patients' chronic cough.

5 | Conclusions

The A-CSI is a valid and reliable tool for assessing chronic cough in Arabic-speaking patients. Its concise nature makes it user-friendly for daily clinical practice. The A-CSI offers valuable insights into the severity and impact of chronic cough on patients, empowering physicians to tailor treatments effectively.

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Conflicts of Interest

The authors declare no conflicts of interest.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.