

# Validation and Cultural Adaptation of the Sinhala Translation of the Cardiff Acne Disability Index (CADI)

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**Introduction:** Quality of life (QoL) is impaired in patients with acne vulgaris. The Cardiff Acne Disability Index (CADI) that assesses QoL of acne patients was initially developed in English and is being currently used widely after being validated in different languages. This study was conducted to validate the CADI in Sinhala, a language used by the majority of Sri Lanka.

**Materials and Methods:** The CADI was translated into Sinhala, and linguistically validated as per published guidelines. This CADI-Sinhala version and the Sinhala version of the Dermatology Life Quality Index (DLQI) were simultaneously administered to 150 Sinhala-speaking young adults with acne. The clinical severity of acne was assessed using the Global Acne Grading System (GAGS). The Cronbach's alpha and Spearman correlation coefficients were used to determine the internal consistency, reliability, and validity of the CADI-Sinhala. Construct validity was examined using a factor analysis.

**Results:** The study included 90% females and their mean age was 23 (SD, 2.5) years. The majority (97.3%) had acne of mild to moderate severity when measured by the GAGS. The CADI-Sinhala Scale showed a Cronbach's alpha coefficient of 0.819 indicating high internal consistency and reliability. The mean item-total correlation coefficient was 0.74 (range, 0.42–0.87) with CADI Q3 having the lowest correlation. CADI Sinhala showed a strong and highly significant correlation with the Sinhala DLQI (Spearman's rho = 0.66;  $P < 0.001$ ) indicating concurrent validity. The correlation with GAGS was of low intensity, although it was statistically significant ( $p < 0.01$ ).

**Conclusion:** The CADI-Sinhala is a reliable and valid tool for assessing the QoL of Sinhala-speaking acne patients. This five-item tool will help clinicians to provide holistic treatment through improved understanding of patient's perspectives.

**Keywords:** acne vulgaris, Cardiff acne disability index-Sinhala, validation, quality of life

## Introduction

Acne vulgaris is a chronic inflammatory condition of the pilosebaceous unit and is the eighth most prevalent disease worldwide affecting 9.4% of the global population.<sup>1</sup> Acne is shown to be most common in postpubescent teens.<sup>1</sup>

The severity and long-term changes caused by acne could lead to permanent scarring of skin of affected areas, which in turn would lead to psychological distress.<sup>2</sup> The complex interaction between psychosocial issues and physical appearance due to acne along with matters related to socialization, and sexuality is complex, specially during adolescence.<sup>3</sup> Acne can negatively affect participation in sports and exercise, and at extreme may lead to suicidal ideation in about 5–6% of affected persons.<sup>4</sup> It is reported that acne patients suffer from social, psychological, and emotional problems that are of a similar standing to those reported by patients with chronic asthma, epilepsy, diabetes, back pain, or arthritis.<sup>5</sup> There is no clear relationship between acne severity and QoL and literature reports mixed results.<sup>6</sup> Therefore, QoL of patients with acne cannot be assessed by using scales that measure acne severity. Thus

irrespective of the severity, an independent assessment of quality of life (QoL) in patients with acne will enable a more holistic approach to patient management.

QoL measures both physical and psychological domains of health by assessing the objective physical functioning and mental well-being of patients with the disease.<sup>7</sup> Several studies have evaluated the QoL of patients with acne using validated generic QoL instruments in relation to skin disease. Although these methods allow comparisons between population groups, they are limited by the lack of disease-specific questions that are important for the holistic management of patients. Research confirms that the use of disease-specific tools is more important for delivering quality patient care, as it helps focus more on disease-specific psychological and social morbidity and helps physicians move towards a more patient-centred approach in the management of patients.<sup>8</sup> To achieve these important objectives, disease-specific tools need to be validated, culturally adapted, brief, easy to administer and interpret in busy clinical practice settings.

Among generic dermatology QoL instruments, the Dermatology Life Quality Index (DLQI) has been extensively used for assessing QoL.<sup>9</sup> The DLQI tool has been translated into the Sinhala language and validated and culturally adapted to measure the QoL of patients attending dermatology practice in Sri Lanka.<sup>10</sup> With regard to disease specific tools, the Cardiff Acne Disability Index (CADI) ([Appendix 1](#)) is an acne-specific QoL measure developed in English, to assess QoL of teenagers and young adults affected by acne initially, and has been validated later to assess all ages.<sup>11,12</sup> It is a short questionnaire comprising five questions and assesses the psychological, social, and emotional concerns of acne. This has been prepared as a shorter version of the Acne Disability Index to enable completion of the questionnaire rapidly and thereby make it more suitable for use in clinical practice.

The psychological and social consequences of acne are addressed by the first two questions, the third question is directed to those having acne of the chest and back, the fourth probes into the patient's mental status and the fifth question inquires into the patients' perception of acne severity. Each question has four possible responses, which scores from 0 to 3 based on the response selected. The cumulative score for the questionnaire would range from a minimum score of zero to a maximum of 15 points. The cumulative CADI score is graded as 0 (no impairment), 1–5 (mild impairment), 6–10 (moderate impairment), and 11–15 (severe impairment).<sup>12</sup> The correlation between patients' responses to the CADI questionnaire and clinicians' assessment of acne severity showed mixed results, indicating that quality of life needs specific assessment.<sup>13</sup> Therefore a specific measure of QoL, such as CADI would help in identifying those who have high degree of functional disability who would need more frequent follow up during treatment or empathetic counselling. CADI would be a useful tool for measuring patient centred outcomes in clinical trials and other interventional studies. Currently the CADI has been translated and validated in 25 languages, and 9 have reported cross cultural adaptation.<sup>13</sup>

In Sri Lanka, two major native languages, Sinhala and Tamil are used for communication, by approximately 70% and 20% respectively. English is primarily a link language and taught as a second language in schools. English is mostly used as a language for communication among professionals and academics, for official purposes. Doctors communicate with patients in their native language. Therefore, this widely used CADI required translation and validation in Sinhala and Tamil prior to its use in Sri Lanka.

This study aimed to translate the CADI into Sinhala using published guidelines on translation and socio-cultural validation,<sup>13</sup> and assess the reliability and validity of the translated version. Such a translation will assist Sri Lankan Dermatologists in managing acne patients based on both clinical presentation and functional disability and thereby individualise their approach to the management of acne patients. Following validation this instrument could also be used in research studies to assess pre-intervention functioning and compare it with that following an intervention or treatment.

## Materials and Methods

The original CADI in English was first translated into Sinhala and then validated among a group of Sinhala-speaking persons suffering from acne.

### Translation

Written permission for translation into Sinhala was obtained from the original author of the CADI. The English version was translated into Sinhala, using the widely recommended forward-backward translation method, which has been

extensively used for the multi-cultural adaptation of research instruments.<sup>14</sup> The forward Sinhala translation was carried out independently by two academics who were well versed in Sinhala and English. The translators were briefed on the objectives of the use of these instruments and instructed to produce simple translations that could be clearly understood by the general population. Discrepancies between the original independent translations by the two academics were resolved by discussion, and a final translation in Sinhala was produced. Another two different academics, who were competent in both Sinhala and English, were asked to independently translate the Sinhala translation back into English. The few discrepancies from the original English CADI version were corrected. This was followed by back-translation until all disparities were resolved. A panel of experts assessed the judgmental validity of the translated version. The appropriateness of the wording and acceptability in the local context was examined. For the cognitive debriefing, ten Sinhala speaking university students with acne were selected to check the face validity of the finalised questionnaire with respect to vagueness, clarity of the items, and applicability to the social setting. The final version of the Sinhala CADI was accepted by the original authors of CADI after several rounds of discussions ([Appendix 2](#)).

## Validation

The translation process was followed by reliability and validity testing of the translated instrument in patients with different acne severity grades. This study was approved by the Ethics Review Committee of the Faculty of Medical Sciences, Sri Jayewardenepura University, Nugegoda, Sri Lanka (ERC 45/22, 30.1.23). The validation study was conducted between 1st April 2023 to 30th June 2023 among students and non-academic staff at the Sri Jayewardenepura University, Nugegoda after obtaining informed written consent and those with acne of any degree of severity were enrolled into the study.

Details of the study were explained in both Sinhala and English Languages using an advertisement displayed in a common area. Volunteers interested in participating in the study were asked to speak to the principal investigator to obtain further details. Eligible volunteers were provided with the date to participate in the study.

After obtaining written informed consent from the eligible participants, basic demographic data were collected using a case record form. They were asked to complete the Sinhala CADI and the previously validated Sinhala DLQI<sup>10</sup> questionnaires and were asked to record the time taken to complete the CADI and comment on its clarity and wording on a scale of 1–4 as poor, average, good, and very good.

The participants were also examined for acne severity using the Global Acne Grading System (GAGS) by two medical graduates trained by a specialist dermatologist. The GAGS includes six locations in the body, with five areas in the face and one in the trunk. A score is assigned to each area. Each type of acne lesion was assigned a value based on its severity (0 = no lesion; 1 = comedones; 2 = papules; 3 = pustules; 4 = nodules). The score for each area was calculated using the following formula: Local score = Factor × Grade (0–4). The Global Score is the sum of the local scores, which determines the severity of acne; a score of 1–18 is considered mild; 19–30 is, moderate; 31–38, severe and >39 is very severe. This method has been confirmed to be very precise, with negligible variability in intra- and inter-observer scoring, and has been extensively used in research studies involving acne grading.<sup>15</sup>

The DLQI is a widely used ten-item questionnaire that assesses QoL of patients with dermatological diseases. The total score ranges from 0 (no bearing of skin disease on QoL) to 30 (Skin disease causing highest impact on QoL). The DLQI total score has been divided into 0–1, with no influence on the patient's life; 2–5, with a small effect; 6–10, with a modest effect; 11–20, with a considerable effect; and 21–30, with a very large impact on the patient's QoL.

The CADI scores were compared with the DLQI and GAGS scores to assess the discriminant validity. The observed differences were statistically assessed using the chi-square test.

Internal consistency is the extent to which items within a domain shows correlation with each other and this was used to assess the reliability of the Sinhala translated CADI. This was measured by estimating the Cronbach's alpha coefficient. A scale of 0.70 or greater, was considered satisfactory. A correlation coefficient (Cohen's Kappa) of 0.60 or above was considered a satisfactory level of agreement between scores. Statistical analyses were done using SPSS version 22 (SPSS Inc., Chicago, IL, USA) for Windows.

## Results

All participants completed the CADI questionnaire with a 100% response rate. The median time to complete the CADI tool had a median of 1.5 minutes with a maximum of 2.5 minutes. Among these participants, two-thirds felt that clarity and wording were very good, whereas one-third agreed that clarity and wording were good on a four-point Likert scale. 150 subjects participated in the study and their mean age was 23 years with a standard deviation (SD) of 2.5. Approximately 82% of the study participants were between the ages 21 to 25 years (Table 1). Nearly 90% were female, with almost all being of the Sinhala ethnicity and practicing the religion Buddhism. Almost all were unmarried (97%), and three fourth of the participants had completed an undergraduate degree or were on their way to complete one. 65% were employed, but nearly 90% were obtaining an income of less than US\$ 33 per month as they were part-time employees during their studentship. The majority (97.3%) of the participants had mild to moderate acne when assessed by using GAGS (Table 1).

**Table 1** Sociodemographic Characteristics of the Study Population

	Number/Mean (SD) (n= 150)	Percentage
<b>Age (years)</b>		
< 20	07	4.7
21–25	123	82.0
≥ 26	20	13.3
Mean age (SD)	23 (2.5)	
<b>Sex</b>		
Male	17	11.3
Female	133	88.7
<b>Ethnicity</b>		
Sinhala	145	96.7
Muslim	05	3.3
<b>Religion</b>		
Buddhism	139	92.7
Others	11	7.3
<b>Marital status</b>		
Married	04	2.7
Others	146	97.3
<b>Education</b>		
Up to advanced level	35	23.3
Diploma/Vocational Training	5	3.3
Degree	108	72.0
Postgraduate qualification	2	1.3

(Continued)

**Table 1** (Continued).

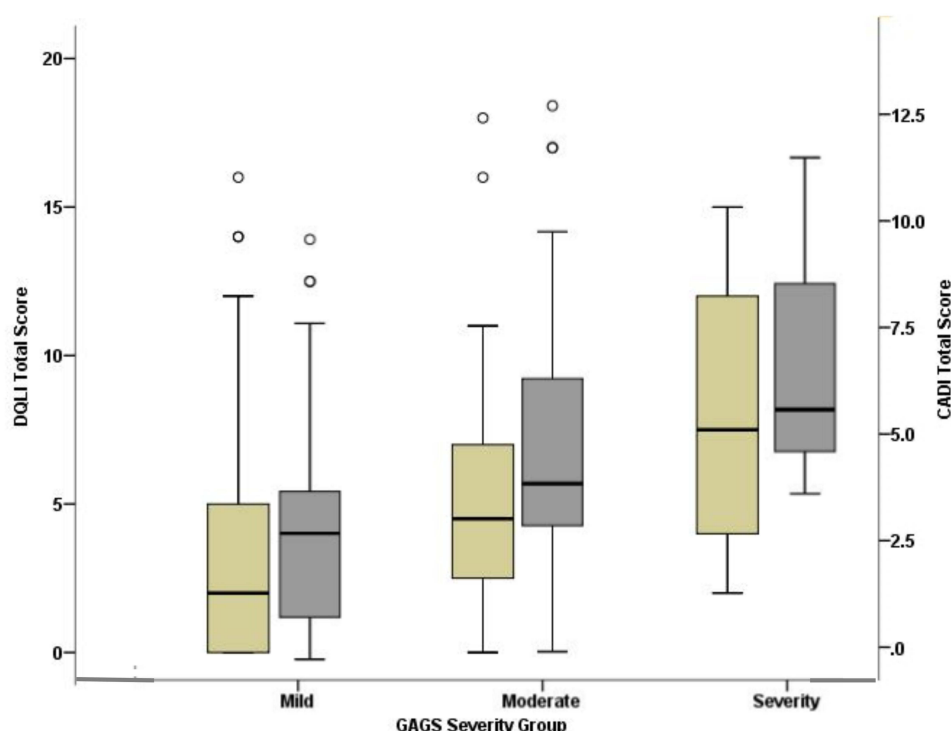
	Number/Mean (SD) (n= 150)	Percentage
<b>Employment</b>		
Unemployed	53	35.3
Employed	97	64.7
<b>Income</b>		
Less than Rs. 10,000 (US\$ 30)	135	90
Rs.10,000–25,000 (US\$ 30–76)	2	1.3
Rs. 25,001–50,000 (US\$ 76–152)	5	3.3
Rs. 50,001–75,000 (US\$ 152–227)	2	1.3
Rs. 75,001–100,000 (US\$ 227–303)	5	3.3
> Rs 100,000 (≥ US\$ 303)	1	0.7
<b>Acne severity by GAGS</b>		
Mild	106	70.6
Moderate	40	26.7
Severe	4	2.7

The mean (SD) Sinhala CADI score obtained in this study was 3.7 (2.8), indicating mild impairment in QoL. The CADI was compared to the GAGS and DLQI (Table 2).

Among those with no impairment in the CADI tool, 95% had no effect at all, as per the DLQI assessment, whereas 95% were found to have mild severity according to the GAGS severity index, as shown in Table 2. Similar observations were also observed at the other end of the grading, in which all 4 participants with severe impairment on the CADI tool were found to have a very large effect on the DLQI tool, with 75% and 25% having moderate and severe severity, with the GAGS.

**Table 2** Comparison of CADI Grading with DLQI and GAGS Severity

	CADI				$\chi^2$ ; df; p value
	No Impairment (n=19) (%)	Mild Impairment (n=100) (%)	Moderate Impairment (n=27)(%)	Severe Impairment (n=4) (%)	
<b>DLQI</b>					
No effect at all	18 (94.7)	33 (33.0)	0 (0.0)	0 (0.0)	117.6; 9; 0.001
Small effect	0 (0.0)	47 (47.0)	7 (25.9)	0 (0.0)	
Moderate effect	1 (5.3)	18 (18)	15 (55.6)	0 (0.0)	
Very large effect	0 (0.0)	2 (2.0)	5 (18.5)	4 (100.0)	
Extremely large impact	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
<b>GAGS severity</b>					
Mild	18 (94.7)	74 (74.0)	14 (51.9)	0 (0.0)	26.1; 6; 0.001
Moderate	01 (5.3)	25 (25.0)	11 (40.7)	3 (75.0)	
Severe	0 (0.0)	1 (1.0)	2 (7.4)	1 (25.0)	



**Figure 1** Comparison of the means of CADI and DLQI scores with the GAGS severity.

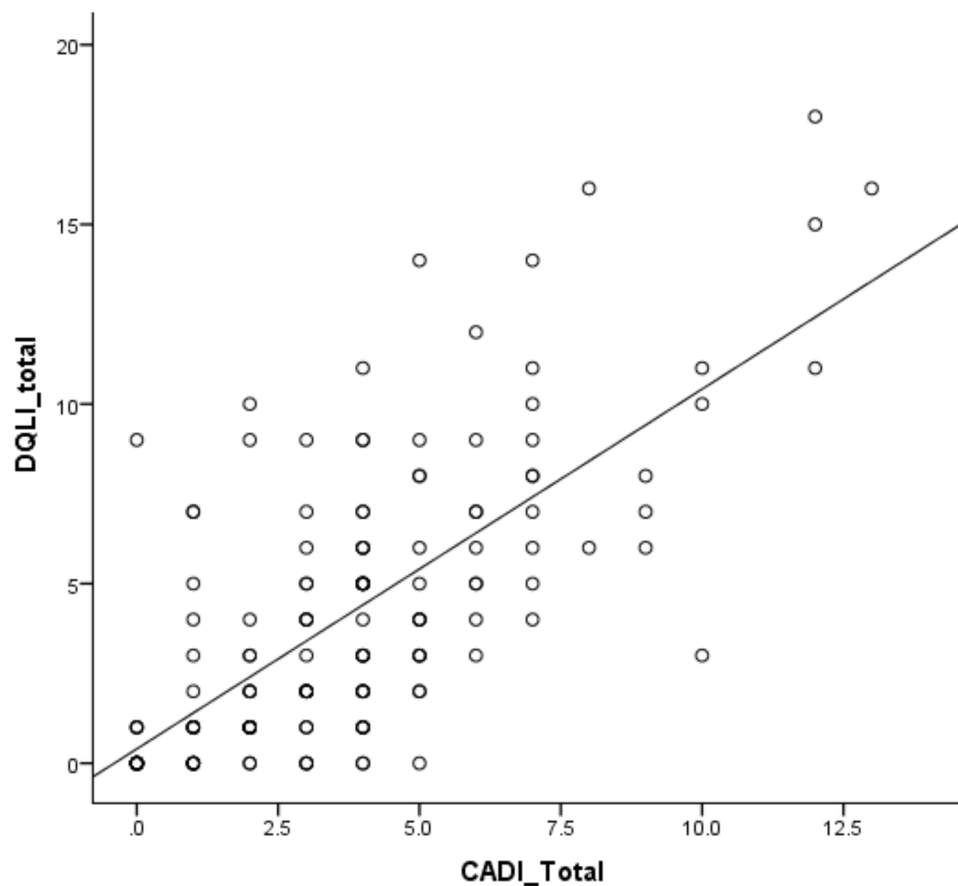
The discriminant validity was assessed by comparing CADI scores with those of the DLQI and GAGS. The statistical significance of the observed differences was assessed using the chi-square test, and there was a significant difference ( $p < 0.001$ ) between the CADI and both the DLQI and GAGS severity scales (Table 2).

Figure 1 compares the severity of GAGS with the two QOL tools. As the severity increased from mild to severe, the CADI showed relatively consistently higher median scores than the DLQI median scores for each category.

Descriptions of the correlations between GAGS and DLQI and CADI are presented in Table 3. This clearly shows that both the CADI and DLQI have constructs that are more correlated to each other than to its items with GAGS. The GAGS is a tool that measures the severity of acne, whereas the other two tools measure the QOL of the population with acne. The correlation between the CADI and GAGS scores was low, regardless of the correlation between the total or item scores. The regression line revealed that 50% of the variability observed in the CADI scores was explained by the regression model (Figure 2).

**Table 3** Spearman's Rho Correlation Between GAGS and DLQI with CADI

	GAGS (p)	DLQI (p)
CADI Total score	0.331 (0.001)	0.696 (0.001)
CADI Q1	0.303 (0.001)	0.604 (0.001)
CADI Q2	0.325 (0.001)	0.532 (0.001)
CADI Q3	0.030 (0.001)	0.299 (0.001)
CADI Q4	0.142 (0.001)	0.509 (0.001)
CADI Q5	0.375 (0.001)	0.589 (0.001)



**Figure 2** Concurrent validity between CADI Sinhala and DLQI Sinhala by Pearson correlation ( $r = 0.696$ ;  $p < 0.001$ ).

Cronbach's alpha coefficient, that measures internal consistency was satisfactory (0.819), indicating a good correlation between the questionnaire items of the CADI. Julie Pallant SPSS Survival Manual mentions that if the items are less than 10, then a Cronbach's alpha of 0.5 or more would be acceptable.<sup>16</sup> However, even with only five items, a very high alpha coefficient was observed which clearly showed the consistency of the tool.

As only four of the five questions had good correlations, construct validity was assessed using exploratory factor analysis. In this analysis criteria of principal component analysis with varimax rotation was adopted. The exploratory factor analysis showed that there was only one factor, suggesting that all items fit into a single theoretical construct. The

**Table 4** Rotated Factor Loads of the Items of CADI

CADI Items	Factor I
CADI Q1	0.874
CADI Q2	0.854
CADI Q3	0.421
CADI Q4	0.761
CADI Q5	0.819
% of variance / % cumulative	58.4%



**Table 5** Cronbach's Alpha of CADI Sinhala and Its Correlations After Removal of CADI Q3

	Inter-Item Correlation				Corrected Item Total Correlation	Cronbach's Alpha if CADI Q3 Deleted
	CADI Q1	CADI Q2	CADI Q3	CADI Q4		
<b>CADI Q1</b>	-	-	-	-	0.762	0.734
<b>CADI Q2</b>	0.689	-	-	-	0.727	0.747
<b>CADI Q3</b>	0.260	0.350	-	-	0.290	0.854
<b>CADI Q4</b>	0.588	0.497	0.202	-	0.612	0.787
<b>CADI Q5</b>	0.649	0.625	0.156	0.533	0.685	0.761

factor is composed of items that assess acne in general, and explains 58.4% of the variance. Among the loadings, the CADI question 3, had a correlation of only 0.421 whereas the other four items had a loading between 0.7 and 0.9 (Table 4). This further shows that item three does not show a correlation with QoL.

The first domain of the CADI, has two items, while the remaining domains have only one item each. Furthermore, as mentioned above, question 3 shows disparaging responses. Therefore, the corrected item-total correlation was calculated, in which each item was correlated with all other items grouped together, as shown in Table 5. This also showed that question 3 had a very low corrected item-total correlation of only 0.29. Therefore, the analysis was done after the removal of question 3, which only increased Cronbach's alpha from 0.819 to 0.854 (Table 5).

## Discussion

Acne is a common skin condition. The chronicity of the disease, as well as its cosmetic appearance, causes significant physical and psychosocial burden, leading to poor QoL. Therefore, assessment of QoL is an important aspect of holistic care for patients with acne. QoL has been evaluated using numerous generic, dermatology-specific, and acne-specific tools. Among these, DLQI and CADI are the most commonly used instruments in clinical trials. The European Academy of Dermatology and Venereology Task Forces on Quality of Life and Patient-Oriented Outcomes recommends the use of QoL assessment, specifically in the management of patients with acne.<sup>17</sup> In a study conducted among patients with acne referred for specialised care, it was concluded that disease-specific QoL measures were more receptive to change than generic QoL measures.<sup>8</sup>

This study validated the Sinhala version of the most commonly used acne-specific patient-reported outcome tool, which measures health-related quality of life. The Sinhala version of the CADI showed high internal consistency with a Cronbach's alpha coefficient of 0.82, reflecting its reliability. Furthermore, the concurrent validation of CADI Sinhala with DLQI Sinhala showed a satisfactory correlation, whereas that with GAGS had a positive but weak correlation.

The validation of the CADI questionnaire in different languages showed similar psychometric properties, with internal consistency ranging from 0.7 to 0.89.<sup>13</sup> The highest time reported for the completion of the questionnaire in the literature was 1.5 minutes although Sinhala version took a maximum of 2.5 minutes for the completion.<sup>13</sup> The Mean Sinhala CADI score in this study was 3.7 with an SD of 2.8. This is consistent with the findings elsewhere, where in community settings, the most commonly found proportion in cases of acne were, patients with mild levels (n = 106; 70.6%), with the minority (n = 4, 2.7%) having more severe levels of the acne. The findings of this study indicate a mild impairment in the QoL of the study population and is consistent with the findings where the CADI was used in non-interventional studies conducted in the community to assess QoL.<sup>18,19</sup>

Regarding the dimensionality and factor structure of the tool, among the six validation studies that had assessed dimensionality, only those conducted on Nepali and Korean showed one factor,<sup>20,21</sup> which is comparable with the Sinhala version, while the other four showed two factors.<sup>22–25</sup>

Among the five items in the questionnaire, question 3 which focused on QoL with truncal acne showed low inter-item correlation which could be partly due to the lower severity of acne, female predominance of the study sample, and the fact that it is uncommon for women to change or wear revealing swimming costumes in public according to Sri Lankan



traditions. Also, this question was pertinent to the GAGS acne severity in the chest and upper back, and 82.7% (n = 124) of the study population did not have acne on the chest and upper back. This probably explains the lack of alignment between question 3 and the results of the remaining questions. However, the internal consistency increased by only 0.035 when question 3 was deleted; therefore, it was decided to retain the item.

The association between acne severity and CADI-rated QoL impairment has yielded conflicting results. In the tool itself, Item 5 focused on acne severity and QoL. In addition, acne severity has been evaluated using various acne-specific tools, including the Comprehensive Acne Severity Scale, Acne Lesion Score Scale, Acne Clinical Severity and Global Acne Grading System. Among the 15 studies which had used GAGS to assess acne severity, eight studies reported significant correlation, 3 showed weak correlation, and 4 studies failed to describe any correlation.<sup>13</sup> The Sinhala version of the CADI showed a weak correlation with acne severity when assessed using the GAGS. This dissociation between QoL and acne severity highlights the importance of managing social and psychological outcome targets for patients with acne, which are not necessarily driven by the degree of severity.

Validation studies of QoL tools, including the CADI, have been compared and correlated using the DLQI and Children's DLQI. Among the 16 validation studies performed previously on the CADI tool, 12 used the DLQI as the comparator for assessing correlation, and all showed good correlation with the CADI, similar to the present study.<sup>13</sup>

The limitations of this study include the lack of assessment of the CADI Sinhala version in a group undergoing acne treatment and not using an unaffected group for a comparative validation analysis.

## Conclusions

The Sinhala version of the CADI showed favourable psychometric properties for use as a reliable and valid tool to assess QoL in Sinhala language-speaking patients with acne. Further studies should be conducted to assess the effectiveness of this tool in assessing the QoL of patients undergoing treatment for acne.

## Abbreviations

CADI, Cardiff Acne Disability Index; DLQI, Dermatology life quality index; GAGS, Global acne grading system; QoL, Quality of life; SD, Standard deviation; SPSS, Statistical Package for Social Sciences.

## Data Sharing Statement

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

## Ethics Approval and Consent to Participate

The study was performed in accordance with the principles of the Declaration of Helsinki and was approved by the Ethics Review Committee of the Faculty of Medical Sciences, Sri Jayewardenepura University, Nugegoda, Sri Lanka (ERC 45/22, 30.1.23).

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## Author Contributions

All authors made a significant contribution to all areas of the study, including conception, study design, execution, acquisition of data, analysis and interpretation; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest in this work.

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