Validity and reliability of an Arabic version of the state-trait anxiety inventory in a Saudi dental setting

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الأهداف: دراسة الخصائص السيكومترية الموثرة في نتائج النسخة المعربة والمعدلة من مقياس تقييم حالة وسمة التوتر (STAI-Y) بين مرضى الأسنان السعوديين البالغين.

الطريقة: في هذه الدراسة المقطعية، تم تقييم ومراجعة النسخة السعودية من (STAI-Y) التي نشرها اثنين من المختصين للتأكد من مواءمتها للثقافة السعودية قبل اجراء الدراسة عليها. شارك 387 من المرضى المترددين على مستشفى طب الأسنان في جامعة الملك عبدالعزيز في جدة، المملكة العربية السعودية. استخدم المقياس التناظري المرئي (VAS) والمقياس المطور للقلق المرتبط بعلاج الأسنان MDAS لمقارنة صحة النتائج المأخوذة من مقياس (STAI-Y) المعدل المعرب لمواءمته للثقافة السعودية.

النتائج: أثبتت النتائج أن هذه النسخة المعربة والمعدلة من مقياس (STAI-Y) لها موثوقية داخلية ثابتة (Cronbach's alpha: 0.989) لكل من حالة وسمة التوتر عند طبيب الأسنان. وعند اجراء التحليل العاملي للمقياس وجد أنه أحادي التكوين، كما وجد ارتباط قوي بينه وبين كل من مقياس VAS ومقياس (MDAS) مما يؤكد المصداقية المعيارية. وعند دراسة دقة التمييز لهذا المقياس (STAI-Y) وجد أن معدلات التوتر عند النساء أعلى منها عند الرجال وعند صغار السن أعلى منها عند كبار السن. كما وجد أن المرضى الذين لايترددون على أطباء الأسنان إلا عندما تدعوهم الحاجة الملحة يظهرون معدلات توتر أعلى عند مقارنتهم بالمرضى كثيري التردد على أطباء الأسنان.

الخاتمة: إن النسخة المعربة من مقياس حالة وسمة التوتر STAI-Y لها اتساق داخلي معتمد وموثوق على غرار مثيلاتها الموجودة في الأبحاث الأخرى. ومن ذلك نستخلص أن هذا المقياس يعد مناسباً لاستخدامه مع السعوديين في تقييم التوتر المصاحب لزيارة أطباء الأسنان.

Objectives: To test the psychometric properties of an adapted Arabic version of the state trait anxiety-form Y (STAI-Y) in Saudi adult dental patients.

Methods: In this cross-sectional study, the published Arabic version of the STAI-Y was evaluated by 2 experienced bilingual professionals for its compatibility with Saudi culture and revised prior to testing. Three hundred and eighty-seven patients attending dental clinics for treatment at the Faculty of Dentistry Hospital, King Abdullah University, Jeddah, Kingdom of Saudi Arabia, participated in the study. The Arabic version of the modified dental anxiety scale (MDAS) and visual analogue scale (VAS) ratings of anxiety were used to assess the concurrent criterion validity.

Results: The Arabic version of the STAI-Y had high internal consistency reliability (Cronbach's alpha: 0.989) for state and trait subscales. Factor analysis indicated unidimensionality of the scale. Correlations between STAI-Y scores and both MDAS and VAS scores indicated strong concurrent criterion validity. Discriminant validity was supported by the findings that higher anxiety levels were present among females as opposed to males, younger individuals as compared to older individuals, and patients who do not visit the dentist unless they have a need as opposed to more frequent visitors to the dental office.

Conclusion: The Arabic version of the STAI-Y has an adequate internal consistency reliability, generally similar to that reported in the international literature, suggesting it is appropriate for assessing dental anxiety in Arabic speaking populations.

Anxiety associated with dental treatment is documented to cause 6% of the general population to skip dental appointments.[1] Therefore, it is of extreme importance to thoroughly assess dental anxiety in the

dental office and to implement measures to control it, so as to provide effective dental treatments; thus, improving dental care and oral health in patients.[2] Several psychometric scales have been developed to measure the presence and severity of current symptoms of anxiety. Such scales are available in different versions for adults and children, and are widely used in both research and clinical practice.[3-6] The state-trait anxiety inventory (STAI) is one of the most extensively used scales to measure anxiety worldwide. This self-reported scale was first published by Spielberger et al[7] in 1970, as the STAI-form X (STAI-X). Subsequently, the STAI scale was revised in 1983 to the STAI-form Y (STAI-Y).[6] The STAI has a total of 40 questions allocated to 2 subscales: the State Anxiety Scale (S-Anxiety), and the Trait Anxiety Scale (T-Anxiety). It possesses excellent psychometric properties for assessing state, and trait anxiety in clinical and research settings.[5,6] Since its first introduction, the STAI has been used in more than 8,000 research studies in different disciplines including; but not limited to medicine, psychology, education, and social sciences,[8] and has been translated into more than 60 languages and dialects, including Spanish,[9] Portuguese,[10] Chinese,[11] French,[12] Japanese,[13] and Arabic.[14] Several studies have used the Arabic version of the STAI.[15-17] However, psychometric information regarding the Arabic version of the STAI is limited to studies of specific populations of school and university students from Egypt, Jordan, and Lebanon.[14-16] In addition, the scales were directly translated without attention to cross cultural issues such as whether emotional states or personality traits are comparable among different cultures; situations that induce anxiety may differ in this respect. Accordingly, the scales may need adjustment to be culturally appropriate. The Arabic language varies considerably between different Arab cultures, particularly with respect to slang and colloquial usage. As such, the Saudi population has distinct cultural and linguistic characteristics as compared with other Arab countries. Consequently, it is inadvisable to use the directly translated scale without further validation or adaptation. Additionally, testing a Saudi specific version of the scale would provide further

data regarding the reliability and validity of the STAI-Y. In this study, the commercially available STAI-Y scale was purchased with no warranty or assurance from the company regarding the quality of translation, and no validation data are available. In view of this, our aim was to investigate the psychometric properties of an adapted Arabic version of the STAI-Y[6,18] in Saudi adult dental patients.

Methods. *Research design and study sample.* This cross sectional study distributed the prepared Arabic version of the STAI-Y to a convenience sample of adult patients who were attending the dental clinics at the Faculty of Dentistry, King Abdulaziz University Hospital, Jeddah, Saudi Arabia, for treatment. Patients attending were mostly Saudis, with varying socioeconomic status. Ethical approval and a waiver of informed consent were obtained from the Ethical Committee of the University, Jeddah, Saudi Arabia. The study was conducted between May 2015 and October 2015, following the principles of the Declaration of Helsinki. All patients were also provided with a brief explanation of the study by the author before participating in the study. The patients were asked to complete the questionnaire in the waiting area prior to their dental appointment. Demographic data including age, gender, and frequency of dental visits were also reported by the participating patients. Sample size was calculated a priori for factor analysis using a ratio of 20:1 (participants to items). Assuming 20 items would be included in the model, the minimum required sample size was 400 patients.[19] Both males and females between the ages of 18 and 70 years were allowed to participate in the study. Our target sample size was 400 patients. Of the 400 patients, 4 refused to participate. Eight questionnaires were incomplete and were excluded from the study. A total of 387 questionnaires were included in analyses.

Questionnaire. The STAI-Y[6] consists of 40 items, split into 2 multiple choice subscales of 20 items each. The first questionnaire measure states anxiety (S-anxiety), consisting of questions that address how respondents feel at the moment, including items that measure subjective feelings of calm, tension, apprehension, nervousness, worry, and other questions that assess autonomic nervous system activity. State anxiety scale items are rated on a 4 point Likert scale (1 = not at all, 2 = somewhat, 3 = moderately so, and 4 = very much so). The second subscale measures trait anxiety (T-anxiety), on how respondents generally feel, using items that measure general states of calmness, security, and confidence. Items were rated on a 4 point Likert scale (1 = almost never, 2 = sometimes, 3 = often,

and 4 = almost always). The total STAI-Y score for each subscale (S-anxiety and T-anxiety) is the addition of response scores for the 20 items, and ranges from 20-80, with higher scores indicating greater anxiety. We followed the test adaptation procedure recommended by Spielberger and Sharma.[20] The commercially available Arabic translation of the STAI-Y (Mind Garden, Menlo Park, CA, USA) was evaluated and revised to assess the quality of Arabic translation and to culturally adapt the scale to Saudi dialect, so as to provide a final set of items that were compatible with Saudi culture. This revision was completed by 2 bilingual experts in dentistry, for whom Arabic was their native language. Both were fluent in English. Those items for which there was an agreement between the translators were subsequently piloted in an Arabic speaking Saudi population, to assess the difficulty of answering the questionnaire. The pilot group consisted of a convenience sample of 50 patients attending the dental clinics. The patients were interviewed while they were completing the questionnaire, to evaluate the clarity of the content. Final adjustments were made to the questionnaire before formally testing its psychometric properties. To assess concurrent criterion validity, we used the Arabic version of the Modified Dental Anxiety Scale (MDAS)[21] and anxiety ratings made using a visual analogue scale (VAS),[22] where 100 referred to extreme anxiety and zero denoted not at all anxious. For the MDAS, the patients were asked to report their anxiety level in response to 5 scenarios. Responses were chosen from 5 possible levels of anxiety, from 1 (not anxious) to 5 (extremely anxious).

Statistical analysis. The Shapiro-Wilk test was used to assess the normality of STAI scores. As the distribution of STAI scores was not normal, latent variable analysis with a robust maximum likelihood (MLM) method was used in FACTOR software version 9.2.[23] The root mean square residual (RMSR) was used as the indicator of model fit. The cutoff value for an acceptable model fit was RMSR ≤0.05 (Factor 9.2 software, Rovira i Virgili University, Tarragona, Spain). We examined the factorability of the dataset using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. Known-group validity was tested by comparing STAI scores among groups using the Mann-Whitney test (in case of 2 groups) or Kruskal-Wallis test (for 3 or more groups). In the case of a significant Kruskal-Wallis test, multiple comparisons among groups were performed using Dunn-Bonferroni tests. Criterion validity was tested based on correlations with the MDAS and anxiety VAS scores. Convergent and discriminant validity were examined via Spearman's rho correlations within and between items and totals for cases where state trait anxiety was absent and cases where it was present. Concurrent criterion validity was tested using the correlations with the MDAS and VAS. Reliability was calculated as ordinal alpha reliability. Data were analyzed using IBM SPSS 20 (IBM, Armonk, NY, USA). A *p*-value<0.05 was taken as statistically significant. All tests were 2 tailed.

Results. The final sample consisted of 173 men (44.7%) and 214 women (55.3%), with an overall mean age of 39.55 ± 9.11 years.

Characteristics of the STAI-Y. The median anxiety state score was 53, and significantly higher among females (n=60) than males (n=39). The median trait anxiety score was 60, and was significantly higher among females than males (females n=60, males n=41) (**Table 1**). Items indicating the presence and absence of state and trait anxiety showed consistently the same pattern, namely significantly higher values among females versus males. Internal consistency reliability analysis generated a Cronbach's alpha value of 0.989 for the total state subscale, with an alpha of 0.976 for anxiety absent items and 0.981 for anxiety present items.

Table 1 - Descriptive statistics of STAI by gender.

Variables	Male (n=173)				Female (n=214)				Total (n=387)			
	Md.	25th	75th	Alpha	Md.	25th	75th	Alpha	Md.	25th	75th	Alpha
State A												
Total	39	24	41	0.978	60	53	72	0.971	53	39	60	0.989
Absent	20	13	21	0.953	30	26	36	0.943	26	20	30	0.976
Present	19	12	20	0.961	30	27	36	0.938	27	19	30	0.981
Trait A												
Total	41	24	49	0.968	60	60	74	0.985	60	41	60	0.989
Absent	15	8	19	0.953	21	21	24	0.928	21	15	21	0.964
Present	26	16	30	0.933	39	39	50	0.985	39	26	39	0.986

P<0.001 for all comparisons between males and females in the STAI scores distribution (Mann-Whitney test) STAI- State-Trait Anxiety Inventory

For the trait anxiety subscale, the total Cronbach's alpha value was for trait absent items 0.989, 0.964, and for trait present items 0.986. Both subscales and the total scale were acceptably reliable for males and females.

Validity analysis. Face validity was assessed by 2 experts who reviewed the relevance and suitability of the scale items for dental anxiety. Content validity was tested using exploratory factor analysis (EFA). As STAI subscales were expected to be correlated, an oblique (promax) rotation was used. The number of factors retained was evaluated using Kaiser's criterion (namely an eigen value >1) and model fit indices.[24] Two factors (**Table 2**) possessed eigen values greater than one for state (16.5 and 1.2) and trait (16.3 and 1.7). An acceptable model fit was found for the one factor solution (RMSP = 0.044 for state, and RMSR = 0.040 for

Table 2 - Exploratory factor analysis of STAI.

Exploratory factor analysis	State anxiety		Trait anxiety	
	Factor 1	Factor 2	Factor 1	Factor 2
Eigenvalue	16.5	1.2	16.3	1.7
Precentage of variance	82.2	6.1	81.3	8.3
Bartlett's test (P-value)	19276.1 (<0.001)		19504.5 (<0.001)	
KMO	0.953		0.968	
RMSR	0.044		0.040	
Factor loadings				
Q1	0.971	0.741	0.865	0.912
Q2	0.957	0.894	0.976	0.807
Q3	0.946	0.893	0.963	0.776
Q4	0.939	0.682	0.837	0.712
Q5	0.460	0.794	0.737	0.834
Q6	0.940	0.887	0.982	0.817
Q7	0.852	0.755	0.681	0.950
Q8	0.864	0.810	0.917	0.538
Q9	0.936	0.703	0.707	0.972
Q10	0.860	0.752	0.648	0.927
Q11	0.911	0.529	0.940	0.681
Q12	0.780	0.965	0.889	0.947
Q13	0.823	0.712	0.640	0.817
Q14	0.931	0.890	0.979	0.809
Q15	0.795	0.975	0.801	0.925
Q16	0.895	0.859	0.701	0.966
Q17	0.808	0.989	0.974	0.786
Q18	0.930	0.843	0.970	0.780
Q19	0.960	0.900	0.953	0.746
Q20	0.950	0.779	0.978	0.791

KMO - Kaiser-Meyer-Olkin, RMSR - root mean square residual

trait). **Table 2** shows the rotated factor loadings for this 2 factor solution. Factor 1 explains most of the variance in the state and trait subscales (82.2%). Regardless of subscale, Factor 1 showed higher loading by most of the state items (16 out of 20). This was also true for Factor 1 in the trait model (11 items out of 20). Concurrent criterion validity (**Table 3**) was strongly positive, as indicated by statistically significant correlations with MDAS of 0.906 for state scores, and 0.848 for trait. Correlations with anxiety VAS scores were also acceptable at 0.768 (state) and 0.696 (trait). Construct convergent and discriminant validity (**Table 3**) were indicated by strong, positive correlations within state and trait subscales, for both presence and absence items (all >0.90; data not shown). Correlations between total state or trait anxiety absent and state or trait anxiety present scores were all strongly negative, and significant (all ≤0.90; **Table 3**).

Table 4 confirms the known group comparison validity of both subscales, whereby significant differences in scale scores were observed according to age and frequency of dental visits. Older patients had significantly lower state and trait anxiety levels: the median state and trait anxiety in the >50 age group was 24 for both subscales, as compared to the 20-29 age group, whose medians were 53 state and 60 trait. All pairwise comparisons between age groups were significant, except between the 20-29 and 40-49 groups for the state subscale, and between 20-29 and 30-39 groups for the trait subscale. Significant differences in state anxiety were observed between those who visit the dentist occasionally,[41] or users who only visit the dentist when in need of care.[53] A significant difference in trait scores was also observed between those who visit the dentist occasionally (n=49) and regular users, (n=40) or users who only visit when in need of care (n=60).

Discussion. The main goal of the present study was to investigate an Arabic version of the STAI-Y.[6] This study was conducted on adult dental patients, in contrast to other studies that used the Arabic version, which were primarily conducted on students.[15-17] The average scores for patients participating in the study were substantially higher than those reported in the English STAI Manual.[4,25] The average state score in the current study was 53 versus 36.54 in the English STAI manual, whereas trait values were 60 and 35.55 in the English STAI manual. The high values in our study might be attributed to the high anxiety expected in our target population (dental patients) as opposed to the general population. The results of the current study suggest that this modified Arabic version of the

STAI-Y is both reliable and valid, with psychometric properties close to those reported in the international literature.[26-28] This modified scale had high internal consistency reliability, with a Cronbach's alpha value of 0.989 for the total state subscale, and 0.989 for the total trait subscale. This high reliability is in accordance with other translated versions of the STAI-Y: Cronbach's alpha for the Greek version was 0.93 for state and 0.92 for trait subscales,[28] and for a group of Lebanese and American university students, Cronbach's alpha ranged from 0.93 to 0.95 for state and 0.91 to 0.93 for trait anxiety.[16] In addition, we found that Cronbach's alpha coefficients were high for both males and females (state: males = 0.978, females = 0.971; trait: males = 0.968, females = 0.985). These results are comparable to Abdullatif,[16] which confirms that this scale is equally reliable for both males and females.

Factor analysis indicated that a one factor model provided the best fit to our data for both state and trait subscales. Other studies have suggested different

Table 3 - Correlation matrix of STAI scale with MDAS and VAS

Scale	Trait Total	State Total	State Absent	State Present	Trait Absent	Trait Present	VAS
State total							
r_s	0.925						
P-value	0.000						
State absent							
r_s	0.930	0.992					
P-value	0.000	0.000					
State present							
r_s	0.927	0.993	-0.980				
P-value	0.000	0.000	0.000				
Trait absent							
r_s	0.998	0.924	0.928	-0.929			
P-value	0.000	0.000	0.000	0.000			
Trait present							
r_s	0.998	0.929	-0.932	0.928	-0.993		
P-value	0.000	0.000	0.000	0.000	0.000		
VAS							
r_s	0.768	0.696	0.700	0.697	0.766	0.769	
P-value	0.000	0.000	0.000	0.000	0.000	0.000	
MDAS							
r_s	0.906	0.848	0.853	0.847	0.905	0.903	0.832
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

VAS - visual analogue scale, MDAS - modified dental anxiety scale,
STAI - State-Trait Anxiety Inventory

Table 4 - The state-trait anxiety inventory by age and frequency of dental visits.

Demographic characteristics	State			*P*-value	Trait			*P*-value
	Median	25th	75th		Median	25th	75th	
Age groups				<0.001				<0.001
20-29	53*	44	60		60*	41	60	
30-39	53	41	53		60*	41	60	
40-49	60*	39	72		60	49	74	
≥50	24	24	24		24	24	24	
Frequency of dental visits				<0.001				<0.001
Regular	44*,†	23	44		40*	24	40	
Occasional	41†	39	71		49	41	74	
On need	53*	53	53		60*	60	60	

Distributions with common superscript within variable are not significantly different

models. Abdullatif[16] compared separate 2 and 3 factor solutions for S-anxiety and T-anxiety for American and Lebanese samples. He found both solutions were strikingly similar, concluding that the 2 factor model is simple and provides a good fit to the data. In a Korean study[26] that only considered the trait component a unifactorial model was compared with a bifactorial model. Exploratory factor analysis supported the 2 factor solution, while confirmatory factor analysis supported both single factor and 2 factor models. The authors concluded that the one factor model is more interpretable and they suggested removal of the reversed items.[26] We supported the one factor model for several reasons. First, we did not test separately the state and trait components as we preferred to simplify the model and adhere to the conceptual definition of state and trait anxiety as 2 psychological constructs of the anxiety scale. Second, this one factor solution explained most of the variance (>80%) for both state and trait items. Third, both reversed and unreversed items correlated equally well with MDAS and anxiety VAS scores, which implies that there is no need to separate items into 2 subscales. However, a different factor structure might arise if we conducted another study involving a larger and more diverse sample of the Saudi population. The correlation of our scale with both MDAS and anxiety VAS scores indicated strong concurrent criterion validity (**Table 3**). This is consistent with 2 previous studies that addressed trait anxiety components, although they used different validity criteria.[26,29] Our results also indicated strong convergent and discriminant validity, again in accordance with previous studies.[26,30] To confirm the discriminant validity of the STAI-Y scale, we compared the patients by gender, age, and frequency of dental visits. All comparisons were consistent with several studies that indicated higher anxiety levels among females as opposed to males,[21,28,31-34] younger versus older individuals,[16,21,26,31,35-37] and patients who do not visit the dentist unless they have a specific need as opposed to more frequent visitors to the dental office.[21,35,38]

Study limitations. We used a convenience sample of dental patients, and we should be cautious on generalizing these findings to other populations. In this study, random sample was difficult to obtain due to the shortage of complete database of all patients attending the clinics. Additional research involving other ages and clinical groups is needed to further test the generality of these results. Moreover, external validity could be better assessed by applying the same questions to adult dental patients in other centers in Saudi Arabia. Second, the data reported in this study were collected via self report, and thus relationships between variables may have been inflated by questionnaire specific method variance. Additionally, both predictive validity and test retest reliability, which measure scale stability, were not assessed. As this was a cross sectional study, it would have been difficult to follow up the same subjects. Additional studies could improve upon this by undertaking such a follow up, combined with assessing future outcomes. Further, diagnostic validity was not assessed as there were no confirmed diagnoses of anxiety disorder for the participants in the present study. Finally, the questionnaire requires approximately 10 minutes to complete, which is a substantial time burden; future research should attempt to develop a shorter version. Despite these limitations, this study usefully adapted a Western anxiety scale into the Arabic language, which is spoken in more than 20 countries by 300 million people.[39] It is of great importance to develop a standardized Arabic version of the STAI-Y scale, using simple Arabic language that is appropriate and understandable by all Arabic speaking individuals across different Arabic cultures and countries. Future studies should validate this version of the Arabic STAI-Y in different settings and in other Arabic speaking countries. Adapting the STAI-Y for other Arabic cultures would also be beneficial for cross cultural research.

In conclusion, our proposed Arabic version of the STAI-Y has an adequate internal consistency, as well as convergent and criterion validity, being generally comparable to those reported in the international literature.

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