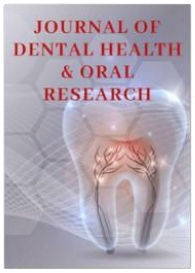

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Research Article

Cross Cultural Adaptation and Validation of the Moroccan Arabic Version of the Standardized Tool for the Assessment of Bruxism (STAB)

Bourzgui Farid[1*], Bouaoud Ikram[2], El Ghali Nihal[2], Serhier Zineb[3], El Quars Farid[1]

[1]Professor, Faculty of Dental Medicine, University Hassan II of Casablanca, Morocco

[2]Doctor, Faculty of Dental Medicine, University Hassan II of Casablanca, Morocco

[3]Faculty of Medicine and Pharmacy, University Hassan II of Casablanca, Morocco

***Correspondence author:** Bourzgui Farid, Professor, Faculty of Dental Medicine, University Hassan II of Casablanca, Morocco;
E-mail: faridbourzgui@gmail.com

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Abstract

Bruxism (daytime or nighttime) is a common and widely observed disorder that has been interpreted in many ways in the literature, encompassing psychological, physiological and behavioral perspectives. To translate, culturally adapt and validate the Standardized Tool for the Assessment of Bruxism into Moroccan Darija, ensuring its reliability and validity for clinical and epidemiological use in Morocco. A cross-sectional study was conducted with 100 participants at the Casablanca Dental Consultation and Treatment Center. The Standardized Tool for the Assessment of Bruxism questionnaire underwent forward and backward translation, followed by cultural adaptation. Reliability was assessed through test-retest and internal consistency was evaluated using Cronbach's alpha. Construct validity was explored via correlation analyses. Cultural and linguistic adaptations improved clarity and accessibility for the Moroccan population. The ICC values showed excellent reliability: 0.83 for Sleep Bruxism, 0.94 for Awake Bruxism and 0.98 for Associated Symptoms. Internal consistency was further assessed among patients with self-reported bruxism, revealing acceptable Cronbach's alpha values for Awake Bruxism (0.7540) and Associated Symptoms (0.7154), while Sleep Bruxism demonstrated a lower alpha (0.4653). Strong inter-subscale correlations supported the multidimensional structure of the Standardized Tool for the Assessment of Bruxism questionnaire. The Moroccan Darija version of the STAB is a valid, reliable and culturally appropriate tool for assessing bruxism. It enhances understanding of bruxism in the Moroccan context and supports future cross-cultural research initiative.

Keywords: Standardized Tool for the Assessment of Bruxism (STAB); Assessment; Awake Bruxism; Bruxism; Diagnosis; Sleep Bruxism

Introduction

Bruxism is a prevalent and widely observed condition, with numerous interpretations in literature, encompassing psychological physiological and behavioral perspectives. Despite its frequent occurrence, its etiology remains complex and multifactorial. According to the American Sleep Disorders Association, bruxism is defined as "tooth grinding or clenching during sleep plus one of the following: tooth wear, sounds or jaw muscle discomfort in the absence of a medical disorder" [1]. More broadly, it can also be described as a repetitive masticatory muscle activity, manifested by clenching or grinding of the teeth and/or bracing or thrusting of the mandible. To better understand and classify this condition, bruxism is divided into two types based on circadian phenotype: Sleep bruxism occurs during sleep and involves masticatory muscle activity that is either rhythmic (phasic) or non-rhythmic (tonic). It is not considered a movement or sleep disorder in otherwise healthy individuals. Awake bruxism, on the

other hand, takes place during wakefulness and is marked by repetitive or sustained tooth contact, as well as bracing or thrusting of the mandible, without being classified as a movement disorder in healthy individuals [2,3]. Given the complexity of diagnosis and classification, the dental profession has long been intrigued by bruxism. This condition has seen varying levels of attention over the years-sometimes it is underdiagnosed, other times over diagnosed and occasionally even misdiagnosed. The challenges in accurately identifying and managing bruxism reflect its complex nature and the wide range of symptoms it can present, from subtle tooth wear to significant jaw discomfort and muscle tension.

Within this context, multiple methods are available to assess bruxism activity, with questionnaires being one of the most commonly used tools. Clinical examinations and observations of tooth wear are also standard approaches in both clinical practice and research settings. Additionally, some studies have attempted to monitor bruxism by using oral devices, which assess factors such as occlusal splint wear force applied to the device and interarch contact patterns [4,5]. More objective methods include portable Electromyographic (EMG) recordings, which measure the activity of masticatory muscles during sleep [6]. Recently, more accessible devices like BiteStrip and Grindcare have been introduced to simplify bruxism monitoring at home [7,8]. Another accurate method for evaluating bruxism is polysomnography - a comprehensive sleep study conducted in a sleep laboratory. This approach provides detailed, high-quality data but is typically reserved for specialized settings due to its complexity and cost [9-13].

The Standardized Tool for Assessing Bruxism (STAB) was developed in response to these factors. It is based on a combination of subjective, clinical and instrumental data and was developed as a means of determining the status of bruxism, its comorbidities, aetiology and consequences. The tool consists of two axes, specifically dedicated to the evaluation of bruxism status and consequences (Axis A) and bruxism risk and etiological factors and comorbid conditions (Axis B). It includes 14 domains, accounting for a total of 66 items. A combination of self-reported, clinically based and instrumentally gathered data is provided to collect information on the above topics [14].

According to our knowledge, in Morocco, bruxism is commonly observed yet under-researched, creating a need for a reliable assessment tool to understand its prevalence, causes and impact within the population. Translating and validating the STAB in Moroccan Darija could help bridge this gap, allowing for accurate, culturally relevant assessment of bruxism in the Moroccan context.

The aim of this study was to translate, culturally adapt and validate the STAB into Moroccan Arabic (Darija), with a focus on ensuring its linguistic accuracy, cultural relevance and psychometric reliability for clinical and epidemiological use in Morocco.

Subjects and Methodology

The study participants in the sample were patients who visited the Casablanca Dental Consultation and Treatment Center, whether or not they had bruxism. Sequential patient inclusion in the sample was based on the following criteria: Adults aged 19 years and above. Individuals fluent in Moroccan Darija. Participants who agreed to participate voluntary. The exclusion criteria were: Severe Cognitive or Psychiatric Disorders: Any condition that might impair understanding or proper completion to the questionnaire. Individuals with Full Dental Prostheses: These may alter the manifestation of bruxism and could bias questionnaire responses. individuals who declined participation. A total of 100 participants were included in the study based on the inclusion criteria. Out of these, 30 participants completed the questionnaire a second time after 30 days, for test-retest reliability analysis.

The translation and cultural adaptation process followed a hybrid approach, drawing from Brislin's back-translation model and incorporating key elements of the Beaton, et al., framework including dual forward and back translations and expert reconciliation [15,16]. However, the final pre-testing phase (cognitive debriefing with target population), as recommended in Beaton's guidelines, was not conducted and thus the process cannot be considered a full implementation of the Beaton framework [16].

Prior to initiating the translation and adaptation process, we contacted the original developers of the STAB questionnaire, namely Professor Daniele Manfredini and Professor Frank Lobbezoo, to obtain formal permission to adapt the tool into Moroccan Darija. The authors kindly granted us access to the original English version of the instrument (Appendix 1) and expressed their full

support for our project. They offered to assist us throughout the study by providing clarifications and guidance on the structure and interpretation of the tool whenever necessary. This collaboration ensured that the adaptation process respected the theoretical foundation and intended use of the original instrument.

We proceeded with two forward translations of the source document from English into the Moroccan dialect (darija), carried out by two independent bilingual translators, both of whom are native speakers of the target language. The two translations were compared. Discrepancies were discussed with proposed equivalences until consensus was reached with the goal of preserving and maintaining the full meaning of each item from the original version as much as possible. Two back-translations of the unified forward translation into English were performed by two independent bilingual translators fluent in English. One back-translator had a medical/dental background, while the other did not. A synthesis of both back translations was reviewed for consistency. Once the back-translation had been completed, it was compared in detail with the original English STAB to ensure conceptual and linguistic equivalence. In this way, the research team was able to identify any discrepancies in meaning, tone or structure and ensure that the adapted content accurately reflected the meaning of the source instrument. Any inconsistencies were noted and used to enhance the translated version, maintaining consistency with the original instrument while remaining culturally and contextually sound. The final version was refined and reviewed for both linguistic and content accuracy. The translation was followed by a validation study to assess its psychometric properties in the target population.

The statistical analysis was performed using SPSS software (Version 17.0, SPSS Inc., Chicago, IL, USA). For all statistical tests, the level of significance was set at $p \leq 0.05$. Data were collected on age, gender, height, weight, current marital status and education level. The reliability assessment is evaluated by calculating the Intraclass Correlation Coefficients (ICC). Cronbach's Alpha Coefficient Measurement: Based on intercorrelations between the 14 domains and the total score. Cronbach's alpha was calculated for the 14 domains of the Standardized Tool for the Assessment of Bruxism (STAB) to evaluate internal consistency.

The research project was submitted to and approved by the thesis committee, which serves as the ethics committee within our institution. Patients were informed about the study's purpose and assured that completing the questionnaire was anonymous and voluntary. Informed consent was obtained, ensuring patients understood and agreed to participate freely and with full awareness. The anonymous format of the questionnaire ensured the confidentiality of the participants' personal data [4].

Result

The study sample included 100 participants (63 were females and 37 were males). The age varied from 19 to 67 years with a mean of 36.5 ± 12.05 years. The height was 168.15cm ± 8.76 on average and the weight was 70.49 kg ± 10.67 on average. The distribution of marital status was as follows: 53 participants were married, 5 participants were divorced, 2 participants were widowed and 40 participants were unmarried.

As for education: 35% had a university degree, 34% had a compulsory school degree, 18% had a secondary school degree and 13% did some university with no degree. The descriptive analysis of the STAB scores was performed for each of the three subscales- Sleep Bruxism (SB), Awake Bruxism (AB) and Associated Symptoms - as well as for the Total Bruxism Score. The analysis included measures of central tendency (mean, median), dispersion (standard deviation, interquartile range) and observed range (minimum and maximum) (Table 1).

The total score, which combines the values of the three subscales, had a mean of 23.97 (SD = 7.79) and a median of 23.00. Scores ranged from 12 to 52. The 25^{th} percentile was 18.75, the median was 23.00 and the 75^{th} percentile was 29.00, indicating a relatively wide distribution of global bruxism scores within the sample.

The test-retest reliability of the STAB questionnaire was assessed on sample of 30 subjects on two occasions. The Intraclass Correlation Coefficient (ICC) for consistency, applied separately to each of the three principal domains: Sleep Bruxism (ICC/ 0.83), Awake Bruxism (ICC/ 0.94) and Associated Symptoms (ICC/ 0.9727). The results are summarized in Table 2.

The internal consistency of the STAB questionnaire was assessed using Cronbach's alpha coefficients, calculated for each of the three domains among participants who self-reported bruxism during anamnesis. The highest internal consistency was observed

for the Awake Bruxism domain, with a Cronbach's alpha of 0.7540, indicating a relatively good level of internal coherence among the items in this section. In contrast, the Sleep Bruxism domain obtained a lower Cronbach's alpha of 0.4653, suggesting less homogeneity among the items assessing nocturnal bruxism in this subgroup. The Symptoms subscale, which includes items related to pain, fatigue and dental consequences, showed a Cronbach's alpha of 0.7154, also reflecting an acceptable internal consistency. All values are presented in Table 3, which summarizes the Cronbach's alpha coefficients per domain.

A Pearson correlation analysis was conducted to explore the relationships between the main STAB subscale scores - Sleep Bruxism, Awake Bruxism, Associated Symptoms and Total Score - and specific items from Axis B, which concern risk factors, comorbidities and etiological variables. The Total STAB Score showed a strong positive correlation with Awake Bruxism ($r = 0.8587$, $p < .001$), Associated Symptoms ($r = 0.8012$, $p < .001$) and Sleep Bruxism ($r = 0.5411$, $p < .001$). A moderate correlation was also found between Awake Bruxism and Sleep Bruxism ($r = 0.4870$, $p < .001$) and between Awake Bruxism and Symptoms ($r = 0.4267$, $p < .001$). The relationship between Symptoms and Sleep Bruxism was weaker and not statistically significant ($r = 0.1481$, $p = 0.141$). Item B2.1, related to sleep apnea screening, showed a significant negative correlation with Sleep Bruxism ($r = -0.2191$, $p = 0.029$), while no significant correlations were observed with the other subscales. Item B3.4 A, concerning Gastroesophageal Reflux Disease (GERD), showed: A significant positive correlation with the Symptoms subscale ($r = 0.2718$, $p = 0.006$). A significant positive correlation with the Total STAB Score ($r = 0.2694$, $p = 0.007$). No notable correlations were observed between GERD-related items and either Sleep or Awake Bruxism subscales. Table 4 presents the full correlation matrix with all corresponding r values and p-values for transparency and completeness.

	Score SB	Score AB	Symptoms	Score Total
N	100	100	100	100
Mean	2.320	9.530	12.12	23.97
Median	1.000	9.000	11.00	23.00
Standard deviation	1.588	4.101	4.258	7.792
Minimum	1	4	7	12
Maximum	6	23	27	52
25th percentile	1.000	7.000	9.000	18.75
50 th percentile	1.000	9.000	11.00	23.00
75 th percentile	3.250	12.00	15.00	29.00

Table 1: Descriptive analysis of STAB scores.

	Subjects	Raters	ICC	Agreement
Sleep Bruxism	30	2	0.83	0.8341
Awake Bruxism	30	2	0.94	0.9412
Symptoms	30	2	0.98	0.9727

Table 2: Intraclass Correlation Coefficient (xICC).

Domains	Cronbach's Alpha
Awake Bruxism	0.754
Sleep Bruxism	0.4653
Symptoms	0.7154

Table 3: Cronbach's Alpha analysis.

		Score Total	Score Symptoms	Score SB	Score AB
Score Total	Pearson's r	-	0.8012	0.5411	0.8587
	P value	-	< .001	< .001	< .001
Score Symptoms	Pearson's r	0.8012	-	0.1481	0.4267
	P value	< .001	-	0.141	< .001
Score SB	Pearson's r	0.5411	0.1481	-	

	P value	< .001	0.141	-	
Score AB	Pearson's r	0.8587	0.4267 <	0.487	-
	P value	< .001	0.001	< .001	-
B2.1	Pearson's r	-0.0525	0.0308	-0.2191	-0.0468
	P value	0.604	0.761	0.029	0.644
B3.4 A	Pearson's r	0.0971	0.2339	-0.1185	-0.0125
	P value	0.337	0.019	0.24	0.902
B3.4 B	Pearson's r	0.0266	0.099	-0.0792	-0.0216
	P value	0.793	0.327	0.434	0.831
B3.4 C	Pearson's r	-0.1091	-0.0284	-0.2118	-0.0958
	P value	0.28	0.779	0.034	0.343
B3.4 D	Pearson's r	0.1497	0.2774	-0.123	0.0441
	P value	0.137	0.005	0.223	0.663
B3.4 E	Pearson's r	0.0532	0.0609	0.0184	0.0307
	P value	0.599	0.547	0.856	0.762

Table 4: Correlation matrix between STAB subscales and Axis B.

Discussion

The current research was conducted to assess the psychometric characteristics of the Moroccan Darija version of the Standardized Tool for the Assessment of Bruxism (STAB), such as its reliability, internal consistency and construct validity after cultural adaptation. The findings provide evidence of the successful application and adaptation of this instrument in the Moroccan population, along with the necessity of various cultural adaptations.

The Moroccan Darija version of the STAB demonstrated excellent temporal reliability. The Intraclass Correlation Coefficients (ICC) obtained in our study were 0.83 for Sleep Bruxism, 0.94 for Awake Bruxism and 0.98 for Associated Symptoms. These values are consistent with those reported in other international validations, including the original multicenter study by Manfredini, et al., which reported ICCs of 0.84, 0.91 and 0.93 respectively [14]. Comparable results were also found in other linguistic adaptations, such as the Italian version, where the ICCs reached 0.85 for Sleep Bruxism, 0.93 for Awake Bruxism and 0.95 for Symptoms [17]. These findings reinforce the robustness and reproducibility of the Moroccan version and its ability to provide stable scores over time. The pattern observed in our study-where Awake Bruxism scores were consistently higher than Sleep Bruxism scores-has also been noted in multiple cultural contexts, confirming the structural validity and cross-cultural stability of the STAB. This supports the conclusion that the Moroccan Darija version of the STAB can be reliably used in both clinical and research settings in Morocco. In addition to overall reliability, internal consistency was analyzed in a subgroup of patients who reported suffering from bruxism during anamnesis. For this group, Cronbach's alpha values were 0.7540 for Awake Bruxism, 0.7154 for Associated Symptoms and 0.4653 for Sleep Bruxism. These values suggest acceptable internal consistency for the first two domains. However, the Sleep Bruxism domain showed a lower internal consistency in this bruxism-positive group. When compared to the original validation by Manfredini, et al., which reported Cronbach's alpha values above 0.80 across all domains, our findings are slightly lower, particularly for Sleep Bruxism [14]. Nevertheless, this pattern is not unique. Similar observations have been made in other cross-cultural validations. In the Italian version developed by Bracci, et al., alpha coefficients were around 0.79 for Sleep Bruxism, 0.87 for Awake Bruxism and 0.84 for Symptoms [17]. Across these studies, the Awake Bruxism domain has consistently shown stronger internal coherence than the Sleep Bruxism domain. This discrepancy can be partly explained by the inherent difficulty patients have in perceiving and reporting bruxism during sleep, as it occurs unconsciously. Consequently, inconsistencies or underreporting may lead to reduced internal consistency for this domain. On the other hand, awake bruxism behaviors are more conscious and observable, which facilitates more consistent self-reporting.

As predicted, Total STAB Score was strongly correlated with Awake Bruxism (r = 0.8587), Associated Symptoms (r = 0.8012) and Sleep Bruxism (r = 0.5411), reflecting good internal convergence among the subcomponents. Moderate correlations between Awake Bruxism and Symptoms (r = 0.4267) and between Awake and Sleep Bruxism (r = 0.4870) also reflect the conceptual validity of the instrument. There was a strong but negative correlation between Sleep Bruxism and Axis B item B2.1 (r = -0.2191, p = 0.029). This may be partly because our study population was not solely composed of bruxism patients. Those without bruxism or with

subclinical symptoms would perhaps not perceive or report sleep bruxism-related behavior, unless instrumentally confirmed. Conversely, awake bruxism patients are more aware of their symptoms and this results in greater associations with subjective experiences and risk factors.

Item B3.4, which reflects psychological vulnerability, was positively correlated with both the Total STAB Score ($r = 0.2694$, $p = 0.007$) and the Symptoms subscale ($r = 0.2718$, $p = 0.006$). This suggests that individuals with higher psychological vulnerability may experience more bruxism-related symptoms. Additionally, certain items from the B1.2 domain-for example, Q4 ("I actively look for ways to replace the losses I encounter in life")-showed a negative correlation with Sleep Bruxism, supporting the STAB's ability to distinguish between co-occurring and independent constructs. Moreover, item B3.2 (QC: "Pain in the middle or upper stomach area") was also negatively correlated with Sleep Bruxism, suggesting a nuanced and potentially individualized relationship between psychosocial stress and bruxism behaviors.

During the adaptation process, certain content and language modifications were needed to render it culturally suitable and comprehensible. We initially removed two categories of marital status-"living as married" and "separated"-as they do not align with Moroccan sociocultural or legal norms. The gender category was also adapted by removing the "unspecified/other" category. This process followed recommended guidelines for cross-cultural adaptation of self-report measures and the universalist model of equivalence proposed in health-related quality of life instruments [16,18]. Additionally, item A3.4 initially contained the words "kissing others," which were removed based on cultural sensitivity. We also had to deal with medical jargon, which involved rephrasing complicated sentences without influencing what they were intended to convey. Some sentence structures were simplified or altered to fit participants' reading level. The other significant factor was that there were illiterate people included in the study sample. Such respondents were placed under the category of compulsory school level and the questionnaire was read out to them so that they could comprehend it. This factor required additional attention to wording and simplicity to maintain the response validity.

This study has certain limitations that may affect the generalizability of its findings. First, the sample was limited to 100 participants, all recruited from the Casablanca region, which may not be representative of the broader Moroccan population. The geographic and socio-economic diversity of Morocco-especially between urban and rural areas-may influence the expression, perception and reporting of bruxism behaviors. Thus, future studies should aim to recruit larger and more geographically and culturally diverse samples, including participants from multiple regions (e.g., rural areas, northern and southern provinces), to enhance external validity. Second, although the STAB questionnaire has been designed for compatibility with instrumental measures such as Electromyography (EMG) and Polysomnography (PSG), this study relied solely on self-reported data. The absence of objective validation may limit the strength of the conclusions regarding convergent validity. Future research should integrate instrumental assessment methods to compare subjective and objective bruxism indicators and to strengthen diagnostic accuracy.

Finally, cultural factors might have influenced the participants' responses. Some items-especially those related to sleep behaviors-may be difficult for participants to interpret or self-assess due to social norms, stigma or lack of awareness about bruxism. Future work could explore cognitive debriefing or qualitative interviews to ensure cultural appropriateness and semantic clarity of the Darija version.

Conclusion

The Moroccan Darija adaptation of the Standardized Tool for the Assessment of Bruxism (STAB) exhibits excellent psychometric qualities, confirming both its validity and reliability, while maintaining strong cultural appropriateness. Although it required a number of linguistic and cultural modifications-including the simplification of medical jargon, rewording of some items to enhance understandability for low-literacy participants and exclusion of items that were culturally inappropriate-the general multidimensional framework of the original instrument was preserved. This ensured that the diagnostic validity and the theoretical underpinnings of the STAB were maintained. The validation process highlighted how sociocultural context can impact symptom perception and reporting. For instance, some weaker or negative subscale correlations may reflect a less aware general population regarding their bruxism behavior, particularly for sleep bruxism, where self-awareness is typically lower. Nevertheless, the higher correlations observed with awake bruxism and associated symptoms reflect a greater capacity for self-reporting daytime behaviors and their psychosomatic repercussions.

In addition to the overall excellent test-retest reliability, internal consistency analyses conducted specifically among patients with self-reported bruxism revealed acceptable Cronbach's alpha values for Awake Bruxism and Associated Symptoms. However, a lower alpha value was observed for Sleep Bruxism, likely due to the challenges in self-perception during sleep. In summary, future research should include broader sampling, incorporate objective measures and further explore the cultural adaptation process to consolidate the STAB's psychometric robustness in Morocco.

Conflict of Interest
The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Data Availability Statement
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Ethical Statement
The project did not meet the definition of human subject research under the purview of the IRB according to federal regulations and therefore, was exempt.

Informed Consent Statement
Informed consent was taken for this study.

Authors' Contributions
All authors contributed equally to this paper.

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