2018-11-21

Translation, cultural adaptation and validation of the cognistat for its use in Arabic speaking population with acquired brain injury.

Almubark, BM

http://hdl.handle.net/10026.1/13228

10.23736/S1973-9087.18.05530-2
European Journal of Physical and Rehabilitation Medicine
Edizioni Minerva Medica

European Journal of Physical and Rehabilitation Medicine
EDIZIONI MINERVA MEDICA

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European Journal of Physical and Rehabilitation Medicine 2018 Nov 21
DOI: 10.23736/S1973-9087.18.05530-2

Article type: Original Article

Article first published online: November 21, 2018
Manuscript accepted: November 21, 2018
Manuscript revised: November 12, 2018
Manuscript received: September 10, 2018

EDIZIONI MINERVA MEDICA

Running head: THE ARABIC COGNISTAT

Translation, Cultural Adaptation and Validation of the Cognistat for its Use in Arabic Speaking Population with Acquired Brain Injury

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Abstract

BACKGROUND: The use of cognitive assessment tools is central to the detection of cognitive impairment in acquired brain injury patients. The Cognistat is a commonly used cognitive screening tool that can detect cognitive deficits among patients with neurological and psychiatric conditions. The Cognistat examines different major ability areas including level of language, construction, memory, calculation, reasoning, consciousness, orientation and attention. To date the Cognistat has not been translated/adapted for use in Arabic speaking countries.

AIMS: To provide normative data for the use of the Cognistat in Arabic-speaking populations with acquired brain injury.

DESIGN: Cross-cultural validation study.

SETTING: Inpatient TBI and stroke rehabilitation ward in a rehabilitation hospital.

POPULATION: A total of 107 healthy Arabic speaking adults and 62 acquired brain injury patients were involved in the study.

METHOD: After the completion of the cross-cultural adaptation process, psychometric properties of the adapted cognitive tool were evaluated.

RESULTS: The Arabic Cognistat was found to have acceptable internal consistency, and the test-retest reliability showed high stability of scores over time. For concurrent validity, patients' performance on the Arabic Cognistat and the Mini-Mental State Examination were compared with excellent correlations overall. Significant differences between the performance of patients and the control group were found on all sub-tests.

CONCLUSION: The Arabic Cognistat appears to be a valid and reliable cognitive screening tool. It is anticipated that the Arabic Cognistat will be widely used in the Arabic speaking countries, allowing for a very precise evaluation of cognitive deficits in acquired brain injury patients.

CLINICAL REHABILITATION IMPACT: As part of the rehabilitation process, health care professionals are regularly required to test patients' cognitive abilities using appropriate measures. The findings of the study provide key solutions for the clinical assessment of Arabic populations: such cognitive tools could help improve the cognitive rehabilitation practice for the Arabic population by offering validated, reliable and culturally-adapted tests in the Arabic language.

Key-words: Cognistat; cognitive tools; acquired brain injury; validity; reliability

Translation, Cultural Adaptation and Validation of the Cognistat for its Use in Arabic Speaking Population with Acquired Brain Injury

Introduction

When adults experience an Acquired Brain Injury (ABI) such as a stroke or a traumatic brain injury, which can impair cognitive processing[1], it is all the most critical that practitioners use culture-specific screening tools[2]. To date, the majority of cognitive tools have been developed in the English language[3] and only a few of them, such as the Mini-Mental State Examination (MMSE)[4] and the Montreal Cognitive Assessment (MoCA)[5], have been adapted for Arabic speakers. Although the MMSE is by far the most frequently used cognitive screening, it has a number of limitations such as generating a high rate of false positives[6], especially within patients with low level of education and socioeconomic status[7]. It is also not clear from the literature which cut-off score should be used, which is essential for differentiating between intact and impaired cognition[8]. Further, it was pointed out that the MMSE is not a useful cognitive screening measure for memory complaints or overall cognitive deficits[9]. Similarly to the MMSE, the MoCA – which has been developed to screen cognitive functions and identify mild cognitive impairment[10] – provides a global score that might be problematic in causing a high rate of false positives[11]. Therefore, the adaptation or development of more specific cognitive measures for Arabic speakers, especially with ABI, is greatly required to overcome the current limitations of existing assessment measures[12].

As an alternative tool, the Cognistat (previously named Neurobehavioral Cognitive Status Examination)[13] is a commonly used cognitive screening test that enables clinicians to understand and identify the patient's areas of cognitive strengths and weaknesses. It has been developed and validated to detect cognitive deficits among patients with neurological conditions[14] such as stroke[15] and TBI[16], besides psychiatric conditions[14]. The test takes about 20 to 40 minutes to administer[13] and is currently available in 12 languages – English[13,17], Spanish[18], Japanese[19,20], Hindi[21], Chinese (Mandarin[22] and Cantonese[23,24]), Swedish[25], Hebrew[26], French, Norwegian, Finnish, and Czech[14] – and the Arabic language is not yet among these versions. The Cognistat examines a broader range of cognitive functioning than the MMSE or the MoCA including language (speech, comprehension, repetition and naming), reasoning (similarities and judgment), orientation (to person, place and time), construction, memory registration, calculation, consciousness and attention[14]. By using a graded series of test items within each cognitive domain, the Cognistat increased the possibility of detecting mild cognitive impairments[17]. It was further demonstrated that the Cognistat is more reliable in detecting cognitive deficits among patients with brain injury (86%) compared to the MMSE (53%)[27]. Research comparing the Cognistat with a number of cognitive screening tests such as the Screening Instrument for Neuropsychological Impairments in Stroke[28] and the Clock drawing test[29] showed that the Cognistat had the highest sensitivity in detecting cognitive deficits (82%) as compared to the other tests, with a specificity of 50%[15].

Given that most cognitive tests target the English population, and given the paucity of available tools for assessing Arabic patients with ABI, it appeared critical to adapt existing measures to assist professionals in examining patients in their own cultural context[2]. Therefore, the aim of the current study was to provide normative data for the use of the Cognistat with Arabic-speaking patients with ABI, by translating, culturally adapting and testing the validity of the Cognistat from English to Arabic.

The language used in the Arabic Cognistat is standard Arabic, which is the language of formal education in all Arabic-speaking countries, and the language used in the newspapers. However, as for the Arabic version of the MMSE, it is anticipated that practitioners will adapt the instructions in their Arabic variety as they deem necessary.

Material and Methods

The study was completed in two stages. First published guidelines for the cross-cultural adaptation process[30] were followed. This started with a forward translation of the original English Cognistat, performed by two bilingual professionals with Arabic as a native language (translator and first author of this paper), who translated and culturally adapted the Cognistat from the source language (English) to standard Arabic. The two forward translators agreed on the final translation/adaptation version (translation synthesis). For the backward translation, a bilingual professional with English as native language translated the Cognistat from Arabic back to English, a process considered as a validity checking. Then an expert committee of five professionals discussed and agreed on the items changed/adapted to suit the Arabic population, especially the Saudi culture. Three of the committee members were qualified occupational therapists, with two of them being PhD students. The fourth member was a qualified translator, and the last member was a final year law student with no medical background. The pre-testing was completed by the first author on 22 healthy Arabic speaking adults with a mean age of 26 (including 12 females and 10 males), and a mean number of 15.8 years in education, using the Arabic Cognistat. It is worth noting that the pretesting sample was slightly younger than the healthy controls in the testing phase (mean = 30.9, SD = 9.5). The pre-testing sample included Arabic speaking individuals living in the UK and in Saudi Arabia. After testing, the healthy adults were asked about the clarity, appropriateness and cultural relevance of the Arabic version. Since no concerns were reported, full data collection was undertaken and the validity and reliability of the Arabic translated/adapted version were tested.

Cultural adaptation of the Cognistat items

The Cognistat examines different major ability areas including level of language (comprehension, repetition and naming), construction, memory, calculations, reasoning (similarities and judgement), consciousness, orientation, and attention. The expert committee panel suggested that the orientation, attention, language (comprehension), construction and calculation did not require any changes. In the comprehension subtest, the sentence length and structure remained unchanged when adapted to Arabic. Yet, some items in the memory, language (repetition and naming) and reasoning (similarities and judgment) sub-tests were adapted to suit the Arabic speaking population, as described below.

Memory

In the memory task the words, 'robin' (English frequency in SUBTLEX-UK[31]: 5283), 'blue jay' (unknown frequency but presumably rarer than 'robin'), 'violin' (1338) and 'guitar' (4894) were replaced with 'falcon' (Arabic frequency from ARALEX[32]: 11.99), 'parrot' (0.23), 'oud' (an Arabic musical instrument known in most Arabic countries i.e. Gulf countries, Egypt, Iraq and Morocco; frequency unknown) and 'drum' (0.44), respectively. Although it is impossible to compare directly word frequencies across lexical databases, we attempted to match a frequent word with another frequent word, which was possible for 'robin' and 'falcon', and for 'guitar' and 'oud'. Similarly we replaced a rarer word with another rarer word, as in 'blue jay' and 'parrot', and 'violin' and 'drum'.

Language

In the language sub-test 'repetition', the sentence 'The beginning movement revealed the composer's intention' did not sound understandable when translated to Arabic, thus it was replaced with an Arabic appropriate sentence: 'The higher the human the more clouds surrounds'. Also, the literal translation of the sentence 'No ifs, ands or buts' was replaced with 'No refuses and excuses or exceptions'. The number of syllables and length of the Arabic sentences were equivalent to the replaced English ones.

Naming

In the naming subtest, ‘kite’ (English frequency: 1546) and ‘xylophone’ (130) were replaced with ‘airplane’ (Arabic frequency: 75.63) and ‘flute’ (0.18) respectively.

Reasoning - Similarities

In the similarities task, ‘rose’ (English frequency: 8873) and ‘tulip’ (325) were replaced with ‘daffodil’ (Arabic frequency: 0.34) and ‘jasmin’ (2.7) which are common flowers in Arabic countries.

Reasoning - Judgment

For the judgment task, the screening question ‘What would do if you were stranded in an airport 1,000 miles from home with only $1.00 in your pocket?’ was clarified with ‘What would you do if you found yourself alone in an airport 1000 miles/ 1600 km away from your home country with only 1 dollar/ 5 Saudi riyals in your pocket, and you wanted to go back to your country?’

The cultural relevance of the replaced items were confirmed by the healthy adults and the expert committee members.

Participants

A total of 62 ABI patients (30 stroke and 32 TBI) and 107 healthy adults took part in the validation study. As in the original English Cognistat study, the controls and patients were further sorted in two groups – young (18-39 years of age) and old (40-60 years of age; Kiernan et al., 1987). Patients were recruited from a rehabilitation hospital in Saudi Arabia (61 out of 62 were Saudis). This group was made of 45 males (72.6%) and 17 females (27.4%) with a mean age of 37.6 years and a mean number of 11.6 years in education. More men were diagnosed with TBI than women as a result of road traffic accident - women did not drive in Saudi Arabia when testing took place. Patients were in the post-acute phase of their illness - a stage in which the primary incident starts to be under control[33].

The inclusion criteria for the stroke patients were as followed: individuals who were diagnosed with stroke according to the WHO definition; patients who were medically stable (patient is conscious, vital signs are stable/unchanging and within normal limits, confirmed by the medical notes); patients between 18-60 years of age.

The inclusion criteria for the TBI patients were as follows: individuals who were diagnosed with Traumatic Brain Injury (TBI) according to the WHO definition; patients who were medically stable; patients between 18-60 years of age; Glasgow Coma Scale (GCS)[34] score of 15 at the time of testing. As suggested by a Reviewer, the Glasgow Outcome Scale[35] (or a similar scale as the Disability Rating Scale[36]) may be more appropriate as the GCS loses its value after the acute scale.

The exclusion criteria for the TBI patients included those with severe visual or hearing impairment, alongside those with a severe global aphasia (that does not make comprehension and verbal production possible even in simplified communicative contexts) confirmed by the patients' medical records documented by the speech and language pathologist. We also excluded patients with history of psychiatric illness and substance abuse, patients unable to speak Arabic, and patients unable to provide informed consent. The exclusion criteria for the stroke patients included those with post stroke depression (confirmed by the patient's medical record, documented by the neuropsychologist) as it might limit the generalisability of the findings. As for TBI, patients with history of psychiatric illness and substance abuse were excluded, together with those with severe visual or hearing impairment, severe global aphasia (as confirmed by the patients' medical records, documented by the speech and language pathologist), patients unable to speak Arabic and unable to give their consent. The GCS reported in the patients' medical records, at the time of recruitment in the study, gave no indication of the severity of cognitive impairment.

Members of the control group were recruited through a rehabilitation hospital in Saudi Arabia, or through the University of Plymouth psychology advertisement website, and through word of mouth. The control group involved 46 males (43.0%) and 61 females (57.0%) with a mean age of 30.9 years and a mean number of 14.6 years of education. These healthy Arabic speaking adults originated from various Arabic-speaking countries with a majority from Saudi Arabia (N = 85 out of 107). The inclusion criteria for the control group involved Arabic speakers aged 18 years and above, with no medical history that could have an impact on cognitive functioning - confirmed using a health check questionnaire. Those with confirmed medical conditions and who were unable to speak Arabic were excluded.

Procedure

Patients completed a written consent form prior to their participation. Some of the patients required help at that stage, as they had difficulty reading (due to low level of education) and writing (due to a low level of education and injury-related physical limitations that affected the dominant hand). In those cases, the examiner read the consent form to the patient and patient orally agreed to take part in the study. After completing a health check questionnaire, all participants were tested using the Arabic Cognistat and the MMSE in a counterbalanced order, at the rehabilitation hospital in Saudi Arabia or in a quiet room at the University of Plymouth. The order of item presentation followed exactly that in the original Cognistat manual[14]. The average participating time was 30 minutes. The paper and pencil versions of the Cognistat and the MMSE were administered by the first author and two trained occupational therapists.

Data analysis

Mean and standard deviation were calculated for each sub-test and each population to establish standardisation data. T-tests were used to compare mean scores of the Arabic ABI patients and the Arabic control group.

In the control group, Pearson's r correlations were used to assess the effect of demographic variables (age, education and gender) on scores of the sub-tests of the Cognistat. For example, we expected a positive correlation between years of education and scores in the reasoning sub-tests, but no effect of gender.

Internal consistency was calculated through Cronbach's alphas, and intra-class correlations were used on a subgroup of 12 healthy participants for the test re-test reliability. For the concurrent validity, Pearson's r correlations were used to compare the Arabic patients' performance on the Cognistat sub-tests to the similar items of the MMSE. Pearson's r correlations were also used to compare the performance of the Arabic control group on the Cognistat to the MMSE.

Further, the performance of Saudi control group to that of other Arabs was assessed through independent t-tests, to ensure that the variety of Arabic spoken by the experimenter (here, Saudi) did not impact on the results. Stroke and TBI patient groups were also compared using an ANCOVA (to control for age as TBI patients were younger than stroke patients), since previous studies[37] suggested that TBI patients could have more extensive and severe cognitive impairments than stroke patients.

Finally, percentile norms for Arabic individuals between the age of 18 and 60 years were provided for each sub-test.

Results

Information regarding the demographic characteristics of the patient and control groups is presented in Table 1. Table 2 presents the means and SDs of the Arabic Cognistat scores for younger control participants (18-39 years), older control participants (40-60), younger ABI patients (18-39), and older patients (41-60).

Insert Tables 1 and 2 around here

Relationship between demographic variables and performance in the test

When pooling all Arabic control participants, stepwise regressions were run to assess the effect of demographic predictors (years of education, age and gender as a dummy variable) on the Cognistat scores (total and subtests; see Table 3 for results). For the Cognistat total scores, it was found that years of education (β = 0.53, $p < 0.001$) and age (β = -0.13, p = 0.004), but not gender (β = -0.05, ns), were significant predictors, explaining 22.6% of the variance ($R^2 = 0.23$, F (1, 106) = 15.2, $p < 0.001$). Regressions on each subtest showed that age was a significant negative predictor for attention, construction, and calculation, but a positive predictor for judgement. Years of education were a significant predictor for orientation, calculation and similarity.

Insert Table 3 here

Score comparison of control participants and patients

Overall, pairwise t-tests indicated statistically significant differences between the patients and control group in the whole test (patients: 55.1; control group: 76.9; independent sample *t* (167) = 12.9, $p < 0.001$), as well as in all sub-tests (even when corrected for multiple comparisons). When broken down into age group, the mean scores of the young control group differed from the mean scores of the young patients (*t* (120) = 12.6, $p < 0.001$), as well as in each subtest. The comparison between the older control group and the older patients also revealed an overall statistical difference (*t* (45) = 4.50, $p < 0.001$) which was found in all sub-tests apart from attention and calculation. Table 2 displays the results per group and per sub-test.

Internal consistency

The Arabic Cognistat showed an acceptable internal consistency for the control group, with Cronbach's alphas of .78. As seen in Table 4, high internal consistency (> = .71) was reached for 8 out the 10 sub-tests. Borderline internal consistency was found for the memory sub-test (.67), whereas low internal consistency was found for the orientation sub-test (.24). This was due to the orientation-to-time item, where 15 participants out of 107 performed lower than in the other items of the orientation subtest.

Insert Table 4 around here

Test-retest reliability

A subgroup of 12 healthy participants (22-52 years) was tested twice over an interval of 7-10 days. Table 6 shows the test-retest reliability coefficients evaluated through intra-class correlation. ICC estimates were calculated using SPSS statistical package version 24 (SPSS Inc, Chicago, IL) based on a single measurement, absolute-agreement, 2-way mixed-effects model. These revealed a high stability of scores over time. Notably, the intra-class correlation coefficients (ICCC) for the orientation, attention and judgment sub-tests were 0.69 and above for the memory sub-test, construction and calculation. They could not be calculated for the language (comprehension, repetition and naming) and similarities sub-test because all participants obtained maximum scores in both test and retest.

Table 5

Concurrent validity

Pearson's r correlations were used to compare the global scores of the Cognistat to those of the MMSE, with the healthy control group scoring 28.5 out of 30 in the MMSE (SD

= 1.9) and the patients 21.2 (SD = 5.3). A significant correlation was found between MMSE and Cognistat scores for the control group (r = 0.543; p = 0.0001) as well as for the patients (r = 0.38, p = 0.003), showing excellent concurrent validity.

Further, patients' performances on the Cognistat sub-tests were compared to the corresponding items of the MMSE – as far as those could be compared, since the MMSE is not designed for the identification of specific domains of impairment (see Table 6). For control participants, a significant correlation was found for orientation (r = .75), attention (r = 0.41) and calculation (r = 0.48). Note that the attention and the calculation subtests of the Cognistat were compared to the same MMSE single item ('Attention and calculation'). Comprehension scores were at ceiling in both the Cognistat and the MMSE, leading to a perfect correlation. Repetition did not show any significant correlation, and correlation could not be calculated for naming scores since MMSE scores were at ceiling. Since the delay interval in recall is not comparable in the Cognistat and the MMSE, the correlation between the memory sub-test of the Cognistat and the MMSE memory item was not examined. In addition, the validity of the construction abilities, similarities and judgment subtests was not tested as these sub-tests are not evaluated in the MMSE.

For patients, significant correlations were found for orientation (r = .97), comprehension (r = 0.66), repetition (r = 0.62) and naming (r = 0.30). However, no significant correlation was found between the attention and calculation sub-tests of the Cognistat and the single corresponding item of the MMSE. Again, no correlation was conducted for the memory, constructional abilities, similarities and judgment subtests as these sub-tests are not evaluated in the MMSE.

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Insert Table 6 here

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Effect of country of origin and type of injury

No significant difference was found between the total Cognistat score of control Saudis (N = 85) and other Arabs (N = 22; t (105) = -1.20, ns), ensuring that the dialect of the experimenter (here, Saudi) did not prevent a reliable administration of the Cognistat for participants who speak a different variety of Arabic dialect. This analysis could not be performed with the patient group as they were 98% Saudis.

To compare the scores of stroke patients and TBI patients, an ANCOVA was conducted on the Cognistat total scores with type of injury as a between-participant factor (TBI, N = 32, versus stroke, N = 30), and age as a covariate (TBI patients were aged 24.8 years and stroke patients 51.4 years). Once corrected for age, TBI and stroke patients' Cognistat scores did not differ significantly (F (1, 61) < 1).

Percentile norms

Finally, percentile norms for Arabic individuals were calculated for each sub-test and each age group, based on the control participants' data (Table 7). These were calculated in SPSS (version 24) where the implemented method computes, for percentile p, the weighted average of X_i and X_{i+1}, where i is the integer part of (w+1)*p (w is the weighted case count).

Insert Table 7 around here

Discussion

The main aim of this study was to validate the Cognistat from English to Arabic to be used with the Arabic-speaking population with ABI, focussing on patients with stroke or TBI. All translations were made in standard Arabic, to be used widely across the Arabic speaking communities. Five sub-tests were modified in order to suit the Arabic population, namely repetition, naming, memory, similarities and judgment. These sub-tests were also modified while developing the Chinese version[24] and the Indian version[21] of the Cognistat.

Standardisation data were established for two age groups, following the same grouping as in the original English standardisation paper: younger adults aged 18-39 years and older adults aged 40-60 years[13]. Adults aged over 60 were not part of this study because accessing this particular population is problematic and challenging in the Arabic world as previously mentioned[12]. Indeed it is notoriously difficult to acquire diagnostic information concerning the Arabic elderly which would be required to test the accuracy of any assessment: Arabic families tend to take care of the elderly themselves[34], which causes difficulties to find patients tested and diagnosed by health care professionals[12]. In addition, it is common in the Arabic culture (particularly Saudi) for elderly not to have an accurate date of birth, as the majority of them were born in their homes, with no systematic registration of the date.

To compile normative data for the Arabic population, scores of the younger healthy group were initially compared to the scores of the younger patients group. As expected, significant differences were found between the healthy and patients group, in all sub-tests. Similarly, the Cognistat distinguished between the older patients group and the older healthy group in all tests, with the exception of two sub-tests, attention and calculation. The lack of significant difference between older patients and older healthy participants in the attention sub-test can be reasonably attributed to a natural age-related decline in attention skills, corroborated by our finding that overall, age negatively predicted attention scores. The lack of sensitivity of the calculation item to distinguish older patients and control participants may reflect a general lack of engagement of older participants in this type of task.

When age groups were collated for healthy controls and patients, it was found that the patient group performed lower than the control group, overall and for each sub-test. This demonstrates that the Arabic Cognistat has the ability to reliably distinguish patients from healthy controls. Based on these results, the Arabic Cognistat provides a better sensitivity than its Chinese adaptation[24] for which 4 subtests out of 10 did not reveal any significant differences between patients and controls. Our results are in agreement with previous research[16] showing that the English Cognistat can reliably detect cognitive deficits in patients with TBI. Our results are also comparable to the Indian adaptation[21] who found systematic significant differences between the Indian TBI patients and the control group.

Analyses on the effects of demographic variables on control participants' Cognistat scores revealed a moderate impact of age and years of education. Similar to previous data[39] reporting that both age and years of education have an impact on several Cognistat scores, we found that attention, construction and calculation were deteriorating with age, whereas judgement improved, possibly reflecting accumulated life experience. Years of education positively impacted orientation, calculation and similarities, as previously found[39]. It is therefore strongly recommended that age and education be taken into account when examining the patient's performance[39].

Results indicated that most of the sub-tests of the Arabic Cognistat showed high internal consistency, even higher that the Indian adaptation in seven sub-tests[21]. Exceptions were found for the memory sub-test which scored borderline. However, borderline internal consistencies are not necessarily problematic when using a sub-test[40]. More problematic is the low internal consistency for the orientation sub-test, which is however not surprising given the strong cultural differences between Arabic and Western cultures in terms of attitude towards time. Indeed it has been documented[41] how Arabic people tend to be casual about time and are not always accurate when it comes to appointments, whereas Americans (and probably other Westerner cultures) are likely to be very time conscious and accurate in regards to appointments. Accordingly, these cultural variations in time awareness could easily explain the lower scores in the time orientation item.

Our results showed an excellent correlation between the global scores of the Cognistat and the global scores of the MMSE, both for the control group and the patient group, confirming the good concurrent validity of the Arabic Cognistat. To further assess concurrent validity, patients' performances on the Cognistat sub-tests were compared to the similar items of the MMSE. While correlations between the Cognistat and the MMSE were found to be significant on most sub-tests, no correlation was found between performance on the mental balance item of the MMSE and the attention and calculation sub-tests of the Cognistat. The mental balance item of the MMSE requires the patient to perform 5 subtractions of 7 from 100 in order to examine attention and calculation. The Indian adaptation of the Cognistat[21] also reported a poor correlation between patients' performance on the mental balance item of the MMSE and calculation sub-test of the Indian Cognistat. They acknowledged that the mental balance item of the MMSE requires greater loading of working memory as compared to the calculation and attention sub-tests of the Cognistat. Thus, the poor correlation could be attributed to the two tests tapping onto different cognitive demands for similar domains.

Previous research[37] reported significant differences between TBI and stroke patients when assessed with the MMSE and the MoCA – TBI patients tended to have more extensive and severe cognitive impairments than those with stroke. This was not replicated in our results, as overall TBI patients did not score lower than stroke patients, once corrected for age differences. However, similar to this previous study[37] we found that orientation and similarities tended to be lower in TBI patients than stroke patients, suggesting that TBI and stroke seem to produce different profiles of cognitive impairments, in terms of specificity rather than severity. The most likely explanation for the similar scores of TBI and stroke patients is that we did not include a measure of the severity of TBI. Our sample may have contained a large proportion of patients with mild to moderate TBI, as compared to severe TBI, which attenuated any difference between TBI and stroke patients.

One limitation of this study is that the sampling was restricted to young (18-39) and older (40-60) adult group, which limits the generalisability of the normative Cognistat profile to these age ranges. Further studies including adults aged above 60 are recommended to increase the usefulness of the Cognistat for patients with ABI. Regarding the profile of ABI patients, other limitations are that information about the severity of brain injury was lacking, and that patients with severe aphasia and/or depression were excluded from the study. It would be useful to estimate how these conditions would modulate the profile of ABI patients tested with the Cognistat.

Conclusion

To conclude, the Arabic version of the Cognistat was found to be a valid and reliable cognitive screening tool. Our findings emphasise the importance of using a culturally-adapted version of the Cognistat in clinical practice to detect potential cognitive deficits among patients.

This study offers data that we hope will be beneficial to Saudi patients and, more generally, Arabic-speaking patients, given the high prevalence of long-lasting cognitive problems in those patients with ABI. Studies have indicated that about 135,000 persons in Saudi Arabia have disabilities that limit their independence, mostly caused by head injury[42]. It is hoped that the Arabic version of the Cognistat will allow a very precise evaluation of the cognitive deficits of ABI patients and open up the road to the assessment of other categories of cognitive impairments.

References

1 Cumming TB, Tyedin K, Churilov L, Morris ME, Bernhardt J. The effect of physical activity on cognitive function after stroke: A systematic review. Int Psychogeria 2012; 24:557–567.

2 Uysal-Bozkir O, Parlevliet JL, de Rooij SE. Insufficient cross-cultural adaptations and psychometric properties for many translated health assessment scales: A systematic review. J Clin Epid 2013; 66:608–18.

3 Siedlecki KL, Manly JJ, Brickman AM, Schupf N, Tang MX, Stern Y. Do neuropsychological tests have the same meaning in Spanish speakers as they do in English speakers? Neuropsy 2010; 24:402-11.

4 Folstein MF, Folstein SE, McHugh PR. Mini-mental state: a practical method for grading the cognitive state of patients for the clinician. J Psychi Res 1975; 12:189–198.

5 Abdel Rahman TT, El Gaafary MM. Montreal cognitive assessment Arabic version: Reliability and validity prevalence of mild cognitive impairment among elderly attending geriatric clubs in Cairo. Japan Geria Soc 2009; 9:4–61.

6 Nelson TO, Leonesio RJ, Landwehr RS, Narens L. A comparison of three predictors of an individual's memory performance: The individual's feeling of knowing versus the normative feeling of knowing versus base-rate item difficulty. J Exp Psy: Learn, Mem Cog 1986; 12:279-287.

7 Fountoulakis KN. Epidemiological dementia index: A screening instrument for Alzheimer's disease and other types of dementia suitable for use in populations with low education level. Dementia GeriaCog Dis 1998; 9:329-38.

8 Nys G, Van Zandvoort M, De Kort P, van der Worp H, Jansen B, Algra A, et al. The prognostic value of domain-specific cognitive abilities in acute first-ever stroke. Neurol 2015; 64:821–27.

9 Blake H, McKinney M, Treece K, Lee E, Lincoln NB. An evaluation of screening measures for cognitive impairment after stroke. Age Ageing 2002; 31:451-6.

10 Nasreddine ZS, Phillips NA, Bedirian V, Charbonneau S, Whitehead V, Collin I, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. Am Geria Soc 2005; 53:695–99.

11 Moss MB, Albert MS. Alzheimer's disease and other dementing disorders. In: Albert MS, Moss MB, editors. Geriatric neuropsychology. New York: Guilford Press; 1988.p. 145-178.

12 Wrobel NH, Farrag MF. Preliminary validation of an Arabic version of the MMSE in the elderly. Clin Geront 2008; 31:75-93.

13 Kiernan RJ, Mueller J, Langston JW, Van Dyke C. The Neurobehavioral Cognitive Status Examination: A brief but quantitative approach to cognitive assessment. Ann Internal Med 1987; 107:481-5.

14 Mueller J, Kiernan R, Langston WJ. Cognistat paper, Cognistat active form, Cognistat assessment system, Cognistat five manual. USA: Cognistat; 2014.

15 Nokleby K, Boland E, Bergersen H, Schanke AK, Farner L, Wagl J, et al. Screening for cognitive deficits after stroke: a comparison of three screening tools. Clin Rehab 2008; 22:1095–1104.

16 Nabors N, Millis S, Rosenthal M. Use of the Neurobehavioral Cognitive Status Examination (Cognistat) in traumatic brain injury. J Head Trauma Rehab 1997; 12:79–84.

17 Schwamm L, Van Dyke C, Kiernan RJ, Merrin EL, Mueller J. The Neurobehavioral Cognitive Status Examination: Comparison with the Cognitive Capacity Screening Examination and the Mini-Mental State Examination in a neurosurgical population. Ann of Internal Med 1987; 107:486–491.

18 Bea-Muñoz M, Medina-Sanchez M. Perceptive and cognitive difficulties in persons with brain stroke: A detection and compensation strategies. Rehabilitation-Madrid 2000; 34:468-82.

19 Matsuda O, Nakatani M. The manuals for the Japanese version of the Neurobehavioral Cognitive Status Examination. Tokyo: World Planning (in Japanese); 2004.

20 Murakami H, Fujita K, Futamura A, Sugimoto A, Kobayakawa M, Kezuka M, et al. The Montreal cognitive assessment and Neurobehavioral cognitive Status Examination are useful for screening mild cognitive impairment in Japanese patients with Parkinson’s disease. Neurol Clin Neurosci 2013; 1:103–8.

21 Gupta A, Kumar NK. Indian adaptation of the Cognistat: Psychometric properties of a cognitive screening tool for patients of traumatic brain injury. Indian J Neurotrauma 2009; 6:123-132.

22 Chan CC, Chan CCH, Yi Wu, Liu KPY, Xu Y. Differentiating cognitive functions of post stroke patients with specific brain lesions: A preliminary study on the clinical utility of Cognistat-P. App Neuropsy Adult 2016; 23:274-283.

23 Chan CCH, Lee TM, Wong V, et al. Validation of the Chinese version Neurobehavioral Cognitive Status Examination (NCSE). Arch Clin Neuropsy 1999; 14:71.

24 Chan CC, Lee TM, Fong KN, Wong V. Cognitive profile for Chinese patient with stroke. Brain Inj 2002; 16:873-84.

25 Johansson MM, Kvitting AS, Wressle E, Marcusson J. Clinical utility of Cognistat in multiprofessional team evaluations of patients with cognitive impairment in Swedish primary care. Int J Fam Med 2014; 2014:1-10.

26 Katz N, Elazar B, Itzkovich M. Cognitive Status Examination (COGNISTAT) in assessing patients post CVA and healthy elderly in Israel. Israeli J Occ Ther 1996; 5:E185-E198.

27 Roper BL, Bieliauskas LA, Peterson MR. Validity of the Mini-Mental State Examination and the Neurobehavioral Cognitive Status Examination in cognitive screening. Neuropsychi, Neuropsy Beh Neurol 1996; 9:54-7.

28 Sodring K, Laake K, Sveen U, Wyller T, Bautz-Holter E. Validation of the screening instrument for neuropsychological impairment in stroke. Physioth Res Int 1998; 3:15-26.

29 Shulman KI. Clock-drawing: Is it the ideal cognitive screening test? Int J Geria Psychi 2000; 15:548–61.

30 Beaton D, Bombardier C, Guillemin F, Ferraz MB. Recommendations for the cross-cultural adaptation of the DASH & quickDASH outcome measures. Ontario: CA: Institute for Work & Health 2002, 2007; 2007.

31 Van Heuven WJ, Mandera P, Keuleers E, Brysbaert M. SUBTLEX-UK: A new and improved word frequency database for British English. Quart J Exp Psy. 2014 Jun 3; 67(6):1176-90.

32 Boudelaa S, Marslen-Wilson WD. Aralex: A lexical database for Modern Standard Arabic. Beh Res Meth. 2010 May 1; 42(2):481-7.

33 Ayres JG, Harrison RM, Nichols GL, Maynard RL. Environmental Medicine. U.S: Taylor & Francis Group; 2010.

34 Balestreri M, Czosnyka M, Chatfield D, Stein L, Schmidt E, Smielewski P, et al. Predictive value of Glasgow coma scale after brain trauma: Change in trend over the past ten years. J Neurol Neurosurg Psychiatry 2004; 75:161–2.

35 Wilson JL, Pettigrew LE, Teasdale GM. Structured interviews for the Glasgow Outcome Scale and the extended Glasgow Outcome Scale: Guidelines for their use. J Neurotrauma. 1998 Aug; 15(8):573-85.

36 Rappaport M, Hall KM, Hopkins K, Belleza T, Cope DN. Disability rating scale for severe head trauma: Coma to community. Arch Physical Med Rehab 1982 Mar; 63(3):118-23.

37 Zhang H, Zhang X, Zhang H, Huang L, Chi Q, Zhang X, et al. Differences in cognitive profiles between traumatic brain injury and stroke: A comparison of the Montreal Cognitive Assessment and Mini-Mental State Examination. Chinese J Traumatology 2016; 19:271-4.

38 Salari S. Invisible in aging research: Arab Americans, Middle Eastern immigrants, and Muslims in the United States. Gerontologist 2002; 42:580-5.

39 Drane DL, Osato SS. Using the Neurobehavioral Cognitive Status Examination as a screening measure for older adults. Arch Clin Neuropsy 1997; 12:139-143.

40 Schmitt N. Uses and abuses of coefficient alpha. Psy Assessment 1996; 4:350-3.

41 Wunderle W. Through the lens of cultural awareness. Fort Leavenworth, KS: Combat Studies Institute Press; 2006.

42 Al-Jadid M. Disability trends in Saudi Arabia. Am J Physical Med Rehab 2014; 93:S47-9.

Table 1

Demographic characteristics of the control participants and ABI patients, per age group.

		Control		ABI patients	
		Younger	Older	Younger	Older
N		87	20	35	27
Age	Range	18-39	40-59	18-39	41-60
	mean (*SD*)	27.1 (*5.2*)	47.7 (*5.5*)	24.9 (*5.5*)	54.1 (*6.7*)
Gender	N males	36	10	27	18
	N females	51	10	8	9
Years in education	N years (*SD*)	14.9 (*2.8*)	13.2 (*5.1*)	13.0 (*2.7*)	9.7 (*5.1*)
	Range	7-20	6-17	8-20	0-17
Highest qualification	N school	26	10	22	21
	N undergraduate	50	6	12	6
	N MSc	7	0	0	0
	N PhD	4	4	1	0
Occupation	N student	41	4	12	0
	N stay at home	1	0	2	7
	N soldier	1	2	8	0
	N public sector	35	5	1	8
	N private sector	3	1	2	4
	N retired	0	1	0	8
	N unemployed	6	7	10	0
Nationality	N Saudi	68	17	35	26
	N other Arabs	19	3	0	1
Type of injury	N stroke			4	26
	N TBI			31	1

Table 2

Subtest score comparisons between control and patient groups, by age group

Sub-tests	Max	Young control (N=87) Mean *SD*	Young patients (N=35) Mean *SD*	*t*	Older control (N=20) Mean *SD*	Older patients (N=27) Mean *SD*	*t*	All control (N=107) Mean *SD*	All patients (N=62) Mean *SD*	*t*
Ori	12	11.8	9	8.8**	11.6	10.2	2.6*	11.8	9.5	8.6**
		0.4	*2.9*		*0.7*	*2.3*		*0.4*	*2.7*	
Att	8	7.7	5.8	5.9**	6.2	5.2	ns	7.4	5.5	6.4**
		0.8	*2.7*		*2.3*	*2.5*		*1.3*	*2.6*	
Comp	6	6	5.6	4.2**	6	5.4	2.6*	6	5.5	5.8**
		0	*0.9*		*0*	*1*		*0*	*0.9*	
Rep	12	11.9	8.9	6.1**	11.7	10.1	2.3*	11.8	9.4	6.4**
		0.2	*4.6*		*0.9*	*3*		*0.4*	*4*	
Nam	8	7.5	6.2	5.5**	7.7	6.5	2.7*	7.5	6.4	5.5**
		0.8	*1.8*		*0.7*	*1.9*		*0.8*	*1.8*	
Cons	6	5.2	2.1	9.9**	4.4	1.6	4.9**	5.1	1.9	11.9**
		1.2	*2.2*		*1.3*	*2.3*		*1.3*	*2.2*	
Mem	12	10.9	7.1	8.3**	10.5	6.7	4.1**	10.8	7	9.5**
		1.8	*3.2*		*1.9*	*3.8*		*1.8*	*3.4*	
Calc	4	3.3	1.8	7.1**	2.6	2	ns	3.1	1.9	6.1**
		1	*1.2*		*1.5*	*1.5*		*1.2*	*1.3*	
Sim	8	7.7	3.2	12.1**	7.1	4.2	2.2*	7.6	3.6	11.2**
		1	*3.1*		*1.6*	*5.6*		*1.2*	*3.4*	
Jud	6	5.5	3.4	7**	6	3.7	4.3**	5.5	3.5	7.8**
		1	*2.3*		*0*	*2.4*		*1*	*2.3*	
Tot	82	77.6	54.8	12.6**	74.1	55.4	4.5**	76.9	55.1	12.9**
		4.3	*15.5*		*6.7*	*17.7*		*5*	*16.3*	

** Significant at the 0.01 level (two-tailed)

* Significant at the 0.05 level (two-tailed)

For each subtest of the Arabic Cognistat, left hand side: mean scores and standard deviations of the younger control group and the younger patients, with t-tests (df = 120). Middle columns: comparison of the older control group and the older patient group (df = 45). Last columns: group comparison for all control participants and all patients (df = 165). ORI= Orientation, ATT= Attention, COMP= Comprehension, REP= Repetition, NAM= Naming, CONS= Construction, MEM= Memory, CALC= Calculation, SIM= Similarities, JUD = Judgment, TOT = Total score.

Table 3

Effect of Age and Years of education on the Cognistat total score and its subtests (stepwise regression results)

	Model			Age	Years of education
	R^2	*F*	p	β	β
Orientation	0.086	9.9	0.002		0.043**
Attention	0.17	21.4	<0.001	-0.058**	
Comprehension	Ns				
Repetition	Ns				
Naming	Ns				
Construction	0.13	15.7	<0.001	-0.049**	
Memory	Ns				
Calculation	0.19	11.9	<0.001	-0.036**	0.099**
Similarities	0.17	21.4	<0.001		0.14**
Judgment	0.072	8.13	0.005	0.026**	
Total score	0.23	15.2	<0.001	-0.13**	0.53**

** Significant at the 0.01 level (two-tailed). The effect of gender was not reported as it was never a significant predictor.

Table 4

Internal consistency for the control group

Sub-tests of Cognistat	Cronbach's alpha	No. of items
Orientation	0.24	8
Attention	0.95	8
Comprehension	1	6
Repetition	0.99	6
Naming	0.97	8
Construction	0.71	3
Memory	0.67	4
Calculation	0.85	4
Similarities	0.88	4
Judgment	0.9	3

Table 5

Test-retest reliability coefficients (for 12 control participants)

Sub-test		1st testing		2nd testing		Intra-class correlation
	Max	Mean	*SD*	Mean	*SD*	
Orientation	12	11.9	*0.2*	11.9	*0.3*	1
Attention	8	7.4	*1.2*	7.4	*1.2*	1
Comprehension	6	6	*0*	6	*0*	nc
Repetition	12	12	*0*	12	*0*	nc
Naming	8	8	*0*	8	*0*	nc
Construction	6	5.8	*0.5*	5.7	*0.8*	0.92
Memory	12	11.4	*1.3*	11.7	*0.8*	0.69
Calculation	4	3	*1.3*	3.2	*1.2*	0.74
Similarities	8	8	*0*	8	*0*	nc
Judgment	6	5.9	*0.3*	5.9	*0.3*	1
Total scores	82	80.1	*2.4*	79.4	*2.6*	0.91

nc = not calculated.

Table 6

Comparison of Cognistat profiles and MMSE scores for control participants and patients

	MMSE corresponding items					
	Control group			Patients		
Cognistat items	mean	*SD*	*r*	mean	*SD*	*r*
Orientation	9.8	*0.44*	0.75**	8.03	*2.3*	0.97**
Attention	3.9	*1.6*	0.41**	2.3	*2*	0.02
Comprehension	3	*0*	1**	2.8	*0.46*	0.66**
Repetition	0.98	*0.14*	-0.03	0.87	*0.34*	0.62**
Naming	2	*0*	N/A	1.98	*0.13*	0.30*
Construction	not assessed in the MMSE					
Memory	not comparable					
Calculation	3.9	*1.6*	0.48**	2.3	*2*	0.06
Similarities	not assessed in the MMSE					
Judgment	not assessed in the MMSE					

** Correlation is significant at the 0.01 level (two-tailed); * Correlation is significant at the 0.05 level (two-tailed).

Table 7

Percentile norms for younger and older Arabic adults on the Cognistat subtests

		ORI	ATT	COM	REP	NAM	CON	MEM	CAL	SIM	JUD	TOT
	Max	12	8	6	12	8	6	12	4	8	6	82
	Perc											
Younger adults (18-39 yrs)	**5**	11	6	6	11	5.4	2	7	1.4	4.8	3	68
	10	11	6.8	6	12	6	3.8	9	2	7.8	4	71.8
	25	12	8	6	12	8	4	11	3	8	6	75
	50	12	8	6	12	8	6	12	4	8	6	79
	75	12	8	6	12	8	6	12	4	8	6	81
	95	12	8	6	12	8	6	12	4	8	6	82
	99	12	8	6	12	8	6	12	4	8	6	82
Older adults (40-59 yrs)	**5**	9.1	0.15	6	8.15	5.1	2	7	0	2.1	6	57.4
	10	11	3.1	6	11.1	7	2	7	0	4.2	6	65.1
	25	11.25	4.25	6	12	8	4	9.25	1	8	6	69.25
	50	12	8	6	12	8	4.5	11.5	2.5	8	6	75.5
	75	12	8	6	12	8	6	12	4	8	6	80
	95	12	8	6	12	8	6	12	4	8	6	81
	99	12	8	6	12	8	6	12	4	8	6	82

Perc = percentile, ORI= Orientation, ATT= Attention, COM= Comprehension, REP= Repetition, NAM= Naming, CON= Construction, MEM= Memory, CAL= Calculation, SIM= Similarities, JUD = Judgment, TOT = Total.