



Mini Balance Evaluation Systems Test (Mini-BESTest): Cultural and Linguistic Adaptation in Russia

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Abstract

Introduction. In clinical practice, a comprehensive assessment of the systems responsible for balance is important both for correct diagnosis and the right choice of therapy. To provide accurate assessment of all the systems involved in balance control, in 2009, F.B. Horak et al. from the Oregon Health and Sciences University developed a universal Balance Evaluation Systems Test (BESTest) consisting of 36 tasks. Subsequently, the authors improved this method by selecting 14 tasks that evenly belonged to four of the six sections of the original BESTest, which collectively constituted the Mini-BESTest. The Mini-BESTest is a unique brief assessment tool that is actively used worldwide for the diagnostics and dynamic evaluation of balance in various nervous system disorders. However, the absence of a validated Russian version makes it challenging to use this test in Russia. The **objective** of the study is to develop an official Russian version (cultural and linguistic adaptation) of the Mini-BESTest to consider the target language and culture (1st stage of the linguistic validation study).

Materials and methods. The author of the test, F.B. Horak, granted her consent for the linguistic validation of Mini-BESTest in Russia. Forward and backward translations of the test and its materials, pilot testing (cognitive debriefing), and development of the Russian version were carried out with the participation of a linguistic philologist and neurologists specializing in working with patients with balance disorders in various neurological diseases.

Results. Based on the results of the expert committee meeting, a cultural and linguistic adaptation of the test was carried out and the final Russian version presented in this article was approved.

Conclusion. The first developed Russian version of Mini-BESTest is officially presented and recommended for use both in clinical and research practice in Russia and other Russian-speaking countries. The psychometric properties (reproducibility, inter-rater reliability, and sensitivity of the test) of the Russian version are currently being assessed.

Keywords: balance systems evaluation test; Mini-BESTest; linguistic validation; cultural and linguistic adaptation

Ethics approval. The research protocol was approved by the Ethics Committee of the V.I. Razumovsky Saratov State Medical University (Protocol No. 6, January 16, 2024).

Acknowledgments. The authors express their gratitude to the staff of the Institute of Neurorehabilitation and Restorative Technologies of the Research Center of Neurology for their assistance in data analysis.

Source of funding. This study was not supported by any external sources of funding.

Conflict of interest. The authors declare no apparent or potential conflicts of interest related to the publication of this article.

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For citation: Yusupova D.G., Salina E.V., Zaytsev A.B., Zimin A.A., Moskvina A.O., Kolokolov O.V., Polekhina N.V., Fedonnikov A.S., Suponeva N.A. Mini Balance Evaluation Systems Test (Mini-BESTest): cultural and linguistic adaptation in Russia. *Annals of Clinical and Experimental Neurology*. 2024;18(4)38–43.

DOI: <https://doi.org/10.17816/ACEN.1141>

Received 30.05.2024 / Accepted 24.06.2024 / Published 25.12.2024

Тест оценки равновесия (Mini Balance Evaluation Systems Test – Mini-BESTest): лингвокультурная адаптация в России

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Аннотация

Введение. В клинической практике всесторонняя оценка функционирования систем, обеспечивающих равновесие, важна не только для диагностики, но и для выбора тактики терапии. С целью точного определения функции всех систем, участвующих в поддержании равновесия, в 2009 г. F.B. Horak и соавт. из Орегонского университета медицины и естественных наук разработали универсальный тест оценки равновесия (Balance Evaluation Systems Test – BESTest), который включает 36 заданий. В последующем авторы усовершенствовали данный метод, отобрав 14 тестовых заданий, равномерно принадлежащих 4 из 6 разделов BESTest, которые получили в совокупности общее название Mini-BESTest. Этот уникальный краткий оценочный тест активно применяется во всём мире для диагностики и динамической оценки функции равновесия при различных заболеваниях нервной системы. Отсутствие валидированной русскоязычной версии данного теста затрудняет его применение в России.

Цель работы – разработка официальной русскоязычной версии (лингвокультурная адаптация) Mini-BESTest с учётом языковых и культурных особенностей (1-й этап валидационного исследования).

Материалы и методы. Получено согласие автора теста F.B. Horak на проведение валидации Mini-BESTest в России. Проведены прямой и обратный переводы теста и материалов к нему, пилотное тестирование, разработка русскоязычного варианта при участии филолога-лингвиста и неврологов, специализирующихся на работе с пациентами с нарушениями функции равновесия при различных неврологических заболеваниях.

Результаты. По результатам заседания экспертной комиссии была проведена лингвокультурная адаптация текста теста, утверждена финальная русскоязычная версия, которая представлена в данной статье.

Заключение. Русскоязычная версия Mini-BESTest впервые официально представлена и рекомендована к использованию как в клинической, так и в исследовательской практике в России и других русскоговорящих странах. Проводится оценка психометрических свойств (воспроизводимости, межэкспертной согласованности и чувствительности) русскоязычной версии теста.

Ключевые слова: тест оценки равновесия; Mini-BESTest; валидация; лингвокультурная адаптация

Этическое утверждение. Исследование одобрено Комитетом по этике Саратовского ГМУ им. В.И. Разумовского (протокол № 6 от 16.01.2024).

Благодарности. Авторы выражают благодарность сотрудникам Института нейрореабилитации и восстановительных технологий Научного центра неврологии за помощь в анализе данных.

Источник финансирования. Авторы заявляют об отсутствии внешних источников финансирования при проведении исследования.

Конфликт интересов. Авторы заявляют об отсутствии явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

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DOI: <https://doi.org/10.17816/ACEN.1141>

Поступила 31.05.2024 / Принята в печать 24.06.2024 / Опубликовано 25.12.2024

Introduction

Balance control is a fundamental complex function required for normal human activity. Coordinating vestibular, visual, oculomotor, and proprioceptive systems ensure control of muscle tone, several higher cortical functions, posture, complex motor activities, and gait on various levels of the nervous system, from receptors to a cortical representation [1]. Moreover, recent discoveries suggest that balance control is involved in cognitive processes, and that balance deficits may cause disorders associated with spatial memory, learning, and navigation [2, 3].

The primary symptoms of balance disorder include dizziness, unsteadiness and falls. 15–20% of the adult population annually experience sensation described as "dizziness" [4]; this same condition, occurring suddenly, accounts for 2.1–3.6% of emergency department visits [5]. Dizziness can occur in any patient, with middle and inner ear disorders being the most common causes in patients < 50 years, while in patients > 70 years a more comprehensive assessment of the factors causing unsteadiness and balance problems is required due to the high risk of falls and related complications [6–8]. The balance control is negatively affected by aging. Age-related changes in the body are multifaceted and encompass a decrease in deep and superficial sensation, vision disturbances (especially contrast detection and depth perception), vestibular and cochlear dysfunctions, a decrease in strength and tone across various muscle groups, and impaired regulatory mechanisms of the central nervous system (CNS), including slowing down of afferent processing and executive functioning. Severe impairment in any of the above systems may predispose the elderly patients to falls, with such risk increasing significantly with the number of functions affected [9]. Fall-related injuries are the sixth leading cause of mortality in the elderly people worldwide, with up to \$10 billion annual costs for the treatment of these injuries [10, 11].

Balance may be disturbed by a variety of somatic and neurological disorders affecting both central and peripheral nervous systems. Risk factors associated with balance disorders include female gender, low level of education, age over 40 years, cardiovascular diseases (CVDs), and anxiety and depression [12, 13]. Finding the true cause of these symptoms is often challenging due to the multi-component nature of the balance system. Patients may be confused when describing their sensations, using terms such as "dizziness", "unsteadiness", "discomfort", "rocking sensation" etc. and therefore a multidisciplinary approach to the management of these patients is required. Incorrect topical diagnosis or late detection of the cause underlying poor functional balance often leads to the gravely limited motor function and significantly reduced quality of life in these patients.

In clinical practice, a comprehensive assessment of the balance system functioning is of significant importance, not only from a diagnostic standpoint, but also for the selection

of an appropriate therapeutic intervention. Consequently, a multitude of specialized assessment tools, questionnaires, scales, and devices have been developed, which have now become integral components of international standards for the diagnosis of diseases. The current assessment techniques have significant drawbacks and are not universally applicable for the majority of disorders associated with vestibular dysfunction, dysbasia, and postural disorders. Most of them are published in English, which also complicates their use by Russian-speaking medical professionals, and a direct word-for-word translation of a scale or a test does not necessarily ensure consistent application within a single country. Therefore, linguistic validation and evaluation of the psychometric properties of the Russian versions of these assessment tools is a necessity.

Recently, new tools for comprehensive assessment of the balance systems have been developed with the potential for use in clinical practice. Mini-BESTest is one such tool that has already been recommended and adapted by numerous researchers of methods to detect balance deficits and postural disorders [14–17]. This test was developed by the Head of the Balance Disorders Laboratory at Oregon Health and Sciences University, Prof. Fay B. Horak et al. Their intention initially was to create a universal tool to assess the functioning of all the systems involved in maintaining balance and to identify the localization of the disorder causing balance impairment. Their work yielded in the BESTest (Balance Evaluation Systems Test). They conducted a study including 22 participants aged 50–88 years. The study sample included a control group with no signs of balance problems and participants with balance impairment caused by various factors (uni- and bilateral vestibulopathy, Parkinson's disease, peripheral neuropathy, hip arthroplasty). The study findings showed that patients with different diagnoses scored poorly on different sections of the BESTest. For example, patients with unilateral vestibular insufficiency had worse results in Section V (Sensory Orientation), while patients with Parkinson's disease had worse results in Section IV (Postural Responses) [18].

The authors reported that their methodology allowed clinicians to identify the specific mechanism underlying impaired balance, but they also admitted the need for further studies to improve the test. The Mini-BESTest has become such a modification. Initially, the BESTest consisted of 36 tasks, grouped into six sections evaluating different balance control systems and mechanisms. The authors selected 14 tasks belonging evenly to four of the six sections from the original BESTest using Rasch psychometric analysis. The new 14-item scale was referred to as the Mini-BESTest [19].

The Mini-BESTest study was conducted at a rehabilitation center where 115 patients (mean age 62.7 years) were recruited. The patients had various neurological diagnoses, including stroke-related hemiparesis, Parkinson's disease, neuromuscular disorders, hereditary ataxia, multiple sclerosis, nonspecific age-related balance system disorders, peripheral vestibular

disorders, traumatic brain injury, diffuse encephalopathy, cervical myelopathy, and CNS neoplasm. Inclusion criteria were the ability to walk with or without a cane and the absence of severe cognitive or communication impairments. The authors note that the novel Mini-BESTest offers a unique brief clinical rating scale for balance and can be used for assessment of severity for different neurological disorders. For example, in a study of 80 patients with Parkinson's disease, the sensitivity and specificity of the BESTest and Mini-BESTest were compared, and it was determined that both tests were suitable for balance assessment. However, with the Mini-BESTest, the difference in results between patients with and without history of falls was greater than with the BESTest (27% vs. 19%, respectively), suggesting that the Mini-BESTest had better sensitivity. The most significant benefit of the Mini-BESTest in clinical practice is that it takes half as much time compared to the BESTest.[20] The Mini-BESTest is widely used in various countries to assess the balance in a range of neurological disorders, both in neurological clinics and rehabilitation centers [21–25].

The **objective** of our study is to develop an official Russian version for cultural and linguistic adaptation of the Mini-BESTest to ensure its conceptual equivalence to the original source document (stage 1 of the linguistic validation) and to carry out cognitive debriefing of this translation.

Materials and methods

The developer of the original test, F.B. Horak, granted her written consent for adaptation of the Mini-BESTest. The first stage of linguistic adaptation was performed by specialists of the Center for Validation of International Scales and Questionnaires of the Research Center of Neurology. The cultural and linguistic adaptation was performed according to general requirements. Forward translation was done by two Russian-speaking medical translators and the backward translation – by native speakers with medical education. The Russian version was reviewed by an expert committee chaired by an expert translator who was not involved in the translation of the Mini-BESTest. The committee included medical translators and neurologists with more than 5 years of experience.

The cognitive debriefing was performed at the Research Center of Neurology and K.N. Tretyakov Department of Neurology in V.I. Razumovsky Saratov State Medical University at the stroke unit and at the neurology department. The study was approved by the local ethical committee of the V.I. Razumovsky Saratov State Medical University (protocol No. 6 of 16 January, 2024).

The inclusion criteria for the cognitive debriefing were the age of patients ≥ 18 years and a patient's informed consent. The recruited patients had central vestibular disorders and

were diagnosed with ischemic stroke, cerebral microangiopathy, Parkinson's disease, and multiple sclerosis. Important criteria included the ability to walk independently or with technical support (with a cane), without an assistant, and the absence of severe cognitive impairment according to the Mini Mental State Examination (MMSE).

Exclusion criteria were severe sensory impairment (major visual, hearing, and deep sensory impairment), decompensation of somatic diseases, class 3 obesity, and severe musculoskeletal disorders.

The cognitive debriefing included 18 patients (10 males and 8 females with neurological diseases: cerebral microangiopathy ($n = 5$), Parkinson's disease ($n = 4$), multiple sclerosis ($n = 3$), vertebrobasilar stroke ($n = 3$), and carotid artery-related stroke ($n = 3$). All patients were native Russian speakers, and the patients' diagnosis met the international criteria.

Results and discussion

The Mini-BESTest consists of 14 tasks developed to evaluate various mechanisms that are responsible for balance. The tasks are organized into four sections (domains) assessing various balance control systems. The first section includes three tasks for preliminary assessment of the balance. The second section consists of three items to assess postural responses. Three tasks of the third section assess the sensory orientation. The final section includes five tests that focus on stability in gait. The methodology of the Mini-BESTest requires additional equipment, including a vestibular cushion, a chair without armrests and wheels, a stopwatch, a platform with a slope, a box approximately 23 cm high, and adhesive tape for measuring and marking the distance on the floor. A patient has to follow instructions to perform each task and the patient's performance is scored from 0 to 2, with a maximum test score of 28. Based on the score, it is possible to determine whether the patient has a balance disorder and to identify the underlying mechanism.

The translation and development of the final Russian version of Mini-BESTest posed some challenges related to conceptual equivalence of the English and Russian versions. Since each task includes instructions, the Russian text should be clear for both physicians and patients. In the course of the work, several minor adjustments were made to the test instructions. The instructions for performing the tasks and interpretation of the obtained results in the Postural Responses section and the Sensory Orientation section were clarified. For instance, to make the instructions for the Compensatory Stepping Forward, Backward, and Lateral tasks more understandable, the phrasing "do whatever is necessary, including taking a step, to avoid a fall" was replaced by "take a step to avoid falling". In the instructions for the Stand on One Leg task, the phrasing "Lift your leg off of the ground behind you without touching or resting your raised leg upon your other standing leg" has been replaced by "You need to raise

one leg without touching the opposite leg". In the Sit to Stand task, the phrase "thrusting of the arms forward" was changed to "compensatory forward arm movement".

The cognitive debriefing was performed by neurologists independently. The interval between examinations by the two investigators was < 24 h. On average, the test took 20 min and the scoring took 5 min. Cognitive debriefing revealed no confusions in understanding the task instructions and further interpretation of the results. Based on the results of cognitive debriefing, the final Russian version was approved during the meeting of the expert committee.

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Conclusion

The 1st stage of the linguistic validation was completed, cultural and linguistic adaptation of the Mini-BESTest was performed, and a Russian version was developed with account to the target language and culture. The Mini-BESTest is an accessible and user-friendly universal tool for comprehensive assessment the balance and neurological localization. The Russian version of the questionnaire is available for download at the official website of the Research Center of Neurology, as well as using a QR code. The psychometric properties of the Russian version are currently being evaluated.

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Authors' contribution. *Yusupova D.G.* – concept and design development, organization and coordination of the study, editing and final approval of the manuscript; *Salina E.V.* – organization and coordination of the study, data collection and analysis, writing and final approval of the manuscript; *Zaitsev A.B.*, *Polekhina N.V.* – analysis of the data; *Zimin A.A.* – analysis of the data, editing the manuscript; *Moskvina A.O.* – analysis of the data, editing the manuscript; *Kolokolov O.V.* – coordination of the study, final approval of the manuscript; *Fedonnikov A.S.* – final approval of the manuscript; *Suponeva N.A.* – coordination of the study, final approval of the manuscript.

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