

ORIGINAL PAPER ΕΡΕΥΝΗΤΙΚΗ ΕΡΓΑΣΙΑ

Health Behavior Inventory-Short Form Translation and validation in Greek

OBJECTIVE To translate and validate the Health Behavior Inventory-Short Form (HBI-SF) in a sample of the general population in Greece. **METHOD** We used the forward-backward translation approach to adapt the HBI-SF for the Greek language. To assess reliability, we calculated Cronbach's alpha for internal consistency and performed a test-retest analysis to evaluate stability through the intraclass correlation coefficient (ICC). Construct validity was tested using confirmatory factor analysis (CFA), while concurrent validity was determined by examining correlations between HBI-SF scores and those from the Online Misinformation Susceptibility Scale (OMISS). **RESULTS** We found that the HBI-SF had very good reliability since ICC for the test-retest for the factor "diet" was 0.995, for the factor "proper use of health care resources" was 0.996, for the factor "anger and stress" was 0.998, and for the factor "substance use" was 0.977. Moreover, Cronbach's coefficient alpha for the four factors was greater than 0.70. CFA showed that the Greek version of the HBI-SF had a four-factor structure as the original version. Concurrent validity of the Greek version of the HBI-SF was satisfactory since we found positive correlations between the four factors of the HBI-SF and the OMISS. **CONCLUSIONS** The Greek version of the HBI-SF is a reliable and valid tool to measure health behaviors in the general population.

Health-related behaviors are widely recognized as fundamental determinants of both individual and population health outcomes. These behaviors –such as dietary patterns, physical activity, substance use, stress management, and adherence to medical advice– directly influence the risk of chronic diseases, mental health conditions, and overall quality of life. At the population level, the prevalence of unhealthy behaviors contributes to increased healthcare costs, reduced productivity, and greater burden on public health systems. Conversely, promoting positive health behaviors is associated with improved longevity, enhanced well-being, and sustainable health outcomes. Understanding and accurately measuring these behaviors is therefore critical for developing targeted interventions, informing

policy decisions, and advancing preventive healthcare strategies.^{1–3}

Health-related behaviors exert a profound influence on multiple dimensions of an individual's life, shaping physical health, psychological well-being, and overall quality of life. Behaviors such as maintaining a balanced diet, engaging in regular physical activity, and avoiding harmful practices like smoking and excessive alcohol consumption are strongly associated with reduced risk of chronic diseases, improved functional capacity, and increased longevity. Conversely, unhealthy behaviors contribute to higher morbidity and mortality rates, diminished life satisfaction, and increased healthcare utilization. Furthermore, health behaviors influ-

ARCHIVES OF HELLENIC MEDICINE 2026, 43(6):828–832
ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2026, 43(6):828–832

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Κλίμακα "Health Behavior
Inventory-Short Form":
Μετάφραση και στάθμιση
στην ελληνική γλώσσα

Περίληψη στο τέλος του άρθρου

Key words

Greek
Health Behavior Inventory-
Short Form
Health behaviors
Reliability
Validity

Submitted 29.9.2025
Accepted 12.10.2025

ence mental health outcomes, as inadequate stress management and poor lifestyle choices are linked to elevated levels of anxiety, depression, and psychological distress. Collectively, these findings underscore the critical role of health behaviors in promoting well-being and highlight the need for accurate measurement tools to inform preventive strategies and public health interventions.^{4–6}

Cultural adaptation is a critical component of instrument validation, as it ensures that the translated tool maintains both linguistic accuracy and conceptual equivalence within the target population. Mere translation may fail to capture cultural nuances, health beliefs, and behavioral norms that influence how individuals interpret and respond to items. By incorporating rigorous adaptation procedures, researchers can enhance measurement validity, reduce response bias, and enable meaningful cross-cultural comparisons. This process ultimately supports the development of evidence-based interventions that are culturally relevant and effective.^{7,8}

Cross-cultural adaptation of health behavior instruments is therefore essential to ensure conceptual equivalence and measurement accuracy. Translation alone is insufficient; rigorous validation procedures are required to confirm reliability and validity within the target population. Such efforts enable meaningful comparisons across cultures and support evidence-based health promotion initiatives tailored to local contexts. In this context, we translated and validated the HBI-SF⁹ in a sample of the general population in Greece.

MATERIAL AND METHOD

The study involved 136 participants from Greece, with data collected in September 2025. The HBI-SF was translated and culturally adapted into Greek using the forward-backward translation procedure.¹⁰ Specifically, two independent experts translated the original English version into Greek, after which two other scholars performed a back-translation into English. A fifth expert reviewed the entire process and resolved any inconsistencies to ensure both semantic and conceptual equivalence.

The HBI-SF was utilized to evaluate participants' health-related behaviors. This instrument comprises 12 items rated on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Six items are reverse scored to ensure that higher total scores consistently reflect greater health risk. The HBI-SF encompasses four dimensions: Diet (three items), appropriate utilization of health care resources (three items), anger and stress (three items), and substance use (three items). Factor scores are computed by summing item responses within each domain and dividing by the number of items, yielding a range from 1 to 7, with higher

values indicating increased engagement in health risk behaviors.⁹

Reliability of the HBI-SF was assessed through internal consistency and stability analyses. Internal consistency was evaluated using Cronbach's alpha, with values exceeding 0.60 considered indicative of acceptable reliability. Additionally, test-retest reliability was examined by calculating the intraclass correlation coefficient (ICC) using the absolute agreement method.

We examined the construct validity of the HBI-SF by performing confirmatory factor analysis (CFA).¹¹ We examined the concurrent validity of the HBI-SF using Online Misinformation Susceptibility Scale (OMISS).^{12,13} The OMISS comprises nine items and one factor. The OMISS is used to measure levels of online misinformation susceptibility in the general population. We expected a positive correlation between the HBI-SF and the OMISS.

Ethical considerations

We applied the guidelines of the Declaration of Helsinki to perform this study.¹⁴ Additionally, the study protocol was approved by the Ethics Committee of Faculty of Nursing at National and Kapodistrian University of Athens (reference approval #01, 14.9.2025).

Statistical analysis

We performed CFA to examine the construct validity of the HBI-SF. In particular, we calculated Chi-square/degree of freedom (χ^2/df); root mean square error of approximation (RMSEA); goodness of fit index (GFI); adjusted goodness of fit index (AGFI); Tucker-Lewis index (TLI); incremental fit index (IFI); normed fit index (NFI); comparative fit index (CFI).^{15,16} Acceptable value for χ^2/df is <5 , for RMSEA is <0.10 , and for all other measures in the CFA >0.90 . We used the AMOS version 21 (Amos Development Corp, 2018) to conduct the CFA.

We calculated Pearson's correlation coefficient between the HBI-SF and the OMISS to examine the concurrent validity of the HBI-SF. Also, we calculated ICCs between the two HBI-SF measurements in a test-retest study.

P-values less than 0.05 were considered as statistically significant. We used the Statistical Package for Social Sciences (SPSS), version 28.0 (IBM Corp released 2021; IBM SPSS Statistics for Windows, IBM Corp, Armonk, NY) for the analysis.

RESULTS

The study population comprised 136 participants from the general population. Among them, 73.5% ($n=100$) were female and 26.5% ($n=36$) were male. The mean age of our sample was 48.7 years (standard deviation [SD]=9.5) with a median of 50 years (interquartile range [IQR]=9.8).

We found that the HBI-SF had a very good reliability since ICC for the test-retest for the factor "diet" was 0.995

(95% confidence interval [CI]: 0.990 to 0.997, $p < 0.001$), and for the factor “proper use of health care resources” was 0.996 (95% CI: 0.993 to 0.998, $p < 0.001$). Additionally, the ICC for the test-retest for the factor “anger and stress” was 0.998 (95% CI: 0.997 to 0.997, $p < 0.001$), and for the factor “substance use” was 0.977 (95% CI: 0.958 to 0.987, $p < 0.001$). Moreover, Cronbach’s coefficient alpha for the four factors was greater than 0.70.

We found that the Greek version of the HBI-SF had a four-factor structure as the original version (fig. 1). All indices indicated an acceptable four-factor model (tab. 1). In particular, RMSEA was < 0.001 , GFI was 1.000, IFI was 1.000, NFI was 0.847, and CFI was 1.000 (tab. 1).

Concurrent validity of the Greek version of the HBI-SF was satisfactory since we found positive correlations between the four factors of the HBI-SF and the OMISS (factor

“diet”: $r = 0.139$, $p\text{-value} = 0.107$, factor “proper use of health care resources”: $r = 0.020$, $p\text{-value} = 0.813$, factor “anger and stress”: $r = 0.136$, $p\text{-value} = 0.115$, factor “substance use”: $r = 0.062$, $p\text{-value} = 0.473$).

DISCUSSION

The HBI-SF was translated and validated for use in the Greek context to provide researchers and healthcare professionals with a reliable instrument for assessing health behaviors in the general population. Findings indicated that the Greek adaptation of the HBI-SF exhibits satisfactory psychometric properties, confirming its validity and reliability as a measure of health-related behaviors. Moreover, the results support a four-factor structure for evaluating health behaviors among the general population.

The Greek version of the HBI-SF demonstrated very good reliability, with ICCs higher than 0.977 for the test-retest analysis and Cronbach’s alpha higher than 0.70 for the four factors. CFA supported a four-factor structure consistent with the original scale, and all fit indices confirmed an excellent model: RMSEA < 0.001 , GFI=1.000, IFI=1.000, NFI=0.874, and CFI=1.000. Concurrent validity was also robust, as evidenced by positive correlations between the four factors of the HBI-SF and the OMISS.

This study was subject to certain limitations. First, the validation of the Greek version of the HBI-SF was based on a convenience sample drawn from the general population, which may limit the generalizability of the findings. Future research should seek to replicate these results using more diverse and representative samples across different regions of Greece. Second, concurrent validity was assessed using self-reported measures, including the OMSS, which may introduce response bias. Further studies are recommended to explore additional forms of validity, such as predictive and criterion validity, to strengthen the evidence base for this instrument.

The present study successfully translated and validated the HBI-SF for use in the Greek context, providing a psychometrically sound instrument for assessing health-related behaviors within the general population. The Greek version

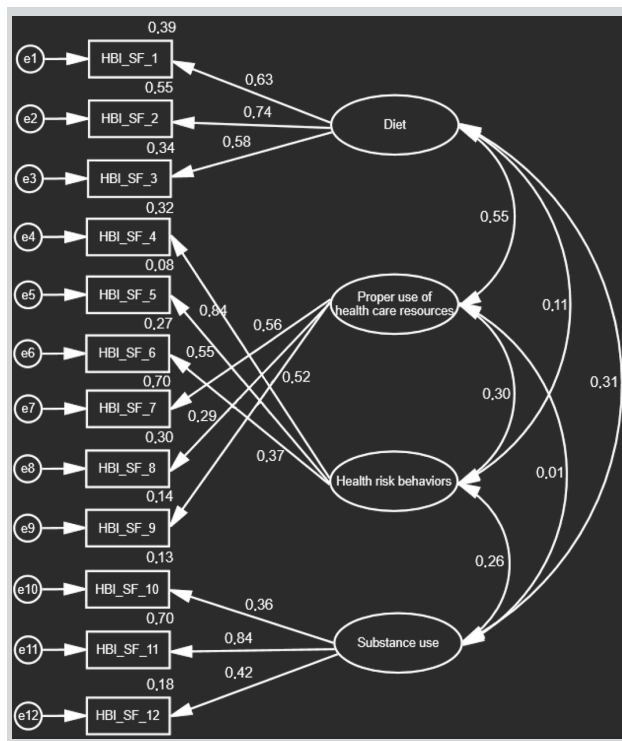


Figure 1. Confirmatory factor analysis for the Greek version of the Health Behavior Inventory-Short Form (HBI-SF).

Table 1. Confirmatory factor analysis for the Greek version of the Health Behavior Inventory-Short Form.

Model	χ^2	df	χ^2/df	RMSEA	GFI	AGFI	TLI	IFI	NFI	CFI
12 items	42.378	43	0.986	<0.001	0.954	0.916	NC	1.000	0.847	1.000

Df: Degree of freedom, χ^2/df : Chi-square/degree of freedom, RMSEA: Root Mean Square Error of Approximation, GFI: Goodness of Fit Index, AGFI: Adjusted Goodness of Fit Index, TLI: Tucker-Lewis Index, IFI: Incremental Fit Index, NFI: Normed Fit Index, CFI: Comparative Fit Index

demonstrated strong reliability and validity, supporting its utility as a robust measure for research and practice. Importantly, the CFA reinforced the original four-factor structure—diet, appropriate use of health care resources, anger and stress, and substance use—underscoring the conceptual integrity of the instrument across cultural settings.

By introducing a culturally adapted tool, this study contributes to the systematic monitoring of health behaviors and attitudes, enabling researchers and practitioners to evaluate the effectiveness of health education programs and intervention strategies. Furthermore, the availability of a validated Greek version facilitates cross-cultural comparisons with studies employing the original HBI-SF or

other standardized instruments, thereby advancing global health behavior research.

From a practical perspective, the findings offer policy-makers and healthcare leaders an evidence-based resource for designing targeted health promotion initiatives that reflect local cultural and behavioral patterns. Future research should aim to replicate these findings in more diverse and representative samples, explore additional forms of validity such as predictive and criterion validity, and examine the instrument's applicability in clinical and high-risk populations. Such efforts will further strengthen the role of the HBI-SF as a valuable tool for informing public health strategies and improving population health outcomes.

ΠΕΡΙΛΗΨΗ

Κλίμακα “Health Behavior Inventory-Short Form”: Μετάφραση και στάθμιση στην ελληνική γλώσσα

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Αρχεία Ελληνικής Ιατρικής 2026, 43(6):828–832

ΣΚΟΠΟΣ Η μετάφραση και η στάθμιση της κλίμακας Health Behavior Inventory-Short Form (HBI-SF) στα Ελληνικά. **ΥΛΙΚΟ-ΜΕΘΟΔΟΣ** Για τη μετάφραση της κλίμακας στα Ελληνικά εφαρμόστηκε η διαδικασία της «προς τα εμπρός-προς τα πίσω μετάφρασης». Για την αξιολόγηση της αξιοπιστίας, υπολογίσαμε τον συντελεστή Cronbach για την εσωτερική συνοχή και διενεργήσαμε μια μελέτη ελέγχου-επανελέγχου για τον υπολογισμό του συντελεστή ενδοταξικής συσχέτισης. Η εγκυρότητα κατασκευής ελέγχθηκε χρησιμοποιώντας επιβεβαιωτική ανάλυση παραγόντων, ενώ η συγκλίνουσα εγκυρότητα προσδιορίστηκε εξετάζοντας τις συσχετίσεις μεταξύ των βαθμολογιών στην HBI-SF και εκείνων στην κλίμακα Online Misinformation Susceptibility Scale (OMISS). **ΑΠΟΤΕΛΕΣΜΑΤΑ** Διαπιστώθηκε ότι η HBI-SF έχει πολύ καλή αξιοπιστία, καθώς ο συντελεστής ενδοταξικής συσχέτισης στη μελέτη ελέγχου-επανελέγχου ήταν 0,995 για τον παράγοντα «διαίτα», 0,996 για τον παράγοντα «ορθή χρήση των διαθέσιμων επιλογών για τη φροντίδα υγείας», 0,998 για τον παράγοντα «θυμός και άγχος» και 0,977 για τον παράγοντα «χρήση ουσιών». Επί πλέον, ο συντελεστής Cronbach's alpha για τους τέσσερις παράγοντες ήταν μεγαλύτερος από 0,70. Η επιβεβαιωτική ανάλυση παραγόντων έδειξε ότι η ελληνική έκδοση της HBI-SF είχε τέσσερις παράγοντες, όπως ακριβώς και η πρωτότυπη έκδοση της κλίμακας. Η συγκλίνουσα εγκυρότητα της HBI-SF ήταν ικανοποιητική, καθώς βρέθηκε θετική συσχέτιση μεταξύ της HBI-SF και της OMISS. **ΣΥΜΠΕΡΑΣΜΑΤΑ** Η ελληνική έκδοση της κλίμακας HBI-SF είναι ένα αξιόπιστο και έγκυρο εργαλείο για την εκτίμηση των συμπεριφορών υγείας του γενικού πληθυσμού.

Λέξεις ευρετηρίου: Αξιοπιστία, Εγκυρότητα, Ελληνικά, Συμπεριφορές υγείας, Health Behavior Inventory-Short Form

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