

C ONFIRMATORY FACTOR ANALYSIS OF THE 8RNEVS SCALE IN A SAMPLE OF MEXICAN UNIVERSITY STUDENTS

¹Francisco Nilson Gonçalves Balbé, ²Omar Arodi Flores Laguna, ³Jose Leonardo Jimenez Ortiz & ⁴Emerald Branson Francis

ABSTRACT

Objective: To perform a confirmatory validity test of the 8 Natural Remedies for a Healthy Lifestyle (8RNEVS) scale and verify the model's goodness-of-fit indices in students from a denominational university.

Method: A quantitative methodological study with a cross-sectional design aimed at investigating the psychometric properties of the 8RNEVS scale by using confirmatory factor analysis (CFA), convergent, and discriminant validities in a sample of 350 students from a university in Northern Mexico was realized. The study was evaluated and endorsed by the Research Committee of the participating institution.

Results: The confirmatory validity test of the 8RNEVS scale showed satisfactory goodness-of-fit indices ($X^2/df = 1.593$; RMSEA = 0.046; GFI = 0.916; IFI = 0.955; TLI = 0.944; CFI = 0.954). The composite reliability, assessed through the omega coefficient, was higher than 0.70 in all dimensions. In addition, the scale demonstrated convergent validity ($AVE \geq 0.500$), and the square root of the AVE exceeded the correlations between latent variables, evidencing the presence of discriminant validity.

Conclusion: The 8RNEVS scale presents confirmatory validity, convergent and discriminant validities in its dimensions, and high composite reliability. This suggests that it is a reliable and valid tool to inquire about using these eight natural remedies to maintain a healthy lifestyle.

Keywords: Healthy Lifestyle. Statistical Factor Analysis. Validation Study. Behavioral Medicine.

Received: 22/09/2024

Approved: 10/12/2024

DOI: <https://doi.org/10.19141/2237-3756.lifestyle.v11.n00.pe1878>

¹ Instituto Federal do Tocantins (IFTO), Campus Palmas, Tocantins, (Brasil). E-mail: balbe@ifto.edu.br
Orcid id: <https://orcid.org/0000-0001-8043-9993>

² Universidad de Morelos, Toluca, (México). E-mail: oflores@um.edu.mx Orcid id: <https://orcid.org/0000-0001-8765-0310>

³ Universidad de Morelos, Toluca, (México). E-mail: jimenezortiz@um.edu.mx Orcid id: <https://orcid.org/0000-0002-3809-8117>

⁴ Universidad de Morelos, Toluca, (México). E-mail: investigacionmsp@um.edu.mx Orcid id: <https://orcid.org/0000-0002-9638-8630>

A NÁLISE FATORIAL CONFIRMATÓRIA DA ESCALA 8RNEVS EM UMA AMOSTRA DE ESTUDANTES UNIVERSITÁRIOS MEXICANOS

RESUMO

Objetivo: Realizar a validade confirmatória da escala 8 Remédios Naturais para um Estilo de Vida Saudável (8RNEVS), verificando os índices de adequação do modelo em um grupo de estudantes de uma universidade confessional.

Método: Este é um estudo metodológico quantitativo, com um desenho transversal, destinado a investigar as propriedades psicométricas da escala 8RNEVS por meio de análise fatorial confirmatória (CFA), validade convergente e discriminante, em uma amostra de 350 alunos de uma universidade no norte do México. O estudo foi avaliado e aprovado pelo Comitê de Pesquisa da instituição participante.

Resultados: A validade confirmatória da escala 8 da RNEVS mostrou índices satisfatórios de adequação ($X^2/gf = 1,593$; RMSEA = 0,046; GFI = 0,916; IFI = 0,955; TLI = 0,944; CFI = 0,954). A confiabilidade composta, conforme avaliada pelo coeficiente ômega, ficou acima de 0,70 em todas as dimensões. Além disso, a escala demonstrou validade convergente ($AVE \geq 0,500$), e a raiz quadrada da AVE excedeu as correlações entre as variáveis latentes, evidenciando a presença de validade discriminante.

Conclusão: A escala 8RNEVS apresenta validade confirmatória, validade convergente e discriminante em suas dimensões, juntamente com alta confiabilidade composta, sugerindo que é uma ferramenta confiável e válida para indagar sobre a prática de oito remédios naturais para manter um estilo de vida saudável.

Palavras-chave: Estilo de Vida Saudável. Análise Fatorial. Estudo de Validação. Medicina do Comportamento

INTRODUCTION

The recent increase in the global burden of lifestyle-related diseases has caused public health authorities such as the World Health Organization (WHO) (1999) to highlight the importance of promoting healthy habits as a key strategy to prevent diseases. Non-communicable diseases (NCDs), such as type 2 diabetes, high blood pressure, different types of cancer, and cardiovascular diseases, cause the death of more than 41 million people each year (WORLD HEALTH ORGANIZATION, 2020).

The Seventh-day Adventists (SDA), a conservative religious group recognized for promoting among its members the incorporation of healthy practices and the abstention from harmful habits (SEVENTH-DAY ADVENTIST CHURCH, 2023), has adopted as a way of life

integrating the "eight natural remedies" (clean air, sunlight, abstinence, rest, exercise, adequate nutrition, use of water and trust in divine power) as pillars of a healthy lifestyle that promotes longevity, disease prevention and health recovery (WHITE, 1905), which has been evidenced in various studies conducted in SDA populations who practice these principles in their lives (CONNERTON; THEURI, 2023; CRAIG et al., 2018; GASHUGI; MASHCHAK; FRASER, 2023; HU, 2024; MAJDA et al., 2022; MILES et al., 2022; SANCHEZ et al., 2019), by reducing common risk factors for NCDs identified by the WHO such as smoking, poor diet, physical inactivity and alcohol consumption (ORGANIZACIÓN PANAMERICANA DE LA SALUD, 2016).

Even though more than 21.9 million members of the SDA Church in the world (HOSOKAWA, 2023) share this philosophy of life, few studies in Latin America analyze these practices. Until recently, there was no specific instrument to evaluate the adherence to the eight natural remedies in a Mexican population. For this reason, construct validity was designed and determined for the reliability of the 8 Natural Remedies for a Healthy Lifestyle Scale (8 RNEVS) in students from a Mexican SDA university (GONÇALVES-BALBÉ; FLORES-LAGUNA; JIMÉNEZ-ORTIZ, 2024).

An Exploratory Factor Analysis (EFA) found the underlying structure of the factors comprising the 8 RNEVS scale in a previous study. Hence, the objective of this study was to carry out the confirmatory validity of the 8 Natural Remedies for a Healthy Lifestyle Scale (8 RNEVS), verifying the goodness-of-fit indices of the model in a group of students from a denominational university.

METHODS

A quantitative methodological approach was used, with a cross-sectional design, to investigate the psychometric properties of the 8RNEVS scale through confirmatory factor analysis (CFA) in a group of university students from northern Mexico. The study was carried out following the Declaration of Helsinki and the General Health Law in force regarding health research in Mexico. It was evaluated and endorsed by the Institutional Research Committee, registered with the Federal Commission for the Protection against Health Risks, granting the reference number 2023-038-CI220 for its execution.

The study sample consisted of 350 undergraduate students (mean age = 21.5 years, SD = 2.3) who completed the selected instrument in person in September 2023. A non-random convenience sampling method was used, including participants of both sexes, and the sample

represented 15.90% of the university's total student population. Of the participants, 183 (52.29%) were men and 167 (47.71%) were women. Participants were recruited through a voluntary convenience sampling approach, inviting students from various faculties across the university. Inclusion criteria required participants to be enrolled in one of the eight undergraduate faculties during the 2022-2023 academic year, to be of legal age, and to provide informed consent. Students who were irregular in their academic status at the time of the instrument's administration were excluded from the study. The sample size was calculated based on a participant-to-item ratio of 12.50, in accordance with the guideline that recommends at least 10 participants per item (JEBB; NG; TAY, 2021).

The instrument used was the 8RNEVS scale, composed of 28 items distributed in eight dimensions: clean air and sunlight, abstinence, rest, exercise, adequate diet, inadequate diet, water, and trust in the power of God. A pilot test was carried out to explore the underlying structure through an exploratory factor analysis using the principal axes extraction method with promax oblique rotation. The scale's reliability was evaluated through the Omega coefficient, showing acceptable values for each dimension (GONÇALVES-BALBÉ; FLORES-LAGUNA; JIMÉNEZ-ORTIZ, 2024).

For this study, the database preparation and the descriptive analysis were carried out using the statistical software IBM SPSS version 27. For the confirmatory factor analysis (CFA), the AMOS software version 24 was used, applying the maximum likelihood method due to the asymmetry and univariate kurtosis of each item being between -1 and 1. In addition, the Mardia coefficient was calculated, which must be less than 5 (KLINE; LITTLE, 2023). To evaluate the goodness of fit of the confirmatory model, the following statistical criteria: the chi-square ratio (χ^2/df) was less than 3, the Root Mean Square Error of Approximation (RMSEA) was less than 0.08, the Goodness of Fit Index (GFI) was equal to or greater than 0.90, the Tucker-Lewis Index (TLI) was equal to or greater than 0.90, and the Comparative Fit Index (CFI) was equal to or greater than 0.90 (RUIZ; PARDO; SAN MARTÍN, 2010).

To confirm the convergent validity or the relationship between the instrument's dimensions and the construct, the average variance extracted (AVE) was used. An appropriate value of greater than 0.500 (FORNELL; LARCKER, 1981) was shown. The square root of the AVE was used as an indicator for the discriminant validity evaluation. The value found for AVE must be greater than the correlations between the instrument's latent variables (dimensions).

To check the overall reliability of the instrument, a composite reliability (McDonald's ω coefficient) was used with reference values ranging between 0.70 and 0.90 (OVIEDO;

CAMPO-ARIAS, 2005). McDonald's ω faithfully exposed the level of reliability and was independent of the number of elements (MCDONALD, 2013).

An exploratory factor analysis (EFA) was carried out in a previous study to identify the underlying structure of the factors that comprise the 8RNEVS scale. To this end, a pilot test was carried out in which the principal axes extraction method was applied, complemented with a promax oblique rotation. The scale's reliability was evaluated using the Omega coefficient, which showed satisfactory levels in each dimension.

In the present study, the items corresponding to the temperance dimension (TEM1 and TEM2) were excluded from the analysis due to significant bias in the responses. This is attributable to the fact that the students surveyed practice temperance promoted by the university. Both items demonstrated preferences for option 5, with 85.5% and 89.5%, respectively. This lack of variability in responses indicates a bias that could compromise the validity and reliability of the statistical analysis, justifying the exclusion of these items from the study.

RESULTS

Table 1 shows descriptive statistics of different dimensions related to healthy lifestyles. These dimensions include "Proper Diet (PD)," "Trust in God's Power (TG)," "Exercise (EX)," "Rest (RES)," "Sunlight and Fresh Air (SLFA)," "Water (WA)," and "Improper Diet (IPD)." For each dimension and its respective items, the mean, standard deviation, skewness, and kurtosis are shown, offering information about the distribution of the responses.

The means of the dimensions vary, with "Trust in God's Power (TG)" and "Water (WA)" showing the highest means (4.081 and 4.198, respectively), suggesting a tendency to value these aspects positively among the participants. "Rest (RES)" has a lower mean (3.097), which may indicate that this dimension is perceived less favorably or that the behaviors associated with this dimension are not practiced consistently.

The standard deviations reflect the variability in participants' responses. Dimensions such as "Rest (RES)" and its items present greater variability (SD close to 1), suggesting significant differences between the participants' responses on these items. Most dimensions have negative asymmetric values, indicating selections at the positive end of the scale. For example, "Trust in God's Power (TG)" showed a skewness value of -0.980, suggesting a trend toward higher responses on that dimension. The kurtosis of the dimensions is generally

negative, indicating dispersion around the mean without long tails. "Rest (RES)" has a kurtosis of -0.388, indicating a flatter distribution of responses compared to a normal distribution.

For a confirmatory validity (CFA) of the 8RNEVS scale, the maximum likelihood method was used, given that the Mardia coefficient was 4.80, a value less than 5, indicating the presence of multivariate normality in the distribution. From the data, several indices were used to evaluate the model's goodness of fit, all providing adequate results. In particular, the GFI (Goodness of Fit Index), IFI (Incremental Fit Index), TLI (Tucker-Lewis Index), and CFI (Comparative Fit Index) indices presented values greater than 0.9, suggesting a good fit of the model. Furthermore, the normed chi-square (χ^2/df) was less than 3, and the RMSEA (Root Mean Square Error of Approximation) was less than 0.05, thus confirming the suitability of the proposed model (See Figure 1).

Table 2 presents the composite reliability (CR) values, which must exceed the threshold of 0.7 to consider the instrument reliable. All reported values are above this limit, indicating the high reliability of the instrument. Additionally, the average variance extracted (AVE) is shown and used to evaluate the convergent validity of the instrument. The reference value for the AVE is equal to or greater than 0.5. Although most dimensions meet this criterion, the proper diet (PD) shows a slightly lower value close to the threshold of 0.5. Hence, the instrument is considered to have convergent validity. Likewise, discriminant validity was calculated by obtaining the square root of the AVE. A value greater than the correlations between the latent variables (dimensions) confirms discriminant validity. In every case, the square root of the AVE exceeded the correlations between the dimensions, concluding the instrument's discriminant validity.

DISCUSSION

The goal was to conduct a confirmatory validity analysis of the 8 Natural Remedies for a Healthy Lifestyle Scale (8RNEVS). The results obtained indicate that the 8RNEVS scale is a psychometrically valid and reliable instrument to evaluate the practice of these natural remedies in a sample of university students in Mexico. The goodness-of-fit indices (CFI = 0.954, TLI = 0.944, RMSEA = 0.046) suggest an adequate fit of the proposed theoretical model, consistent with previous healthy lifestyles research (CONNERTON; THEURI, 2023; GASHUGI; MASHCHAK; FRASER, 2023). Furthermore, the composite reliability, calculated using the Omega coefficient, showed values greater than 0.70 in all dimensions, supporting the internal consistency of the instrument (VENTURA-LEÓN; CAYCHO-RODRÍGUEZ, 2017).

Likewise, convergent and discriminant validity were confirmed, demonstrating that the average variance extracted values (AVE) in all dimensions were equal to or greater than 0.50. Furthermore, the square root of the AVE exceeded the correlations between the dimensions, supporting the instrument's adequate discriminant validity. This shows that each dimension effectively and distinctly measures the intended theoretical construct.

Of the eight natural remedies, the dimension "Trust in God's Power (TG)" obtained the highest scores, which aligned with the relevance of this dimension in a denominational university context (CRAIG et al., 2018; RÍOS ROSADO et al., 2023). The "Rest (RES)" dimension presented the lowest mean, suggesting that it may be undervalued or under-practiced by students. This could be relevant for future research since previous studies have highlighted the importance of adequate rest in promoting a healthy lifestyle (GONZÁLEZ CADENAS et al., 2024; GONZÁLEZ GONZÁLEZ et al., 2024; HU, 2024; RÍOS ROSADO et al., 2023).

It is important to note that, despite the positive results, the study has certain limitations. The exclusion of the items corresponding to the "Temperance" dimension due to biases in the responses suggests the influence of the cultural and religious context on students' practices. This highlights the need to adapt the scale to different cultural contexts in future studies to evaluate the consistency of response patterns in various populations.

Therefore, the validity of the 8RNEVS scale provides a valuable tool for researchers and health professionals seeking to promote healthy lifestyles based on natural remedies. The instrument's ability to measure various dimensions of a healthy lifestyle makes it a useful resource for health promotion programs in educational institutions, especially those with a denominational focus. Future research could focus on validating this scale in other contexts and populations and exploring interventions that promote health and well-being using its results.

CONCLUSION

The 8RNEVS scale presents adequate psychometric properties, including confirmatory, convergent, and discriminant validity in its dimensions. These results indicate that the scale accurately evaluates the proposed theoretical constructs and exhibits high composite reliability. It can be concluded that the 8RNEVS is a reliable and valid tool for investigating the eight natural remedies for a healthy lifestyle.

REFERENCES

CONNERTON, C.; THEURI, S. NEWSTART: An 8-Week Faith-Based Health Promotion Program to Reduce Chronic Disease Risk Factors in the US. **Journal of Religion and Health**, v. 62, n. 5, p. 3175–3187, 2023.

CRAIG, B. et al. Religious Affiliation Influences on the Health Status and Behaviours of Students Attending Seventh-Day Adventist Schools in Australia. **Journal of Religion and Health**, v. 57, n. 3, p. 994–1009, 2018.

FORNELL, C.; LARCKER, D. F. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. **Journal of Marketing Research**, v. 18, n. 1, p. 39–50, fev. 1981.

GASHUGI, L.; MASHCHAK, A.; FRASER, G. Lifestyle-related behavior and self-reported health status among Seventh-day Adventists. **Americal Journal of Lifestyle Medicine**, v. 17, n. 1, p. 1–13, 2023.

GONÇALVES-BALBÉ, F.; FLORES-LAGUNA, O.; JIMÉNEZ-ORTIZ, J. Diseño y validación de un instrumento de Estilo de Vida Saludable en una universidad confesional. **Revista Brasileira de Saúde Funcional**, v. 12, n. 2, p. 317–328, 2024.

GONZÁLEZ CADENAS, G. et al. Calidad de vida en estudiantes de una universidad mexicana. **Unaciencia Revista de Estudios e Investigaciones**, v. 16, n. 31, p. 106–117, 31 jan. 2024.

GONZÁLEZ GONZÁLEZ, D. Y. et al. Capacidad de autocuidado en estudiantes universitarios: estudio longitudinal. **Revista científica ciencias de la salud**, v. 6, p. 01–06, 6 mar. 2024.

HOSOKAWA, E. **The Seventh-day Adventist Church: 160 years later**. Disponível em: <<https://adventist.news/news/the-seventh-day-adventist-church-160-years-later>>. Acesso em: 18 set. 2023.

HU, F. Diet strategies for promoting healthy aging and longevity: An epidemiological perspective. **Journal of Internal Medicine**, v. 295, n. 4, p. 508–531, 2024.

JEBB, A. T.; NG, V.; TAY, L. A Review of Key Likert Scale Development Advances: 1995–2019. **Frontiers in Psychology**, v. 12, p. 637547, 4 maio 2021.

KLINE, R. B.; LITTLE, T. D. **Principles and practice of structural equation modeling**. Fifth edition ed. New York London: The Guilford Press, 2023.

MAJDA, A. et al. Religiously Conditioned Health Behaviors within Selected Religious Traditions. **International Journal of Environmental Research and Public Health**, v. 19, n. 1, p. 454, 1 jan. 2022.

MCDONALD, R. P. **Test Theory: A Unified Treatment**. 0. ed. [s.l.] Psychology Press, 2013.

MILES, F. et al. The Biology of Veganism: Plasma Metabolomics Analysis Reveals Distinct Profiles of Vegans and Non-Vegetarians in the Adventist Health Study-2 Cohort. **Nutrients**, v. 14, n. 3, p. 709, 2022.

ORGANIZACIÓN PANAMERICANA DE LA SALUD. **Factores de riesgo de las enfermedades no transmisibles en la Región de las Américas: Consideraciones para fortalecer la capacidad regulatoria. Documento técnico de referencia REGULA.** Disponível em: <<https://iris.paho.org/handle/10665.2/28227?locale-attribute=es>>. Acesso em: 15 set. 2023.

OVIEDO, H.; CAMPO-ARIAS, A. Aproximación al uso del coeficiente alfa de Cronbach. *Revista Colombiana de Psiquiatría*, v. 34, n. 4, p. 572–580, 2005.

RÍOS ROSADO, N. L. et al. Ansiedad, depresión y bienestar espiritual en estudiantes universitarios durante el confinamiento por COVID-19. *Unaciencia Revista de Estudios e Investigaciones*, v. 16, n. 30, p. 94–105, 5 out. 2023.

RUIZ, M.; PARDO, A.; SAN MARTÍN, R. Modelos de ecuaciones estructurales. *Papeles del Psicólogo*, v. 31, n. 1, p. 34–45, 2010.

SANCHEZ, A. et al. Multiple lifestyle interventions reverses hypertension. *Cogent Medicine*, v. 6, n. 1, p. 1636534, 1 jan. 2019.

SEVENTH-DAY ADVENTIST CHURCH. **Living a Healthful Life.** General Conference of Seventh-Day Adventist Church, , 2023. Disponível em: <<https://www.adventist.org/health/#:~:text=Adventists%20believe%20the%20key%20to,—promote%20clean%2C%20healthy%20lives>>. Acesso em: 14 mar. 2024

VENTURA-LEÓN, J.; CAYCHO-RODRÍGUEZ, T. El coeficiente Omega: un método alternativo para la estimación de la confiabilidad. *Revista Latinoamericana de Ciencias Sociales, Niñez y Juventud*, v. 15, n. 1, p. 625–627, 2017.

WHITE, E. G. **The ministry of healing.** Altamont: Ellen G. White Estate, Inc., 1905.

WORLD HEALTH ORGANIZATION. **Healthy living: what is a healthy lifestyle?** WHO Regional Office for Europe, , 1999. Disponível em: <<https://iris.who.int/handle/10665/108180>>. Acesso em: 11 jul. 2023

WORLD HEALTH ORGANIZATION. **WHO package of essential noncommunicable (PEN) disease interventions for primary health care.** WHO, , 2020. Disponível em: <<https://www.who.int/publications/i/item/9789240009226>>. Acesso em: 23 jan. 2023