

A brief transnational measure of mindfulness: measurement invariance of the Five Item Mindfulness-Based Awareness Scale in six Latin American countries

Una medida breve transnacional de atención plena: invarianza de medición de la Escala de Atención y Conciencia Plena de Cinco Ítems en seis países de América Latina

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ABSTRACT

Objectives: The Five-Item Mindfulness Attention Scale (MAAS-5) is a self-report measure of mindfulness that has demonstrated reliability and validity across various countries. However, no study to date has specifically examined the measurement invariance (MI) of the MAAS-5 across Latin American countries, which limits its comparability. Thus, we aimed to explore if the MAAS-5 provides comparable measurements across Latin American countries. **Methods:** Using the alignment method, we assessed the approximate MI of the MAAS-5 in 2,519 individuals residing in six Latin American countries (El Salvador, Paraguay, Chile, Colombia, Bolivia, and Peru). A one-factor structure of the MAAS-5 was used as the theoretical model. In the alignment method, item parameters are expected to be as invariant as possible while allowing for some degree of variability. This approach makes group comparisons more robust to violations of measurement invariance. **Results:** The results indicate that the factorial structure is invariant for both factor loadings ($R^2 = 0.99$) and item intercepts ($R^2 = 0.99$). Regarding the percentage of non-invariant parameters by country, all factor loadings and intercepts were found to be invariant (0%). Therefore, these findings provide evidence of both metric and scalar invariance of the MAAS-5, allowing for comparisons of mean mindfulness scores. No significant differences were observed among participants from different countries, indicating similar levels of mindfulness. **Conclusions:** It is expected that this study will provide evidence for future cross-cultural research on mindfulness and the MAAS-5. However, caution is warranted when interpreting MAAS-5 results, as the scale has been criticized for assessing inattention rather than mindfulness itself. Despite this limitation, the MAAS remains a valuable instrument in countries with limited tools for assessing mindfulness.

Keywords: Invariance; Measurement; Mindfulness (source: MeSH NLM).

RESUMEN

Objetivos: La Escala de Atención y Conciencia Plena de Cinco Ítems (MAAS-5, en inglés) es una medida de autoinforme de atención plena que ha demostrado fiabilidad y validez en varios países. Sin embargo, hasta la fecha, ningún estudio ha examinado específicamente la invarianza de la medición (IM) de la MAAS-5 en países latinoamericanos, lo que limita su comparabilidad. Por lo tanto, nos propusimos explorar si la MAAS-5 proporciona mediciones comparables en todos los países latinoamericanos. **Materiales y métodos:** Mediante el método de alineación, evaluamos la IM aproximada de la MAAS-5 en 2519 personas residentes en seis países latinoamericanos (El Salvador, Paraguay, Chile, Colombia, Bolivia y Perú). Se utilizó una estructura unifactorial de la MAAS-5 como modelo teórico. En el método de alineación, los parámetros de los ítems deben ser lo más invariantes posible, permitiendo alguna variabilidad en la invarianza. Así, las comparaciones de grupos pueden ser más robustas ante violaciones de la MI. **Resultados:** Los resultados indican que la estructura factorial es invariante tanto para las cargas factoriales ($R^2 = 0,99$) como para los interceptos de los ítems ($R^2 = 0,99$). En cuanto al porcentaje de parámetros no invariantes por país, todas las cargas factoriales e interceptos resultaron invariantes (0%). Por lo tanto, estos hallazgos proporcionan evidencia de la invarianza métrica y escalar de la MAAS-5. Esto, permitió la posibilidad de comparar las puntuaciones medias de mindfulness, donde no se observaron diferencias significativas entre los participantes de diferentes países, es decir, presentaron similares niveles de atención plena. **Conclusión:** Se espera que este estudio aporte evidencia para futuras investigaciones transculturales sobre atención plena y la MAAS-5. Sin embargo, hay que tener cautela con los resultados del MAAS-5 pues ha sido criticada por evaluar la inatención en lugar de la atención plena en sí. A pesar de esto, la MAAS sigue siendo un instrumento valioso en países con herramientas limitadas para evaluar la atención plena.

Palabras clave: Invarianza; Medición; Atención Plena (fuente: DeCS Bireme).

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INTRODUCTION

Mindfulness is a concept rooted in Eastern traditions, particularly in Buddhist meditative practices [1]. However, since the 1970s, mindfulness has been increasingly introduced into the medical and mental health frameworks of Western countries [2]. In Western psychology, mindfulness is broadly defined as a receptive attention and sustained awareness of present events and experiences, without judgment regarding what may be occurring in the mind, body, or immediate environment [3,4]. Various studies have demonstrated that practicing mindfulness enhances psychological well-being by reducing levels of anxiety, depression, and stress in both clinical and non-clinical populations [5-8]. Moreover, mindfulness has been shown to improve concentration and help regulate emotions [9,10].

The relevance of mindfulness in improving psychological well-being has been supported by the development of various mindfulness measures [11]. A well-known measure of mindfulness is the Mindful Attention Awareness Scale (MAAS) [12], one of the most widely used instruments [13]. The MAAS is a unidimensional scale that includes 15 items describing the general tendency to be attentive to or aware of present-moment experiences in daily life [12]. Based on self-regulation theory, the MAAS was developed to assess mindfulness as a trait, grounded in the hypothesis that inattention is a measurable psychological characteristic [12]. However, this conceptualization has been criticized for assessing lack of attention rather than mindfulness itself [13]. The original MAAS adopted an indirect assessment approach, as it evaluates the absence rather than the presence of mindfulness [14]. It has been argued that this indirect approach is more accessible to individuals with little or no prior training in mindfulness [12]. Despite this, it has been suggested that the opposite of inattention does not necessarily capture mindfulness [15]. Furthermore, the content of MAAS items has been argued to reflect automatic inattention, which corresponds to the first component of mindfulness as defined by Bishop, but not the second component, namely acceptance [16]. Therefore, being mindful requires attention and concentration on present experience, in contrast to the “autopilot” mode assessed by the MAAS, which involves automatic or habitual behaviors that often go unnoticed [17,18].

Despite such criticism, the MAAS remains a valuable instrument in countries with limited tools for assessing mindfulness. It has been suggested that the MAAS is primarily related to self-awareness and considers distinct mechanisms of mindfulness [19]. Additionally, the MAAS has been validated and translated into various languages and its one-factor structure was reliably confirmed, providing evidence for its internal consistency, test-retest reliability, as well as construct and criterion validity [20]. However, in recent years, some concerns have been raised about the

validity of certain MAAS items, noting that some of them may report limited ability to discriminate among different levels of mindfulness [21,22]. As a result, shorter versions of the MAAS have been proposed, including selected 10-item [23], or 13-item [24], or 6-item [25] versions.

Another study suggested that an unidimensional model comprising five items (items 7, 8, 9, 10, and 19), proposed as the MAAS-5, may provide a good model fit, offering information comparable to the original 15-item version, and remaining consistent with the conceptual unidimensional basis of the MAAS [23]. This model has also been supported by further research involving undergraduate students [26], adolescents [27], and both meditators and non-meditators [16]. In Latin America, the MAAS-5 has been scarcely employed, despite having demonstrated good psychometric properties in non-clinical samples of Peruvian and Mexican university students [13,28] and Peruvian older adults [29].

While there is evidence of adequate psychometric properties of the MAAS-5, it is still of interest to test the validity of MAAS-5 in assessing mindfulness across different countries without the presence of measurement bias. Cross-national research may explore the employment of this measure in detecting mindfulness as a potentially similar psychological trait in the Latin American context. In order to address these questions, it is necessary to establish MI across countries. Thus, the purpose of MI is to determine the extent to which a self-report measure conveys the same meaning and whether item responses are driven by the same underlying factors across different groups [30]. Without evidence of MI, valid cross-country comparisons in international mindfulness studies using the MAAS-5 are not possible. Traditionally, MI is tested through multigroup confirmatory factor analysis (MGCFA), which proceeds in stages [31]. Although commonly used, MGCFA presents limitations for testing MI. For instance, poor model fit indices may arise when the number of groups and participants is large [32]. Moreover, achieving scalar invariance in large-sample studies has proven to be difficult [33].

Considering these limitations, an alignment method has been proposed, considered as an extension of MGCFA, and used when conducting MI analyses across many groups [34,35]. Unlike MGCFA, the alignment method minimizes the extent of non-invariance while estimating factor means and variances, thus allowing for approximate MI [34,36]. The alignment method allows researchers to identify invariant patterns across groups and to estimate means and variances based on actual differences in factor loadings and intercepts. Additionally, the alignment method is a flexible and practical tool for testing MI and comparing latent factors across many groups [33]. The viability of using alignment to compare constructs across multiple groups has been demonstrated in Latin American settings [37,38].

Having an invariant measure that can be used to assess changes in mindfulness across countries is crucial [39]. Various studies have shown that individuals from different countries and cultural backgrounds perceive and experience mindfulness in different ways [1]. As Karl and Fischer [40] have noted, mindfulness research is largely dominated by American and European scholars. However, people living in Latin American countries tend to work significantly longer hours, which limits the time available for individual mindfulness practice. Additionally, many people in Latin America lack access to basic water and sanitation services, as well as adequate public health systems, conditions that differ significantly from those in the United States [41]. These realities may lead many individuals in Latin America to deprioritize mindfulness-related activities [42].

On the other hand, these differences may also be explained by variations in how individuals interpret items on mindfulness scales, differences in response styles, or daily routines that shape attentional patterns. For example, it has been suggested that individuals from different cultural backgrounds may use Likert-type scales differently, tending to prefer moderate or extreme response options depending on cultural norms. These differences in response styles may affect cross-country comparisons without necessarily reflecting true differences in the underlying construct, in this case mindfulness [43].

Similarly, a single item on a scale such as the MAAS-5 may be interpreted differently depending on cultural norms, cognitive practices, or interpretative traditions, as a result of differences in communication styles [43]. Likewise, factors such as daily routines, cultural practices (e.g., meditation habits or contemplative practices), and social expectations may also shape how individuals allocate their attention in everyday life, which may in turn be reflected in their responses to different scales [44]. Despite these differences, Latin American countries share a set of cultural influences and characteristics that may foster similar ways of engaging in mindfulness [45]. The central role of the family in many Latin American countries may make mindfulness a well-received practice, given its emphasis on emotional awareness and attentiveness [42]. Therefore, assessing the MI of a mindfulness measure can provide insight into the cross-national comparability of this construct.

Other studies have evaluated measurement invariance (MI) across countries using different mindfulness scales, such as the Five-Facet Mindfulness Questionnaire [46,47], the Child and Adolescent Mindfulness Measure (CAMM) [48] and the Mindful Self-Care Scale [49]. Measurement invariance testing of these different instruments demonstrated that they are comparable across countries, enabling cross-cultural research on mindfulness using

these measures. However, research on the MI of the MAAS-5 across countries is limited to a single previous study that assessed MI among university students from Peru and Mexico using the MGCFA method. The results showed that the unidimensional structure of the MAAS-5 was similar among Peruvian and Mexican university students; therefore, students from both countries conceptualize mindfulness in a similar way [29]. This prior study, focused on samples of university students from two Latin American countries, provided evidence of measurement invariance across those countries. However, the current study is important because it confirms this evidence in a larger sample of participants from the general population (2,519 individuals) across multiple countries in Central and South America (six Latin American countries: El Salvador, Paraguay, Chile, Colombia, Bolivia, and Peru). This extends the evidence to a broader sample with more diverse national characteristics. Moreover, to the best of current scientific knowledge, only one study has evaluated the MI of the original 15-item Mindful Attention Awareness Scale (MAAS) across samples from Thailand and the Philippines [50]. This limited evidence highlights the need to examine the MI of the MAAS-5 across different countries, particularly in Latin American contexts. Without cross-national MI evidence, it is not possible to confirm whether the MAAS-5 is a suitable tool for cross-cultural research in Latin American countries. In this context, the aim of our study was to assess the cross-national MI of the MAAS-5 among participants from six Latin American countries.

METHODS

Participants

A total of 2,519 individuals from six Latin American countries (El Salvador, Paraguay, Chile, Colombia, Bolivia, and Peru) were involved in the study. All participants were selected using a non-probabilistic snowball sampling method, which involved asking initial respondents to forward the online survey to relatives, friends, or other contacts who met the following inclusion criteria: (a) being of legal age; (b) residing in one of the participating countries; (c) being able to read in Spanish and having access to the internet to complete online surveys; and (d) providing informed consent. A minimum of 200 to 300 participants per country was targeted, which was considered an adequate sample size for psychometric studies [51] and for achieving greater precision in the alignment method [52]. The number of participants per country ranged from 354 (Peru) to 506 (El Salvador).

As shown in Table 1, the mean age ranged from 27.1 ± 11.6 years old in Colombia to 40.8 ± 10.1 years old in Chile. Furthermore, in all countries, there was a higher proportion of women than men. In most countries, more than half of the participants were single. Regarding participants'

educational attainment, only in Paraguay (53.9%) and Chile (83.9%) participants completed a university degree. In the other involved countries, only a small proportion of participants completed higher education: El Salvador (26.3%), Colombia (26.7%), Bolivia (49.7%), and Peru (45.8%). In terms of employment, most participants reported having a permanent job, except in Colombia (33.9%) and Peru (33.1%). Additionally, most participants across all countries reported living in urban areas (> 70%). Lastly, most respondents in all countries did not report suffering from a chronic illness. Further details on sociodemographic characteristics are presented in Table 1.

Instruments

Sociodemographic Survey. A specific questionnaire collecting sociodemographic data was developed for this study, aiming to gather information on country of residence, age, sex, marital status, educational level, type of employment, area of residence, and the presence of chronic illness.

Mindful Attention Awareness Scale (MAAS-5). This version was previously proposed by Goh et al.^[18], Osman et al.^[27], Smith et al.^[28], and van Dam et al.^[23], and it assesses the degree of attention to present-moment events in

Table 1. Sociodemographic Characteristics of Participants

Sociodemographic Data	El Salvador (n = 506)	Paraguay (n = 538)	Chile (n = 384)	Colombia (n = 382)	Bolivia (n = 355)	Peru (n = 354)
Age (M ± SD)	30.2 ± 9.7	30.4 ± 9.9	40.8 ± 10.1	27.1 ± 11.6	27.6 ± 10.5	29.7 ± 10.7
Sex, n (%)						
Female	279 (55.1%)	387 (72.5%)	236 (63.4%)	219 (62.2%)	248 (67.4%)	230 (66.3%)
Male	227 (44.9%)	147 (27.5%)	136 (36.6%)	133 (37.8%)	120 (32.6%)	117 (33.7%)
Marital Status, n (%)						
Single	351 (69.4%)	356 (66.7%)	179 (48.1%)	267 (75.9%)	205 (55.7%)	269 (77.5%)
Married	107 (21.1%)	103 (19.3%)	110 (29.6%)	40 (11.4%)	117 (31.8%)	45 (13%)
Widowed	3 (.6%)	0 (0%)	2 (.5%)	3 (.9%)	1 (.3%)	3 (.9%)
Divorced	3 (0.6%)	20 (3.7%)	31 (8.3%)	9 (2.6%)	19 (5.2%)	3 (.9%)
Cohabiting	25 (4.9%)	45 (8.4%)	45 (12.1%)	20 (5.7%)	22 (6%)	21 (6.1%)
Other	17 (3.4%)	10 (1.9%)	5 (1.3%)	13 (3.7%)	4 (1.1%)	6 (1.7%)
Educational Level, n (%)						
Completed primary education	10 (2%)	2 (.4%)	1 (.3%)	2 (.6%)	0 (0%)	1 (.3%)
Incomplete primary education	10 (2%)	0 (0%)	0 (0%)	1 (.3%)	0 (0%)	0 (0%)
Completed secondary education	94 (18.6%)	50 (9.4%)	9 (2.4%)	86 (24.4%)	37 (10.1%)	41 (11.8%)
Incomplete secondary education	35 (6.9%)	10 (1.9%)	0 (0%)	14 (4%)	8 (2.2%)	7 (2%)
Completed technical education	49 (9.7%)	11 (2.1%)	28 (7.5%)	42 (11.9%)	53 (14.4%)	21 (6.1%)
Incomplete technical education	3 (.6%)	1 (.2%)	4 (1.1%)	2 (.6%)	11 (3%)	8 (2.3%)
Completed higher education	133 (26.3%)	288 (53.9%)	312 (83.9%)	94 (26.7%)	183 (49.7%)	159 (45.8%)
Incomplete higher education	172 (34%)	172 (32.2%)	18 (4.8%)	111 (31.5%)	76 (20.7%)	110 (31.7%)
Type of Employment, n (%)						
Unemployed	98 (19.4%)	93 (17.4%)	36 (9.7%)	141 (40.1%)	91 (24.7%)	122 (35.2%)
Retired	17 (3.4%)	7 (1.3%)	0 (0%)	9 (2.6%)	5 (1.4%)	5 (1.4%)
Permanent job	321 (63.4%)	351 (65.7%)	310 (83.3%)	117 (33.9%)	192 (52.2%)	115 (33.1%)
Temporary job	69 (13.6%)	83 (15.5%)	26 (7%)	85 (24.1%)	80 (21.7%)	105 (30.3%)
Area of Residence, n (%)						
Urban	366 (72.3%)	495 (92.7%)	344 (92.5%)	339 (96.3%)	328 (89.1%)	298 (85.9%)
Rural	140 (27.7%)	39 (7.3%)	28 (7.5%)	13 (3.7%)	40 (10.9%)	49 (14.1%)
Chronic Illness, n (%)						
Yes	58 (11.5%)	75 (14%)	98 (26.3%)	35 (9.9%)	47 (12.8%)	27 (7.8%)
No	448 (88.5%)	459 (86%)	274 (73.7%)	317 (90.1%)	321 (87.2%)	320 (92.2%)

M: mean, SD: standard deviation.

populations with no prior meditation experience. For this study, the Spanish adaptation and validation of the MAAS-5 was used [13,24], in which each of the five items presents six response options ranging from almost always = 1 to almost never = 6. Higher scores indicate greater levels of mindfulness. The MAAS-5 items can be found in Table 2. The study by Caycho-Rodríguez et al. [19] reported that the MAAS-5 items showed favorable evaluations in terms of clarity, coherence, and relevance, with all Aiken’s V coefficients being statistically significant and greater than 0.70. Additionally, the lower bound of the 95% confidence interval for Aiken’s V for all items met the population-level criterion ($Li > 0.59$).

Procedures

In all participating countries, individuals completed the MAAS-5 as part of a larger project titled “Cross-cultural measurement of patience and associated factors”. The study was conducted in accordance with the principles set forth in the Declaration of Helsinki.

Data collection was carried out through an online survey hosted on Google Forms, which was disseminated via social media and email between July 31 and September 6, 2024. Each participant completed the MAAS-5 voluntarily, provided informed consent, and received no financial compensation for their participation. All data were alphanumerically coded to ensure anonymity. The same data collection procedure was followed uniformly across all countries.

Statistical analysis

In the Confirmatory Factor Analysis (CFA), the Robust Maximum Likelihood estimator (MLR) was used, given the six-category response format of the items [53]. Model fit was evaluated using the following indices: Root Mean Square Error of Approximation (RMSEA) (< 0.08), Standardized Root Mean Square Residual (SRMR) (< 0.08), CFI (> 0.95), and Tucker-Lewis Index (TLI) (> 0.95) [54]. Although the MAAS-5 items are ordinal, each item contains six response categories. Previous methodological research has shown that robust maximum likelihood estimators perform well with ordinal variables when five or more response categories are available [55]. In addition, the observed distributions showed moderate skewness, and all response categories were adequately represented across countries, supporting the use of the MLR estimator. Because the items are measured on a bounded Likert-type scale (1-6), extreme values in the traditional sense are not possible. Nevertheless, item distributions were inspected for potential irregularities or extreme response patterns. No values outside the valid response range were detected. Skewness and kurtosis indices were examined and were within commonly accepted thresholds, suggesting that the distributions did not present problematic deviations from normality. Internal consistency was assessed using Cronbach’s alpha [56] and McDonald’s omega [57], with values above 0.70 considered acceptable [58].

To examine factorial invariance of the scale across countries, the Multi-Group Factor Analysis Alignment method was applied [37]. This method simultaneously

Table 2. Formato de instrucción e ítems del MAAS-5 (Instruction format and items of the MAAS-5)

Debajo hay una serie de enunciados sobre tu experiencia diaria. (Below is a series of statements about your daily experience.)
 Por favor, indique lo frecuente o poco frecuente que tienes cada experiencia. (Please indicate how frequently or infrequently you have each experience.)
 Por favor, responda de acuerdo a lo que refleje su experiencia y no de lo que piensa que su experiencia debería ser. (Please respond according to your actual experience rather than how you think your experience should be.)
 Simplemente marca tu respuesta con la que mejor te identificas. (Simply mark the response that best reflects your experience.)
 Considere cada enunciado separadamente del resto de los enunciados. (Consider each statement separately from the others.)

N°	Afirmaciones	Casi Siempre	Muy frecuentemente	Algo frecuente	Algo infrecuente	Muy infrecuente	Casi nunca
1	Parece como si funcionara en “piloto automático”, sin estar muy consciente de lo que estoy haciendo.						
2	Realizo mis actividades rápidamente, sin estar muy atento a lo que hago.						
3	Me enfoco tanto en mis objetivos, que pierdo la noción de lo que estoy haciendo para conseguirlos.						
4	Hago trabajos automáticamente, sin darme cuenta de lo que estoy haciendo.						
5	Me doy cuenta que hago las cosas sin poner atención.						

evaluates the invariance of factor loadings and item intercepts, and assumes that these parameters do not necessarily need to be identical across all groups. Additionally, it assumes that the number of non-invariant parameters and the degree of non-invariance should be minimal^[35]. This analysis began with the specification of an unconstrained configural model across all groups, which was subsequently optimized using a component loss function^[37]. Tolerance thresholds for invariance were set at 0.40 for factor loadings and 0.20 for intercepts^[59], and the alignment power was set to 0.25 for both parameters^[60]. Parameter invariance was assessed using the R^2 index, where values near 0 indicate low invariance and values near 1 indicate high invariance^[35]. A 25% cutoff was established for both loadings and intercepts, with values exceeding this threshold indicating non-invariance of the scale^[35]. To complement the alignment analysis, a traditional MGCFA was conducted to evaluate configural, metric, and scalar invariance across the six countries. Model comparisons were evaluated using changes in fit indices ($\Delta CFI \leq 0.010$ and $\Delta RMSEA \leq 0.015$). Although sample sizes differed slightly across countries, the differences were relatively modest (ranging from 347 to 534 participants). Previous methodological research indicates that moderate differences in group sizes are unlikely to substantially bias parameter estimation or measurement invariance testing when all groups have sufficiently large samples^[61,62]. In addition, simulation studies suggest that changes in model fit indices used to evaluate invariance (e.g., ΔCFI and $\Delta RMSEA$) are generally robust to moderate differences in group sample sizes^[63]. In the present study, all country samples exceeded 300 participants, which is considered adequate for stable parameter estimation in CFA. Once invariance was established, item scores were summed to generate a total score, which was used to compare differences across countries. Country differences were evaluated using Cohen's d .

All statistical analyses were conducted using the “lavaan” package^[64] for CFA and the “sirt” package^[59] for the alignment method, within the R environment via RStudio.

Ethical considerations

The study was part of a larger research project entitled “Cross-cultural measurement of patience and associated factors”. This project was approved by the Department of Medical Psychology of the Faculty of Medical Sciences of the National University of Asunción in accordance with Resolution No. 0708-00-2022 of the Board of Directors of the Faculty (Ethical approval N° 001-007-2024).

RESULTS

Descriptive Analysis

The descriptive results can be found in Supplementary Material 1. The five items of the MAAS-5 exhibited similar average scores across the six countries. To provide greater transparency regarding item distributions, response frequencies were examined by item, category, and country. Overall, responses tended to concentrate in the lower response categories (1-3), indicating a moderate floor tendency rather than a ceiling effect. Importantly, all response categories were used across countries for each item, suggesting adequate variability in responses.

Regarding distributional characteristics, skewness values ranged from 0.13 to 0.75, indicating moderate but acceptable asymmetry, while kurtosis values ranged from -0.18 to -1.01, suggesting relatively flat distributions. These values fall within commonly accepted thresholds (Skewness $< \pm 2$; Kurtosis $< \pm 7$) for psychometric analyses, in accordance with the criteria proposed by Finney and DiStefano^[65].

Validity Based on Internal Structure

As shown in Table 3, the unidimensional model demonstrated adequate fit indices across all six countries studied. Thus, the one-factor structural model fits well in each country. Table 2 also shows that the factor loadings for all items ranged from moderate to high, indicating that the items adequately represent the construct of mindfulness. To evaluate the robustness of the results, the CFA model was re-estimated using the Weighted Least Squares Mean and Variance adjusted (WLSMV) estimator, treating the items as ordered categorical variables. The results were highly consistent with those obtained using the MLR estimator, with similar model fit indices and factor loadings across countries. Therefore, the conclusions regarding the factorial structure of the MAAS-5 remained unchanged.

Scale Reliability

Table 3 shows that the scale in all countries demonstrated adequate internal consistency indices: El Salvador ($\omega = 0.79$; $\alpha = 0.79$), Paraguay ($\omega = 0.83$; $\alpha = 0.82$), Chile ($\omega = 0.86$; $\alpha = 0.86$), Colombia ($\omega = 0.83$; $\alpha = 0.82$), Bolivia ($\omega = 0.79$; $\alpha = 0.78$), and Peru ($\omega = 0.78$; $\alpha = 0.78$). These findings support the conclusion that the scale reliably measures the construct of mindfulness in each of the countries included in the study. To facilitate cross-

country comparison, a forest plot summarizing the omega estimates is presented in Figure 1. The results show minimal variability in reliability across countries, supporting the stability of the scale’s internal consistency across different Latin American contexts.

Measurement Invariance by Country

As shown in Table 4, the factorial structure of the MAAS-5 is invariant across countries, both in terms of factor loadings ($R^2 = 0.99$) and item intercepts ($R^2 = 0.99$). Regarding the percentage of non-invariant parameters by country, all factor loadings were found to be invariant (0%), as were all intercepts (0%). Therefore, these results provide evidence for both metric and scalar invariance of the scale. The alignment results indicated that all factor loadings and intercepts were invariant across countries, with R^2 values close to 1. Because such results may appear unusually strong in cross-national applications, additional checks were conducted. First, the coding and specification of the model were carefully reviewed, including the direction of items and the treatment of

the response scale. Second, a traditional MGCFAs was performed as a sensitivity analysis.

The configural model showed good fit (CFI = 0.995, RMSEA = 0.039), supporting the equivalence of the factorial structure across countries. Constraining factor loadings to equality across groups (metric invariance) resulted in negligible changes in model fit ($\Delta CFI = -0.002$; $\Delta RMSEA = -0.003$), supporting metric invariance. When intercepts were additionally constrained (scalar invariance), changes in model fit remained within recommended thresholds ($\Delta CFI = -0.004$; $\Delta RMSEA = 0.002$), indicating support for scalar invariance. Therefore, the results support scalar invariance of the MAAS-5 across the six countries, indicating that latent mean comparisons are appropriate.

Table 5 displays the latent mean of each item across the six countries studied, as well as the latent mean of mindfulness by country. The results indicate no significant differences in mindfulness levels among participants from different countries, as their confidence intervals overlapped. This finding is illustrated more clearly in Figure 2.

Table 3. Fit indices of the different MAAS-5 scale models in Latin American countries

Country	χ^2	df	p-value	CFI	TLI	SRMR	RMSEA (90% CI)	Factor Loading (λ)					Reliability	
								M1	M2	M3	M4	M5	α	ω
El Salvador	6.156	5	0.291	0.99	0.99	0.018	0.026 (0.000 - 0.080)	0.76	0.67	0.53	0.76	0.56	0.79	0.79
Paraguay	12.91	5	0.024	0.99	0.98	0.024	0.062 (0.018 - 0.105)	0.82	0.71	0.42	0.81	0.69	0.82	0.83
Chile	2.76	5	0.737	1.00	1.00	0.010	0.000 (0.000 - 0.061)	0.87	0.71	0.56	0.86	0.71	0.86	0.86
Colombia	9.87	5	0.079	0.99	0.98	0.021	0.060 (0.000 - 0.117)	0.80	0.77	0.55	0.78	0.58	0.82	0.83
Bolivia	10.24	5	0.069	0.99	0.97	0.023	0.063 (0.000 - 0.119)	0.69	0.73	0.44	0.77	0.64	0.78	0.79
Peru	2.57	5	0.765	1.00	1.01	0.015	0.000 (0.000 - 0.064)	0.73	0.67	0.53	0.69	0.58	0.78	0.78

χ^2 : Chi-square, df: Degrees of Freedom, SRMR: Standardized Root Mean Square Residual, TLI: Tucker-Lewis Index, CFI: Comparative Fit Index, RMSEA: Root Mean Square Error of Approximation, ω : McDonald’s Omega, CI: confidence interval.

Table 4. ML Invariance Alignment (IA) in Latin American Countries

Variable	Parameters	Items	M	SD	Min	Max	Country						R2	%
Mindfulness	Factor loading	1	1.17	0.07	1.05	1.25	1	2	3	4	5	6	0.99	0.0%
		2	1.04	0.05	0.94	1.09	1	2	3	4	5	6		
		3	0.74	0.10	0.58	0.89	1	2	3	4	5	6		
		4	1.12	0.00	1.12	1.12	1	2	3	4	5	6		
		5	0.95	0.08	0.82	1.03	1	2	3	4	5	6		
	Intercept	1	2.55	0.05	2.47	2.61	1	2	3	4	5	6	0.99	0.0%
		2	2.55	0.03	2.51	2.60	1	2	3	4	5	6		
		3	2.52	0.10	2.38	2.64	1	2	3	4	5	6		
		4	2.38	0.00	2.38	2.39	1	2	3	4	5	6		
		5	2.71	0.07	2.58	2.78	1	2	3	4	5	6		

%: Percentage of non-invariant item parameters, M: mean, SD: standard deviation, Min: minimum, Max: maximum.

Parentheses indicate that the parameter is non-invariant for that specific group (country).

1: El Salvador; 2: Paraguay; 3: Chile; 4: Colombia; 5: Bolivia; 6: Peru.

Table 5. Comparison of Latent Means Across Countries

Country	Latent Mean of Items					Comparison of Latent Means			
	M1	M2	M3	M4	M5	Latent mean	SD	Lower CI	Upper CI
El Salvador	2.47	2.60	2.58	2.39	2.58	2.53	0.09	2.45	2.61
Paraguay	2.84	2.75	2.58	2.62	3.00	2.76	0.16	2.61	2.91
Chile	2.59	2.51	2.37	2.37	2.73	2.52	0.15	2.38	2.66
Colombia	2.63	2.65	2.55	2.51	2.87	2.65	0.13	2.53	2.77
Bolivia	2.67	2.59	2.68	2.47	2.78	2.64	0.11	2.54	2.74
Peru	2.50	2.54	2.61	2.34	2.63	2.53	0.11	2.43	2.63

SD: standard deviation, CI: confidence interval.

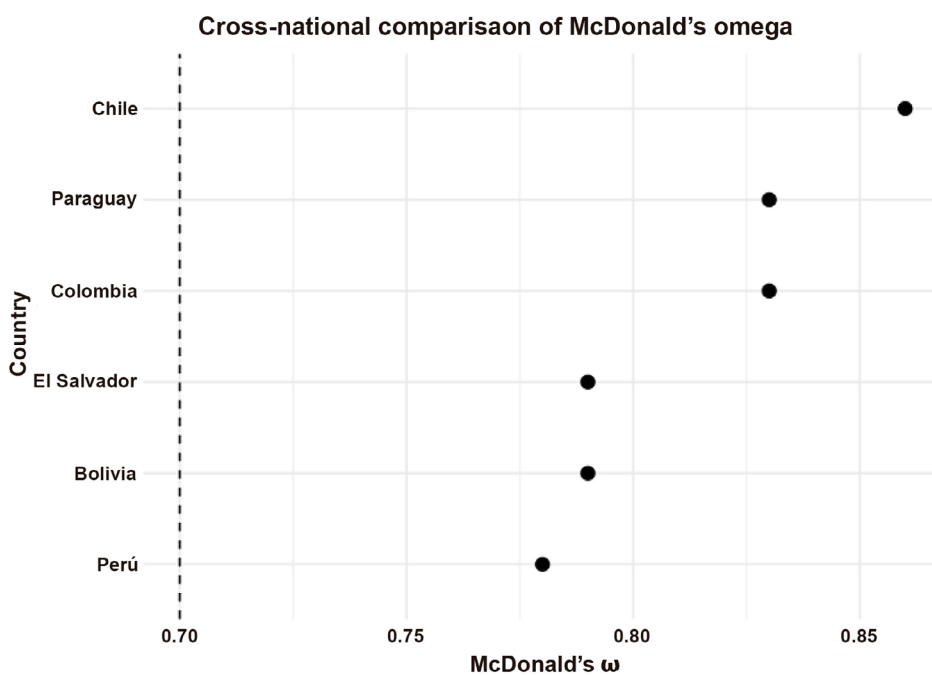


Figure 1. McDonald's omega coefficients of the MAAS-5 across six Latin American countries.

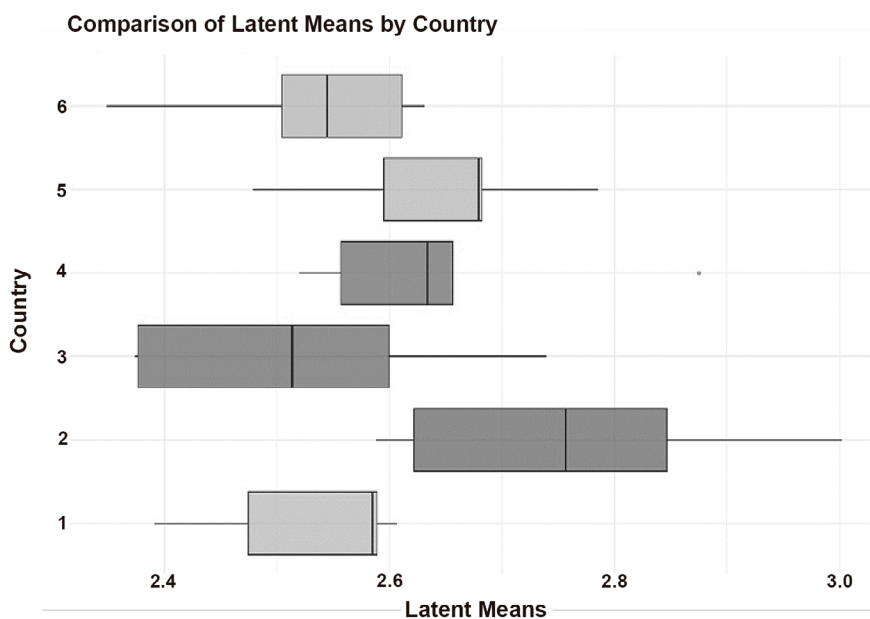


Figure 2. Comparison of Latent Mean Levels of Mindfulness Across Countries.

Boxes represent the estimated latent means and whiskers indicate the corresponding 95% confidence intervals. The overlap of confidence intervals suggests that differences in latent means across countries are small and not statistically meaningful.

DISCUSSION

This is the first study aimed to explore the cross-national MI of the MAAS-5 among individuals from six Latin American countries. Overall, the findings supported the evidence that the five items form a single underlying factor across all six countries, and that they demonstrated adequate reliability. The approximate MI across countries suggests that the MAAS-5 measures the mindfulness construct within the specific contextual conditions of general populations in these six Latin American countries.

First, the factorial structure of the MAAS-5 was examined using CFA. The analyses showed that the one-factor model yielded acceptable fit in each of the six countries, replicating the factorial structure of the MAAS-5 observed in other linguistic versions [19,23,24,27-30]. Therefore, these findings suggest that mindfulness among individuals from six Latin American countries can be explained by a single underlying trait, like findings in samples with different characteristics. This supports the applicability of the MAAS-5 as a unidimensional measure of mindfulness in Latin American settings. In addition, Cronbach's alpha and McDonald's omega coefficients were used to assess reliability in each sample, with the latter providing more realistic reliability estimates [66]. The results indicated that the MAAS-5 demonstrated adequate reliability coefficients, suggesting good measurement precision in each country-consistent with previous international studies that primarily used Cronbach's alpha [24,27,28] and omega coefficients [19,29,30].

The MI test using the alignment method showed that all factor loadings and intercept parameters were invariant. Thus, the unidimensional structure of the model was consistent across the six countries and retained its meaning across national contexts. Additionally, equivalent item intercepts suggest that the different countries shared similar latent mean levels of the mindfulness construct [31]. The alignment method, which is more flexible and based on realistic assumptions that relax strict invariance constraints, showed that the MAAS-5 presents an approximate MI pattern [37]. Therefore, the MAAS-5 is suitable for use in groups from different Latin American countries. The use of the alignment method provided evidence consistent with approximate measurement invariance of the MAAS-5, while preserving model fit and allowing for comparisons of latent means across different groups. However, this result does not imply that cultural differences do not influence the MI pattern, especially considering the small number of Latin American countries included. Although the use of the alignment method is relatively new in the field of transnational mental health research and allows testing invariance across groups, further studies involving additional Latin American countries are needed to establish more precise fit indicators.

Research on mindfulness has noted that, as mindfulness practices transitioned from Eastern to Western contexts, the concept became more individualistic, focusing on personal freedom [67]. Therefore, our findings, which support a unidimensional structure similar to that reported in European and U.S. samples, may suggest that the MAAS-5 captures conceptualizations of mindfulness more aligned with Western and individualistic cultures, as opposed to the more collectivist Eastern contexts where the concept originated [11]. This may reflect a systematic Western individualistic bias embedded in mindfulness measures, implying that mere adaptation may not be sufficient [11]. Further research is therefore needed to understand mindfulness across different cultural settings.

Finally, the alignment-based MI results showed that scale scores are comparable across the six countries. Additionally, no items showed non-invariant parameters in terms of factor loadings or intercepts across countries. This suggests that indicators of mindfulness, as assessed by the MAAS-5, such as performing activities quickly without paying close attention or becoming so focused on goals that one loses awareness of the process, may be equally representative across all countries evaluated. Specifically, equal factor loadings indicate that each item is equally related to the mindfulness construct across countries. In other words, "performing activities quickly without paying attention" represents the same underlying construct in all countries. Likewise, equal intercepts imply that the average levels reported by participants for each item are not biased by country of origin. Therefore, individuals with the same overall level of mindfulness respond similarly to each item regardless of their country. This is important, as it suggests that the MAAS-5 is comparable across countries not only at the total score level but also at the level of individual items.

The findings indicate no significant differences in mindfulness levels among participants from the included countries. As previously mentioned, this suggests that Latin American countries may share cultural influences and characteristics, such as the prominent role of family in promoting emotional awareness and attentiveness [45,68], which could foster similar ways of understanding and practicing mindfulness [42].

One major strength of our study is the inclusion of six Latin American countries. Furthermore, the use of a common survey protocol across countries contributed to the comparability of MAAS-5 findings at the cross-national level. Despite these strengths, the results must be interpreted in light of certain methodological limitations. First, the use of a non-probabilistic sampling method means that the samples are not representative of the national populations, limiting the generalizability of findings [69]. Additionally, this sampling method resulted in uneven representation in terms of gender and educational

level, likely underrepresenting men and individuals with lower educational attainment, further restricting the representativeness and interpretation of the findings. Second, the use of self-report instruments is susceptible to social desirability bias. When asking about opinions or beliefs, there is always the possibility of receiving socially desirable rather than truthful answers. To mitigate this bias, future research should assess the appropriateness of item content rather than the tendency toward desirable responses. Third, the MAAS-5 was not compared against other existing instruments, preventing the assessment of concurrent and discriminant validity, both of which would further support the metric quality and relevance of the MAAS-5. Fourth, a cross-sectional design was used, which limits the ability to assess the stability of the MAAS-5 over time within Latin American contexts. Future research should include test-retest reliability analyses. Fifth, only transnational measurement invariance was evaluated; invariance across age and gender was not assessed due to sample imbalances. Across countries, differences in the proportion of men and women ranged from 10.2% (El Salvador) to 45% (Paraguay), while mean age ranged from 27.1 to 40.8 years. Given this substantial imbalance, measurement invariance analyses by sex and age were not conducted, as estimates of intercepts and factor loadings may become unstable and biased, thereby affecting model optimization and the identification of invariant parameters [36,37]. This represents an important limitation, as it is known that gender and culture interact in mindfulness practices [70]. Future studies aiming to replicate these findings should ensure samples with comparable demographic characteristics across groups. Sixth, no structured clinical interviews were used to validate the self-report data, making it impossible to assess the specificity and sensitivity of the MAAS-5 as a mindfulness screening tool. Seventh, no analysis of content validity evidence for the MAAS-5 items was conducted in each country; instead, a previously translated and adapted Spanish version was used. However, the robustness of the results suggests that the MAAS-5 items are clear, coherent, and relevant for assessing mindfulness.

Cross-cultural research on mindfulness requires a common and equivalent measure to facilitate meaningful comparisons. Evidence of cross-national invariance is important for both theoretical and practical reasons. There is ongoing debate about the cross-cultural equivalence of various mental health constructs, including mindfulness, in culturally diverse settings [11,71,72]. The research presents mindfulness as an equivalent construct, while other perspectives argue that it is a culture-bound practice [11]. From a pragmatic standpoint, it is necessary to conduct research that examines how culture, language, and religion may shape how individuals from different countries respond to items that define a given mental health category.

For mindfulness research, these results are valuable for valid cross-national comparisons. That is, one country may exhibit higher or lower levels of mindfulness than another without this being an artifact of measurement. Moreover, the findings can be more readily generalized across different cultural contexts, and more robust explanatory models can be developed in which relationships (e.g., between mindfulness and depression) can be examined with the assurance that the mindfulness construct is measured equivalently, without concern for structural biases across countries.

The MAAS-5 appears to be a suitable tool for understanding mindfulness in populations from six Latin American countries. The results suggest that, while the MAAS-5 is comparable at the total score level, it is also comparable at the item level, as no items were found to vary across countries. In this regard, from a clinical interpretation perspective, if the items function equivalently across all countries, cross-national comparisons are not biased by differences in cultural interpretation. Therefore, one can state with greater confidence that if individuals in one country obtain higher average scores on the MAAS-5 than those in another, this reflects true differences in mindfulness practice rather than differences in the functioning of the scale. This principle is fundamental in comparative psychometrics and underpins valid comparisons across groups from different cultures or countries. Additionally, similar criteria could be used to identify low levels of mindfulness in different populations. Regarding the use of the total MAAS-5 score, it can be employed as a global indicator of mindfulness across the six countries, as the items contribute equivalently across them. Likewise, health professionals can have greater confidence that results derived from the MAAS-5 accurately reflect patients' levels of mindfulness rather than cultural bias in the instrument. This could assist mental health departments in adapting their practices to incorporate mindfulness-based approaches. In this sense, if a country exhibits lower levels of mindfulness, it is clinically reasonable to implement mindfulness-based interventions, as the measured deficit is likely to be genuine. Moreover, mindfulness can be studied not only at the individual level but also at collective and national levels, as it is significantly associated with several indicators of mental health and contributes to better quality of life and well-being [5,73]. Additionally, employing a shorter mindfulness measure is particularly beneficial in large-scale surveys where participants are required to complete multiple questionnaires, making cognitive load a key concern.

In conclusion, our findings suggest that the MAAS-5 exhibits a solid factorial structure and MI across six countries. The results indicated that the factorial structure is invariant for both factor loadings and item intercepts.

These findings provide evidence of both metric and scalar invariance of the MAAS-5. Therefore, the MAAS-5 can be used to assess mindfulness in El Salvador, Paraguay, Chile, Colombia, Bolivia, and Peru.

Supplementary Material

The supplementary material can be accessed at the following link: <https://revistas.cientifica.edu.pe/index.php/mecp/article/view/3311/1732>

Author contributions

TC-R: Conceptualization, Methodology, Writing – Original Draft, Writing – Review & Editing. LWV and AS-V: Formal Analysis, Visualization, Writing – Original Draft, Writing – Review & Editing. JT, LH-O, CC-L, DF-B, DXP-C, MEL-R, PASS, RM-H, AM-D-C-T, JB-C, MR-B, JG-M, AV, JFAA and NA-L: Investigation, Writing – Original Draft, Writing – Review & Editing.

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The authors declare no conflicts of interest.

Generative Artificial Intelligence use statement

The authors declare that no artificial intelligence was used in any part of the manuscript preparation process.

Data Availability Statement

The data generated and/or analyzed during the present study are available in the Open Science Framework repository at the following link: <https://osf.io/pwtgc/files/p4m9w>.

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REFERENCES

- Ivtzan I, Young T, Lee HC, Lomas T, Daukantaitė D, Kjell ON. Mindfulness based flourishing program: a cross-cultural study of Hong Kong Chinese and British participants. *J Happiness Stud.* 2018;19:2205-23. doi: [10.1007/s10902-017-9919-1](https://doi.org/10.1007/s10902-017-9919-1).
- Suresh K, Dar AA, Prasad DLN, Fernandes D. Mindfulness to Mental Health: Exploring Bibliometric Pathways via Metacognition, Rumination, and Emotion Regulation. *J Theo Soc Psychol.* 2024;2024(1):5867754. doi: [10.1155/jts5/5867754](https://doi.org/10.1155/jts5/5867754).
- Brown KW, Ryan RM, Creswell JD. Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychol InquirY.* 2007;18(4):211-37. doi: [10.1080/10478400701598298](https://doi.org/10.1080/10478400701598298).
- Grossman P, Niemann L, Schmidt S, Walach H. Mindfulness-based stress reduction and health benefits: A meta-analysis. *J Psychosom Res.* 2004;57(1):35-43. doi: [10.1016/S0022-3999\(03\)00573-7](https://doi.org/10.1016/S0022-3999(03)00573-7).
- Galante J, Friedrich C, Dawson AF, Modrego-Alarcón M, Gebbing P, Delgado-Suárez I, et al. Mindfulness-based programmes for mental health promotion in adults in nonclinical settings: A systematic review and meta-analysis of randomised controlled trials. *PLoS Med.* 2021;18(1):e1003481. doi: [10.1371/journal.pmed.1003481](https://doi.org/10.1371/journal.pmed.1003481).
- Liu H, Cai K, Wang J, Zhang H. The effects of mindfulness-based interventions on anxiety, depression, stress, and

- mindfulness in menopausal women: A systematic review and meta-analysis. *Front Public Health*. 2023;10:1045642. doi: [10.3389/fpubh.2022.1045642](https://doi.org/10.3389/fpubh.2022.1045642).
7. Martin KJ, Golijani-Moghaddam N, dasNair R. Mindfulness self-help interventions for symptoms of depression, anxiety and stress: Review and meta-analysis. *Int J Ther Rehabil*. 2018;25(2):82-95. doi: [10.12968/ijtr.2018.25.2.82](https://doi.org/10.12968/ijtr.2018.25.2.82).
 8. Strohmaier S, Jones FW, Cane JE. Effects of length of mindfulness practice on mindfulness, depression, anxiety, and stress: A randomized controlled experiment. *Mindfulness*. 2021;12:198-214. doi: [10.1007/s12671-020-01512-5](https://doi.org/10.1007/s12671-020-01512-5).
 9. Chan RM, Mak WW, Yu BC. Going beyond mindfulness: How concentration and tranquility commonly co-arising with mindfulness account for mental health. *Int J Environ Res Public Health*. 2023;20(8):5470. doi: [10.3390/ijerph20085470](https://doi.org/10.3390/ijerph20085470).
 10. Raugh IM, Berglund AM, Strauss GP. Implementation of Mindfulness-Based Emotion Regulation Strategies: A Systematic Review and Meta-analysis. *Affect Sci*. 2024;1-30. doi: [10.1007/s42761-024-00281-x](https://doi.org/10.1007/s42761-024-00281-x).
 11. Karl JA, Prado SMM, Gračanin A, Verhaeghen P, Ramos A, Mandal SP, et al. The cross-cultural validity of the Five-Facet Mindfulness Questionnaire across 16 countries. *Mindfulness*. 2020;11:1226-37. doi: [10.1007/s12671-020-01333-6](https://doi.org/10.1007/s12671-020-01333-6).
 12. Brown KW, Ryan RM. The benefits of being present: mindfulness and its role in psychological well-being. *J Pers Soc Psychol*. 2003;84(4):822-48. doi: [10.1037/0022-3514.84.4.822](https://doi.org/10.1037/0022-3514.84.4.822).
 13. Sauer S, Walach H, Schmidt S, Hinterberger T, Lynch S, Büssing A, et al. Assessment of mindfulness: Review on state of the art. *Mindfulness*. 2013;4(1):3-17. doi: [10.1007/s12671-012-0122-5](https://doi.org/10.1007/s12671-012-0122-5).
 14. Brown KW, West AM, Loverich TM, Biegel GM. Assessing adolescent mindfulness: validation of an adapted Mindful Attention Awareness Scale in adolescent normative and psychiatric populations. *Psychol Assess*. 2011;23(4):1023-33. doi: [10.1037/a0021338](https://doi.org/10.1037/a0021338).
 15. Van Dam NT, Earleywine M, Borders A. Measuring mindfulness? An item response theory analysis of the Mindful Attention Awareness Scale. *Pers Individ Dif*. 2010;49(7):805-10. doi: [10.1016/j.paid.2010.07.020](https://doi.org/10.1016/j.paid.2010.07.020).
 16. Bishop SR, Lau M, Shapiro S, Carlson L, Anderson ND, Carmody J, et al. Mindfulness: A proposed operational definition. *Clinical psychology: Science and practice*. 2004;11(3):230-241. doi: [10.1093/clippsy/bph077](https://doi.org/10.1093/clippsy/bph077).
 17. Kabat-Zinn J. Full catastrophe living: Using the wisdom of your body and mind to face stress, pain and illness using mindfulness meditation. New York: Dell Publishing; 1990.
 18. Segal Z, Williams M, Teasdale J. Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse. New York: Guilford Press; 2002.
 19. Caycho-Rodríguez T, García Cadena CH, Reyes-Bossio M, Cabrera-Orosco I, Oblitas Guadalupe LA, Arias Gallego WL. Evidencias psicométricas de una versión breve de la mindful awareness attention scale en estudiantes universitarios. *Rev Argent Cienc Comput*. 2019;11(3):19-32. doi: [10.32348/1852.4206.v11.n3.24870](https://doi.org/10.32348/1852.4206.v11.n3.24870).
 20. Stuart-Edwards A. Mindfulness, subjective, and psychological well-being: A comparative analysis of FFMQ and MAAS measures. *Appl Psychol Health Well Being*. 2025;17(2):e70019. doi: [10.1111/aphw.70019](https://doi.org/10.1111/aphw.70019).
 21. Nooripour R, Ghanbari N, Hoseinian S, Vakili Y, Dobkins K. Psychometric validation of the Farsi version of the Mindful Attention Awareness Scale (MAAS) in a sample of Iranian students in the USA. *Int J Ment Health Addict*. 2023;21(2):729-39. doi: [10.1007/s11469-021-00617-9](https://doi.org/10.1007/s11469-021-00617-9).
 22. Chiesi F, Donati MA, Panno A, Giacomantonio M, Primi C. What about the different shortened versions of the Mindful Attention Awareness Scale? *Psychol Rep*. 2017;120(5):966-90. doi: [10.1177/0033294117711132](https://doi.org/10.1177/0033294117711132).
 23. Van Dam NT, Earleywine M, Borders A. Measuring mindfulness? An item response theory analysis of the Mindful Attention Awareness Scale. *Pers Individ Dif*. 2010;49(7):805-10. doi: [10.1016/j.paid.2010.07.020](https://doi.org/10.1016/j.paid.2010.07.020).
 24. Goh HE, Marais I, Ireland MJ. A Rasch model analysis of the mindful attention awareness scale. *Assessment*. 2017;24(3):387-98. doi: [10.1177/1073191115607043](https://doi.org/10.1177/1073191115607043).
 25. Medvedev ON, Siegert RJ, Feng XJ, Billington DR, Jang JY, Krägeloh CU. Measuring trait mindfulness: How to improve the precision of the Mindful Attention Awareness Scale using a Rasch model. *Mindfulness*. 2016;7:384-95. doi: [10.1007/s12671-015-0454-z](https://doi.org/10.1007/s12671-015-0454-z).
 26. Black DS, Sussman S, Johnson CA, Milam J. Psychometric assessment of the mindful attention awareness scale (MAAS) among Chinese adolescents. *Assessment*. 2012;19(1):42-52. doi: [10.1177/1073191111415365](https://doi.org/10.1177/1073191111415365).
 27. Osman A, Lamis DA, Bagge CL, Freedenthal S, Barnes SM. The mindful attention awareness scale: Further examination of dimensionality, reliability, and concurrent validity estimates. *J Pers Assess*. 2016;98(2):189-99. doi: [10.1080/00223891.2015.1095761](https://doi.org/10.1080/00223891.2015.1095761).
 28. Smith OR, Melkevik O, Samdal O, Larsen TM, Haug E. Psychometric properties of the five-item version of the Mindful Awareness Attention Scale (MAAS) in Norwegian adolescents. *Scand J Public Health*. 2017;45(4):373-80. doi: [10.1177/1403494817699321](https://doi.org/10.1177/1403494817699321).
 29. Reyes-Bossio M, Zapparigli EL, Caycho-Rodríguez T, Carbajal-León C, Castaman LAO, Pino GLH, et al. Cross-cultural validity of the five items Mindful Attention Awareness Scale (MAAS-5) in Peru and Mexico during the COVID-19 pandemic. *Psicol Reflex Crit*. 2022;35:12. doi: [10.1186/s41155-022-00218-y](https://doi.org/10.1186/s41155-022-00218-y).
 30. Caycho-Rodríguez T, Tomás JM, Ventura-León J, Carranza Esteban RF, Oblitas Guadalupe LA, Reyes-Bossio M, et al. Factorial validity and invariance analysis of the five items version of Mindful Awareness Attention Scale in older adults. *Aging Ment Health*. 2021;25(4):756-65. doi: [10.1080/13607863.2020.1716685](https://doi.org/10.1080/13607863.2020.1716685).
 31. Vandenberg RJ, Lance CE. A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organ Res Methods*. 2000;3(1):4-70. doi: [10.1177/109442810031002](https://doi.org/10.1177/109442810031002).
 32. Milfont TL, Fischer R. Testing measurement invariance across groups: Applications in cross-cultural research. *Int J Psychol Res*. 2010;3(1):111-30.
 33. Beierlein C, Davidov E, Schmidt P, Schwartz SH, Rammstedt B. Testing the discriminant validity of Schwartz'Portrait Value Questionnaire items—A replication and extension of Knoppen and Saris (2009). *Surv Res Methods*. 2012;6(1):25-36. doi: [10.18148/srm/2012.v6i1.5092](https://doi.org/10.18148/srm/2012.v6i1.5092).
 34. Marsh HW, Guo J, Parker PD, Nagengast B, Asparouhov T, Muthén B, et al. What to do when scalar invariance fails: The alignment method for multi-group factor analysis comparison of latent means across many groups. *Psychol Methods*. 2018;23(3):524-45. doi: [10.1037/met0000113](https://doi.org/10.1037/met0000113).
 35. Muthén B, Asparouhov T. IRT studies of many groups: The alignment method. *Front Psychol*. 2014;5:978. doi: [10.3389/fpsyg.2014.00978](https://doi.org/10.3389/fpsyg.2014.00978).
 36. Muthén B, Asparouhov T. Recent methods for the study of measurement invariance with many groups: Alignment and random effects. *Sociol Methods Res*. 2018;47(4):637-64. doi: [10.1177/0049124117701488](https://doi.org/10.1177/0049124117701488).

37. Asparouhov T, Muthén B. Multiple-group factor analysis alignment. *Struct Equ Modeling*. 2014;21(4):495-508. doi: [10.1080/10705511.2014.919210](https://doi.org/10.1080/10705511.2014.919210).
38. Caycho-Rodríguez T, Valencia PD, Ventura-León J, Carbajal-León C, Vilca LW, Reyes-Bossio M, et al. Cross-cultural invariance of the Spanish version of the COVID-19 Assessment Scorecard to measure the perception of government actions against COVID-19 in Latin America. *Psicol Reflex Crit*. 2023;36(1):34. doi: [10.1186/s41155-023-00277-9](https://doi.org/10.1186/s41155-023-00277-9).
39. Caycho-Rodríguez T, Vilca LW, Cervigni M, Gallegos M, Martino P, Calandra M, et al. Cross-national measurement invariance of the Purpose in Life Test in seven Latin American countries. *Front Psychol*. 2022;13:974133. doi: [10.3389/fpsyg.2022.974133](https://doi.org/10.3389/fpsyg.2022.974133).
40. Raphiphatthana B, Jose PE, Chobthamkit P. The association between mindfulness and grit: an east vs. west cross-cultural comparison. *Mindfulness*. 2019;10:146-58. doi: [10.1007/s12671-018-0961-9](https://doi.org/10.1007/s12671-018-0961-9).
41. Karl JA, Fischer R. The state of dispositional mindfulness research. *Mindfulness*. 2022;13(6):1357-72. doi: [10.1007/s12671-022-01853-3](https://doi.org/10.1007/s12671-022-01853-3).
42. Demarzo MMP, Cebolla A, Garcia-Campayo JMDDP. The implementation of mindfulness in healthcare systems: a theoretical analysis. *Gen Hosp Psychiatry*. 2015;37(2):166-71. doi: [10.1016/j.genhosppsych.2014.11.013](https://doi.org/10.1016/j.genhosppsych.2014.11.013).
43. Hamamura T, Heine SJ, Paulhus DL. Cultural differences in response styles: The role of dialectical thinking. *Personality and Individual Differences*. 2008;44(4):932-942. doi: [10.1016/j.paid.2007.10.034](https://doi.org/10.1016/j.paid.2007.10.034).
44. Huggins CF, Williams JH, Sato W. Cross-cultural differences in self-reported and behavioural emotional self-awareness between Japan and the UK. *BMC Research Notes*. 2023;16(1):380. doi: [10.1186/s13104-023-06660-0](https://doi.org/10.1186/s13104-023-06660-0).
45. García-Campayo J, Demarzo M, Shonin E, Van Gordon W. How do cultural factors influence the teaching and practice of mindfulness and compassion in Latin countries? *Front Psychol*. 2017;8:1161. doi: [10.3389/fpsyg.2017.01161](https://doi.org/10.3389/fpsyg.2017.01161).
46. Karl JA, Prado SMM, Gračanin A, Verhaeghen P, Ramos A, Mandal SP, et al. The cross-cultural validity of the Five-Facet Mindfulness Questionnaire across 16 countries. *Mindfulness*. 2020;11(5):1226-1237. doi: [10.1007/s12671-020-01333-6](https://doi.org/10.1007/s12671-020-01333-6).
47. Wong MYC, Yuan GF, Huang SY, Lian AEZ, Derin G, Akiş AD, et al. Psychometric Evaluation of the 15-Item Five Facet Mindfulness Questionnaire: A Cross-Cultural Comparison Study Among English-and Chinese-Speaking Adult Mental Health Service Users. *Healthcare*. 2026;14(3):307. doi: [10.3390/healthcare14030307](https://doi.org/10.3390/healthcare14030307).
48. García-Rubio C, Rodríguez-Carvajal R, Langer AI, Paniagua D, Steinebach P, Andreu CI, et al. Validation of the Spanish version of the Child and Adolescent Mindfulness Measure (CAMM) with samples of Spanish and Chilean children and adolescents. *Mindfulness*. 2019;10(8):1502-1517. doi: [10.1007/s12671-019-01108-8](https://doi.org/10.1007/s12671-019-01108-8).
49. Hotchkiss JT, Cook-Cottone CP, Wong MYC, Guyker W, Garcia ACM. Intercultural validation of the mindful self-care scale—Rasch and factor analysis of 16 studies representing five continents. *Mindfulness*. 2023;14(8):2055-2072. doi: [10.1007/s12671-023-02196-3](https://doi.org/10.1007/s12671-023-02196-3).
50. Klainin-Yobas P, Thanoi W, Vongsirimas N, Tang LK, Ramirez D, Fernandez Z, et al. Measurement invariance of the mindfulness attention awareness scale among youths across five samples. Preprints. 2023. doi: [10.20944/preprints202309.0056.v1](https://doi.org/10.20944/preprints202309.0056.v1).
51. VanVoorhis CW, Morgan BL. Understanding power and rules of thumb for determining sample sizes. *Tutor Quant Methods Psychol*. 2007;3(2):43-50.
52. Pokropek A, Lüdtke O, Robitzsch A. An extension of the invariance alignment method for scale linking. *Psychol Test Assess Model*. 2020;62(2):305-34.
53. Brown TA. *Confirmatory Factor Analysis for Applied Research*, Second Edition. Guilford Publications; 2015.
54. Schumacker RE, Lomax RG. *A Beginner's Guide to Structural Equation Modeling: Fourth Edition (4th ed.)*. Routledge; 2015.
55. Rhemtulla M, Brosseau-Liard PÉ, Savalei V. When can categorical variables be treated as continuous? A comparison of robust continuous and categorical SEM estimation methods under suboptimal conditions. *Psychological methods*. 2012;17(3):354-373. doi: [10.1037/a0029315](https://doi.org/10.1037/a0029315).
56. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika*. 1951;16(3):297-334. doi: [10.1007/BF02310555](https://doi.org/10.1007/BF02310555).
57. McDonald RP. *Test Theory: A Unified Treatment*. Taylor & Francis; 1999.
58. Viladrich C, Angulo-Brunet A, Doval E. A journey around alpha and omega to estimate internal consistency reliability. *Anales Psicol*. 2017;33(3):755-82. doi: [10.6018/analesps.33.3.268401](https://doi.org/10.6018/analesps.33.3.268401).
59. Robitzsch A. sirt: Supplementary Item Response Theory Models (R package version 3.9-4); 2020.
60. Fischer R, Karl JA. A primer to (cross-cultural) multi-group invariance testing possibilities in R. *Front Psychol*. 2019;10:1-18. doi: [10.3389/fpsyg.2019.01507](https://doi.org/10.3389/fpsyg.2019.01507).
61. Meade AW, Bauer DJ. Power and precision in confirmatory factor analytic tests of measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*. 2007;14(4):611-635. doi: [10.1080/10705510701575461](https://doi.org/10.1080/10705510701575461).
62. Rutkowski L, Svetina D. Assessing the hypothesis of measurement invariance in the context of large-scale international surveys. *Educational and Psychological Measurement*. 2014;74(1):31-57. doi: [10.1177/0013164413498257](https://doi.org/10.1177/0013164413498257).
63. Chen FF. Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*. 2007;14(3):464-504. doi: [10.1080/10705510701301834](https://doi.org/10.1080/10705510701301834).
64. Rosseel Y. lavaan: An R Package for Structural Equation Modeling. *J Stat Softw*. 2012;48(2):1-36. doi: [10.18637/jss.v048.i02](https://doi.org/10.18637/jss.v048.i02).
65. Finney SJ, DiStefano C. Nonnormal and categorical data in structural equation modeling. In G. R. Hancock & R. O. Mueller (Eds.), *Structural equation modeling: A second course* (pp. 439-492). IAP Information Age Publishing; 2013.
66. Bonniga R, Saraswathi DA. Literature review of Cronbach alpha coefficient and mc donald's omega coefficient. *Eur J Mol Clin Med*. 2020;7(06):2943-49.
67. Purser RE, Milillo J. Mindfulness revisited: A Buddhist-based conceptualization. *J Manage Inquiry*. 2015;24(1):3-24. doi: [10.1177/1056492614532315](https://doi.org/10.1177/1056492614532315).
68. García Campayo J, Demarzo M. *Manual Práctico de Mindfulness*. Curiosidad y Aceptación. Siglantana; 2014.
69. Winton BG, Sabol MA. A multi-group analysis of convenience samples: free, cheap, friendly, and fancy sources. *Int J Soc Res Methodol*. 2022;25(6):861-76. doi: [10.1080/13645579.2021.1961187](https://doi.org/10.1080/13645579.2021.1961187).
70. Eichel K, Gawande R, Acabchuk RL, Palitsky R, Chau S, Pham A, et al. A retrospective systematic review of diversity

- variables in mindfulness research, 2000–2016. *Mindfulness*. 2021;12:2573-92. doi: [10.1007/s12671-021-01715-4](https://doi.org/10.1007/s12671-021-01715-4).
71. Berry JW. The role of psychology in ethnic studies. *Can Ethn Stud*. 1990; 23: 7-21.
 72. Virtbauer G, Shaw S. Understanding mindfulness: Current epistemological, methodological, and ethical issues. *SFU Forschungsbulletin*. 2017;5(2):22-49. doi: [10.15135/2017.5.2.22-49](https://doi.org/10.15135/2017.5.2.22-49).
 73. Shankland R, Tessier D, Strub L, Gauchet A, Baeyens C. Improving mental health and well-being through informal mindfulness practices: An intervention study. *Appl Psychol Health Well Being*. 2021;13(1):63-83. doi: [10.1111/aphw.12216](https://doi.org/10.1111/aphw.12216).