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# Propiedades psicométricas de la State Mindfulness Scale for Physical Activity 2 (SMS-PA2) en adultos brasileños

# Psychometric properties of the State Mindfulness Scale for Physical Activity 2 (SMS-PA2) in Brazilian adults

# Propriedades psicométricas da State Mindfulness Scale for Physical Activity 2 (SMS-PA2) em adultos brasileiros

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**RESUMEN**

El objetivo principal de la investigación fue estimar la evidencia de validez basada en la estructura interna y consistencia interna de la versión brasileña de la Escala de Atención Plena para la Actividad Física (SMS-PA2) en practicantes de ejercicio físico y deporte. La muestra incluyó 231 participantes entre 18 y 72 años. A través del análisis factorial confirmatorio, se encontró mejor ajuste en el modelo bifactorial (CFI = .990, TLI = .987, RMSEA = .035), con índices de consistencia interna adecuados. También se estimó la validez basada en relaciones con otras variables: afecto positivo, satisfacción con el ejercicio y afecto negativo. Se concluyó que la versión brasileña del SMS-PA2 es una medida válida y coherente con la estructura teórica bifactorial original, lo que favorece su uso para evaluar la atención plena en el contexto del ejercicio, con aplicaciones relevantes tanto para la investigación como para la práctica.

**Palabras clave:** Ejercicio, Evaluación Psicológica, Psicología del Deporte, Atención Plena, Validez

**ABSTRACT**

The main objective of this study was to estimate evidence of validity based on internal structure and internal consistency of the Brazilian version of the Mindfulness Scale for Physical Activity (SMS-PA2) in physical activity and sports practitioners. The sample included 231 participants aged between 18 and 72 years. Confirmatory factor analysis showed better fit for the bifactor model (CFI = .990, TLI = .987, RMSEA = .035), with adequate internal

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consistency indices. Validity evidence was also estimated based on relationships with other variables: positive affect, exercise satisfaction, and negative affect. The study concluded that the Brazilian version of SMS-PA2 is a valid measure, consistent with the original bifactor theoretical structure, supporting its use in assessing mindfulness in the context of physical activity, with relevant applications for both research and practice.

**Keywords:** Exercise, Psychological Assessment, Sport Psychology, Mindfulness, Validity

## RESUMO

O principal objetivo da pesquisa foi estimar a evidência de validade baseada na estrutura interna e na consistência interna da versão brasileira da Escala de Atenção Plena para a Atividade Física (SMS-PA2) em praticantes de exercício físico e esportes. A amostra foi composta por 231 participantes com idades entre 18 e 72 anos. Por meio da análise fatorial confirmatória, observou-se melhor ajuste no modelo bifatorial (CFI = .990, TLI = .987, RMSEA = .035), com índices adequados de consistência interna. Também foi estimada a validade com base nas relações com outras variáveis: afeto positivo, satisfação com o exercício e afeto negativo. Concluiu-se que a versão brasileira da SMS-PA2 é uma medida válida e alinhada à estrutura teórica bifatorial original, favorecendo sua utilização na avaliação da atenção plena no contexto do exercício físico, com aplicações relevantes tanto para a pesquisa quanto para a prática.

**Palavras-chave:** Exercício, Avaliação Psicológica, Psicologia do Esporte, Atenção Plena, Validade

## INTRODUCTION

Mindfulness can be defined as a psychological state characterized by the concentration of attention on the present moment by adopting an attitude of acceptance and non-judgment about experiences (Bishop et al., 2004; Brown & Ryan, 2003). The literature in Sport and Exercise Psychology has shown evidence that supports the potential of mindfulness during physical and sports activities to facilitate the experience of well-being, sports performance, positive emotions and motivation to carry out these activities (Ullrich-French & Cox, 2020; Peixoto et al., 2019; Popa et al., 2020; Latino et al., 2021;); contributing to greater engagement and maintenance over time (Cox et al., 2022). Nonetheless, there is still a shortage of specific mindfulness measures for the context of exercise and sport, which limits the development of research in the area. To contribute to filling this gap in the Brazilian context, this research aims to estimate the validity evidence based on internal structure and relations to other variables of the extended version of the State Mindfulness Scale for Physical Activity (SMS-PA, Cox et al., 2016), the SMS-PA 2 (Ullrich-French et al., 2022).

The original version of the SMS-PA had 12 items developed to assess the mental and physical mindfulness state during the practice of physical and sports activities. The instrument's items were based on the State Mindfulness Scale (SMS) authored by Tanay and Bernstein (2013). The SMS is composed of two factors, body mindfulness, and mental mindfulness; however, experiences that are potential targets of mindfulness in physical activity and sports, such as muscle engagement, effort (Lara-Cobos et al., 2024), and movements performed during practice (Martín-Miguel, et al., 2025), were not adequately represented, so new items were developed for movement contexts (Cox et al., 2016). Exploratory and confirmatory analyses indicated the adequacy of a bifactor model, composed of 12 items divided into two specific factors (i.e., physical mindfulness and mental mindfulness) and a general one (i.e., state mindfulness). All indicators had good levels of internal consistency; the alpha coefficient was greater than .80. The instrument was adapted to other languages, such as Spanish (Ullrich-French et al., 2017a; 2017b), Italian (Bisagni et al., 2018), and Brazilian-Portuguese (Peixoto et al., 2019), with adequate psychometric properties, like the stability of the factorial structure and high levels of internal consistency (i.e., for Spanish, for Italian, and for Brazilian-Portuguese).

Validity evidence based on relations to other variables indicated moderate positive correlations between mindfulness and intrinsic motivation for physical activity and sport (Peixoto et al., 2019). Additionally, consistency can be observed in a greater magnitude association between the body mindfulness dimension with this external variable when compared to the mental mindfulness subscale, as well as the identification of differences in groups practicing yoga and other physical activities (Ullrich-French et al., 2021). The average total mindfulness score among yoga practitioners was significantly higher compared to the average score of those engaged in other types of activities. These findings support the hypothesis that yoga is inherently a practice that promotes mindfulness (Cox et al., 2016). However, caution is advised when extrapolating these results, as the analysis of measurement invariance between yoga practitioners and non-practitioners did not show consistent invariance at the scalar level.

The instrument was also assessed regarding the parameters of the items (i.e., difficulty, item adjustment indices, and item-theta correlations) and participant characteristics (i.e., level of intensity in the construct/theta) using the Rating Scale Model; results show that the items related to the mental mindfulness factor were more difficult to endorse than the items of body mindfulness, the items' difficulty estimation provided an understanding of the continuum represented by items' content, which corroborates the hypothesis presented by Ullrich-French and Cox (2020) of a gap in the assessment of the quality of the state of awareness experienced in the physical activity context (i.e., body and mental levels). Additionally, the items presented good fit indexes, infit/outfit ranged between .62 and 1.27, a good level of Rasch reliability (.85), and a moderated/strong item-theta correlation (Peixoto et al., 2023).

Although the development of the SMS-PA has encouraged and operationalized research in the context of sports and exercise, some limitations were identified. Ullrich-French and Cox (2020) pointed out that the measure is adequate to assess the monitoring of mental and physical experience, a mechanism that concerns the use of conscious attention to understand the experiences of the present moment; however, it is inadequate to assess the acceptance of these states, which refers to an orientation towards the present moment with an attitude of openness and receptivity. Beyond its emphasis on enhancing athletic performance, both practical applications and research on mindfulness in the sports context indicate that this approach is frequently integrated with the concept of acceptance. Acceptance, in turn, is widely acknowledged as a fundamental component of mindfulness-based interventions and constitutes a central element of the traditional definition of mindfulness.

A large cross-sectional study of 720 Chinese university students (Guo, 2025) found that those who engaged in regular physical exercise scored higher on mindfulness, which in turn was linked to better emotional outcomes. Exercise was associated with greater mindfulness and resilience, which predicted higher positive affect and lower psychological distress. A study with adults that completed moderate exercise under three conditions: with mindfulness guidance, without mindfulness, or mindfulness alone suggested that integrating mindfulness into workouts can make exercise feel easier and increase immediate positive affect (exercise enjoyment/pleasure) without compromising performance (Solk et al., 2023).

In Brazil, a 12-week intervention in a vulnerable community combined weekly contemplative practice (i.e., socioemotional learning with mindfulness techniques) and group physical activity (Torres-Cruz et al., 2025). Participants in the intervention showed significant reductions in negative affect and lower depression scores compared to a control group, and their qualitative feedback indicated that the program also alleviated stress and anxiety and improved their sense of vitality. This real-world trial highlights that integrating mindfulness-based emotional skills with exercise can improve mood (less negative affect) in adult populations, even under high-stress conditions (e.g., pandemic recovery in a *favela*). Thus, mindfulness can serve as a psychological resource, amplifying the emotional benefits of exercise.

In this regard, within athletic environments, mindfulness involves not only the monitoring of internal experiences but also acceptance, understood as the willingness to experience thoughts, emotions, and physical sensations without judgment or attempts to avoid them. When athletes are able to fully direct their attention to the present moment, they become more capable of accessing and executing previously acquired skills with accuracy and

fluidity. Furthermore, the awareness and acceptance of internal states reduce the likelihood of automatic or negative responses to discomfort, allowing attention to remain focused on the task at hand, free from internal defensive mechanisms (Birrer et al., 2023). Accordingly, the inclusion of mental and bodily acceptance subscales in the SMS-PA2 reflects this theoretical and practical duality. While monitoring facilitates a clear perception of present-moment experiences, acceptance fosters a non-reactive stance toward these experiences, thereby supporting emotional regulation and adaptation to challenging situations (Ullrich-French et al., 2021).

Thus, the instrument can be expanded through the development of new items that assess the quality of attention oriented to the present moment during the practice of physical activity. The SMS-PA 2 was then expanded by adding new items to address the acceptance of bodily (e.g., "I acknowledged how my body felt without trying to change it") and mental experiences (e.g., "I accepted my thoughts/emotions without judging them"); factors were named monitoring of the mind (i.e., 6 items), monitoring of the body (i.e., 6 items), accepting of the mind (i.e., 3 items), and accepting of the body (i.e., 4 items, Ullrich-French & Cox, 2021).

The original version of the SMS-PA (Cox et al., 2016) prioritized the monitoring aspect of mindfulness (the observation of physical sensations and mental states), but did not include items that explicitly assessed the non-judgmental acceptance of such experiences, a critical gap highlighted by subsequent studies (Ullrich-French & Cox, 2020). In this regard, the new items introduced in the SMS-PA2 were specifically developed to capture this missing dimension, thereby enabling a more accurate assessment aligned with the original theoretical construct. For instance, in high-pressure sport contexts, athletes may be able to monitor their anxiety (via the monitoring subscale); however, it is the element of acceptance that enables them to cope with it without self-criticism, thus preventing performance decline (Birrer et al., 2023). Research using the original version of the scale found that although monitoring was associated with intrinsic motivation, the lack of an acceptance component limited the understanding of how athletes integrated challenging experiences (Peixoto et al., 2019). Thus, the inclusion of these new items in the SMS-PA2 not only addresses this theoretical limitation but also enhances the practical utility of the scale.

Studies of the psychometric properties of the SMS-PA 2 indicated adequacy of the bifactor structure composed of four specific factors and one general factor (i.e., $\chi^2$(df)= 234.85 (127), RMSEA= .07, SRMR= .06; CFI= .98 and TLI= .96). The alpha coefficient varied between .75 (i.e., accepting of the mind) and .89 (i.e., monitoring of the mind). Additionally, a reduced version of the instrument was proposed with four items for each dimension and three items for the dimension accepting the mind; the short version also presented adequate fit-indexes (i.e., $\chi$2(df)= 124.53(69), RMSEA= .06; SRMR= .05; CFI= .98 and TLI= .98), internal consistency (i.e., alpha coefficient greater than .83), and validity evidence based on relations to other variables (i.e., intrinsic motivation, affect and emotions, state body image). The results indicated that the SMS-PA2 scores were positively associated with intrinsic motivation for exercise, state of body appreciation, remembered affect, and negatively with the state of body vigilance and state of anxiety (Ullrich-French et al. 2021).

Considering the multidimensionality and relevance of mindfulness to Sport and Exercise Psychology and the potential of the SMS-PA2 to measure the different dimensions of state mindfulness, our research is a continuation of the process of cultural adaptation of the SMS-PA into Brazilian Portuguese (Peixoto et al., 2019). Therefore, our aim is to adapt the SMS-PA2 and its short version.

## METHOD

### *Research Design*

This study follows a cross-sectional methodology (Ato et al., 2013) and was conducted in accordance with the Declaration of Helsinki, which outlines the fundamental ethical principles for research involving human participants, as well as the Ethical Standards in Research in Sport and Exercise Sciences (Harriss et al., 2019). It

was also conducted in compliance with Organic Law 3/2018, of December 5, regarding Personal Data Protection and the guarantee of digital rights.

***Participants and Procedures***

The sample consisted of 231 participants (volunteers), aged between 18 and 72 years ($M$ = 30.9, $SD$ = 12.2), 73.6% women, and 59.3% single. Regarding the educational level, 39.8% were undergraduate students, 15.2% had an undergraduate degree, and 21.6% had a graduate degree. Among the respondents, 51.9% reported practicing a sport or physical exercise with other people, and 85.3% practiced non-competitively. As for the time of practice, 29.4% practice for one to five years. The most frequently reported activities were strength training (56.7%), walking (22.9%), running (17.7%), and dancing (16.0%). Other commonly cited practices included functional training (11.7%), CrossFit (10.7%), and mind-body activities such as yoga and pilates (10.4%). Team sports such as basketball (10.0%), football (7.3%), and volleyball (3.5%) were also mentioned, though less frequently.

***Instruments***

*Sociodemographic Questionnaire.* Which allowed access to the main characteristics of the participants, such as sex, age, educational level, sport or physical exercise modality, time of experience, and time of investment in the activity.

*State Mindfulness Scale for Physical Activity (SMS-PA2).* The instrument assesses the state of mindfulness during physical exercise and sports and is composed of 19 items, which are answered on a five-point Likert scale. The SMS-PA2 factors are monitoring of the mind (i.e., 6 items, “I was aware of different emotions that arose in me”; Cronbach’s alpha = .89), monitoring of the body (i.e., 6 items, “I focused on the movement of my body”; Cronbach’s alpha = .87), accepting of the mind (i.e., 3 items, “I let my thoughts/emotions just be without fixating on them”; Cronbach’s alpha = .75), and accepting of the body (i.e., 4 items, “I was okay with experiencing the physical sensations in my body”; Cronbach’s alpha = .81) (Ullrich-French et al., 2021).

*Positive and Negative Affect Scale (PANAS).* The PANAS measures positive (e.g., pride, strong, vigorous) and negative affect (e.g., humiliated, irritated, nervous) through 20 items in the form of adjectives, answered on a Likert scale, ranging from 1 = *Completely disagree* to 5 = *Completely agree*. The positive scale had Cronbach’s alpha = .84, and the negative affect scale Cronbach’s alpha = .90 (Nunes et al., 2019).

*Satisfaction with the Practice of Physical Exercise Scale (SPES)***.** The SPES measures the perception of satisfaction with exercise practice. The scale consists of three items rewritten from the satisfaction with life scale (i.e., “My practice of physical activity is close to my ideal.”, “My conditions for practicing physical activities are excellent.”, and “I am satisfied with my practice of physical activity”). Internal structure studies indicate a unidimensional structure and a good reliability index (Cronbach’s alpha = .91) (Romano et al., 2024).

***Procedures***

Upon approval by the Ethics Committee of São Francisco University (31959220.6.0000.5514), data collection was conducted online via Google Forms. To participate, respondents had to voluntarily agree to take part in the study and confirm they were 18 years of age or older. Informed consent was obtained from all participants. Participants then completed a sociodemographic questionnaire, the State Mindfulness Scale for Physical Activity (SMS-PA2), the Positive and Negative Affect Scale (PANAS), and the Satisfaction with the Practice of Physical Exercise Scale (SPES), with an average duration of 20 minutes.

***Adaptation Process of the New Items SMS-PA2.*** The adaptation process for the new items incorporated into the expansion of the SMS-PA2, specifically three items in the mental acceptance factor and four items in the body acceptance factor, followed a methodology analogous to that employed in the initial Brazilian Portuguese version of the instrument, as developed by Peixoto et al. (2019). Initially, three independent translations from English to Portuguese were conducted to ensure semantic comprehensiveness. Subsequently, a synthesized version was consolidated through group discussions led by four researchers specialized in the field, aimed at adapting technical terminology and ensuring cultural equivalence. Following this, a back-translation (from Brazilian Portuguese to English) was performed and compared with the original text to verify conceptual compatibility and terminological consistency, in accordance with guidelines established by reference literature (AERA et al., 2014; Cid et al., 2022; ITC, 2017). This methodological rigor sought to preserve the construct validity and applicability of the adapted items, aligning with international best practices for the cross-cultural adaptation of research instruments.

***Data Analysis***

We tested a confirmatory factor analysis (CFA) using the MPlus software, considering the Weighted Least Squares with Mean and Variance Adjusted (WLSMV) estimation method from the polychoric correlation matrix, as the variables are ordinal. Four models were tested: (M1) corresponds to a one-factor model, (M2) corresponds to four oblique factors (i.e., monitoring **the** mind, monitoring the body, accepting of the mind, and accepting of the body), (M3) corresponds to a hierarchical model with four second-order factors and a general factor explaining the specific factors, (M4) corresponds to a bifactor model (i.e., each item loads on the general and the specific factor). For the short version, we considered only the bifactor model. We adopted the following parameters: CFI and TLI > .90, RMSEA < .08 considered adequate (Muthén & Muthén, 2012; Tabachnick & Fidell, 2019). We used Cronbach's alpha and McDonald's omega coefficients to evaluate the instruments' reliability indicators. Values equal to or greater than .70 were considered good indicators (Brown, 2015). To evaluate the bifactor model, the following indices were considered: the omega coefficient (ω) and hierarchical omega (ωh), common variance explained (ECV) (Sijtsma, 2009), and the percentage of uncontaminated correlations (PUC) (Reise et al., 2013). For data interpretation, when ωh is high (>0.80), it indicates that the total scores can be considered essentially unidimensional (Reise et al., 2013). ECV and PUC >0.7 suggest that the relative bias is mild and the common variance is essentially unidimensional. However, when PUC values are below 0.8, ECV >0.6, and ωh >0.7 (of the general factor), it suggests that the possibility of some multidimensionality is not significant enough to entirely dismiss the interpretation of the instrument as essentially unidimensional (Rodriguez et al., 2016a; Rodriguez et al., 2016; Reise et al., 2013). These indices were calculated using the Bifactor Indices Calculator (Dueber, 2017). Finally, to verify the relationship between the variables, we used Pearson's coefficient correlation.

## RESULTS

Regarding validity evidence based on internal structure, we tested different models to verify which would be more suitable for the Brazilian sample: one-factor, four oblique factors, hierarchical, and a bifactor model. All fit indexes are shown in Table 1. The bifactor structure was the best solution, which is similar to the original version of the instrument. The short form also showed a good fit with a bifactor structure.

**Table 1**

*Comparison of the Confirmatory Factor Analysis of the Four Models.*

| Model Test | $\chi^2$ | df | $\chi^{2/df}$ | CFI | TLI | RMSEA (CI 90%) |
|---|---|---|---|---|---|---|
| **One-factor** | 594.979 | 152 | 3.914 | .829 | .807 | .132 (.122, .141) |
| **Four Oblique Factors** | 260.919 | 146 | 1.787 | .984 | .981 | .041 (.026, .054) |
| **Hierarchical** | 286.669 | 148 | 1.937 | .965 | .959 | .060 (.049, .072) |
| **Bifactor** | 222.718 | 133 | 1.675 | .990 | .987 | .035 (.015, .049) |
| **Short-form Bifactor** | 129.502 | 75 | 1.727 | .992 | .989 | .033 (.001, .053) |

*Note.* $\chi^2$ = Chi-Square, df= degree of freedom, CFI= comparative fit index, TLI= Tucker-Lewis index, RMSEA= root mean square error of approximation, CI = confidence interval.
$\chi^2$/df (Chi-Square divided by Degrees of Freedom): Values ≤ 3 indicate an adequate fit. CFI and TLI: Values ≥ 0.90 suggest a good fit; values ≥ 0.95 indicate excellent fit. RMSEA and SRMR: Values ≤ 0.08 are considered acceptable; values ≤ 0.05 are ideal.

Table 2 presents the factor loadings of the items of each factor for the SMS-PA2 and SMS-PA2-Short Version. We can observe that for the full version, all items had loadings higher than .30; some items were better explained by the specific factor (i.e., items 2 to 5 from the monitoring of the mind factor). The same result was replicated in the short version; however, two items (i.e., items 1 and 2) from the accepting of the body factor were better explained by the general factor. The internal structure of the two versions of the scale, measured with coefficients omega and alpha, were >.70.

**Table 2**

*Bi-factor model of the Brazilian Version of the SMS-PA2 and the Short Version*

| SMS-PA2 | | | | | | | SMS-PA2-Short Version | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Items | Specific factors | | | | GF | Variances | Items | Specific factors | | | | GF | Variances |
| | MM | MB | AM | AB | | | | MM | MB | AM | AB | | |
| 1 | .381 | | | | .442 | .688 | 2 | .740 | | | | .227 | .469 |
| 2 | .724 | | | | .167 | .519 | 3 | .852 | | | | .213 | .332 |
| 3 | .776 | | | | .242 | .398 | 4 | .879 | | | | .129 | .256 |
| 4 | .834 | | | | .227 | .365 | 5 | .580 | | | | .388 | .729 |
| 5 | .846 | | | | .139 | .321 | 3 | | .515 | | | .593 | .356 |
| 6 | .554 | | | | .439 | .711 | 4 | | .700 | | | .536 | .186 |
| 1 | | .544 | | | .454 | .463 | 5 | | .616 | | | .551 | .240 |
| 2 | | .516 | | | .552 | .388 | 6 | | .578 | | | .493 | .455 |
| 3 | | .488 | | | .654 | .310 | 1 | | | .507 | | .535 | .704 |
| 4 | | .569 | | | .604 | .259 | 2 | | | .361 | | .669 | .604 |
| 5 | | .450 | | | .626 | .305 | 3 | | | .315 | | .493 | .915 |
| 6 | | .536 | | | .543 | .450 | 1 | | | | .060 | .710 | .446 |
| 1 | | | .487 | | .530 | .743 | 2 | | | | .190 | .767 | .455 |
| 2 | | | .435 | | .622 | .608 | 3 | | | | .471 | .735 | .287 |
| 3 | | | .389 | | .441 | .909 | 4 | | | | .298 | .694 | .519 |
| 1 | | | | .334 | .677 | .475 | | | | | | | |
| 2 | | | | .397 | .689 | .444 | | | | | | | |
| 3 | | | | .487 | .663 | .389 | | | | | | | |
| 4 | | | | .452 | .625 | .488 | | | | | | | |
| ω | .880 | .899 | .731 | .838 | | | ω | .896 | .882 | .731 | .838 | | |
| α | .877 | .899 | .729 | .837 | | | α | .894 | .882 | .729 | .837 | | |

*Note.* MM = monitoring the mind, MB = monitoring the body, AM = accepting the mind, AB = accepting the body, GF = general factor; ω = McDonald's omega, α = Cronbach's alpha

Additionally, the results of the bifactor structure indicate that the common variance explained (AVE) by the general factor (GF - Mindfulness) was significantly higher than that of the specific factors in both the original and abbreviated models, as illustrated in Table 3. This suggests that the items of the scale are predominantly influenced by the general mindfulness factor, rather than the specific dimensions. These findings support the robust fit indices obtained in the confirmatory factor analysis (CFA), reinforcing the appropriateness of the bifactor model as the most parsimonious and theoretically aligned structure for measuring the state of mindfulness during physical activity. Regarding the reliability indices, the general factor showed consistently higher omega (ω) values compared to the specific factors, highlighting its dominance in explaining the shared variance. However, the hierarchical omega (ωh), which assesses the unique contribution of the general factor after controlling for the influence of the specific factors, was found to be lower only than the value obtained for the monitoring the mind (MM) factor in both the original and abbreviated versions.

**Table 3**

*Indices of the bifactor structure of SMS-PS2*

| SMS-PA2 | | | | | | SMS-PA2 Short Version | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Indices** | **GF** | **MM** | **MB** | **AM** | **AB** | **Indices** | **GF** | **MM** | **MB** | **AM** | **AB** |
| ECV | .467 | .270 | .146 | .052 | .064 | ECV | .492 | .258 | .159 | .053 | .038 |
| ω | .937 | .889 | .899 | .732 | .866 | ω | .931 | .883 | .887 | .736 | .861 |
| $\omega_h$ | .691 | .765 | .404 | .295 | .246 | $\omega_h$ | .719 | .804 | .489 | .241 | .094 |
| PUC = .772 | | | | | | PUC = .800 | | | | | |

*Note.* Factors: MM = monitoring the mind, MB = monitoring the body, AM = accepting the mind, AB = accepting the body, GF = general factor; ECV = common variance explained; Indices: ω = omega coefficient, ωh = hierarchical omega, PUC = Percent of Uncontaminated Correlations

In Table 4 are presented the correlations, the full version (i.e., below the diagonal) and the short version (i.e., above the diagonal). We omitted the correlation of the factors accepting of the mind and accepting of the body because they have the same items for the full and short versions. Positive affect positively correlated with all the SMS-PA 2 factors, and negative affect negatively correlated with factors related to body perception (i.e., monitoring of the body and accepting of the body). These results suggest that a mindful state increases positive affect and decreases negative affect toward body perception during physical activity. Exercise satisfaction positively correlated with all the SMS-PA 2 factors except for monitoring of the mind, which suggests that monitoring of the mind may not contribute to satisfaction. Monitoring without acceptance can be a negative or positive experience, and due to that, determining the directionality in the relationship between the variables is not possible.

**Table 4**

*Descriptive Statistics and Correlations Among Constructs Measured*

| Variable | Mean±sd | MM | MB | AM | AB | PA | AN | SWE |
|---|---|---|---|---|---|---|---|---|
| MM | 3.91±.,86 | — | .228** | .148* | .116 | .264** | .149* | .047 |
| MB | 4.15±.77 | .344** | — | .389** | .546** | .438** | -.103 | .381** |
| AM | 2.52±.73 | .193* | .395** | — | | | | |
| AB | 3.91±.87 | .195* | .541** | .672** | — | | | |
| PA | 3.92±.72 | .337** | .428** | .249** | .377** | — | | |
| NA | 1,89±.81 | .090 | -.133* | -.090 | -.245** | -.167* | — | |
| SWE | 4.4±1.61 | .128 | .404** | .260** | .322** | .529** | -.168* | — |

*Note.* *$p$<.05; **$p$<.01; Factors: MM = monitoring of the mind, MB = monitoring of the body, AM = accepting of the mind, AB = accepting of the body; AP = positive affect, NA = negative affect; SWE= Satisfaction with exercise.

## DISCUSSION

In this study, we investigated the validity evidence based on internal structure and relations to other variables and reliability for the extended version of the State Mindfulness Scale for Physical Activity and its short version (SMS-PA2, Ullrich-French et al., 2021). The results demonstrated the instrument's adequacy in its Brazilian version and corroborated the study proposed by Ullrich-French et al. (2021).

The results from this study add to the empirical data demonstrating that the bifactor model is the best to assess the construct, as it sustains a certain degree of dependence between factors, with adequate internal consistency indexes. These results indicate that the instrument can estimate the scores of the factors comprising mindfulness with a low level of error associated with the measurement (Tabachnick & Fidell, 2019). The short version also presented good reliability indexes, which is consistent with its long-version results. Ullrich-French et al. (2021) observed similar results when testing a bifactor model of the SMS-PA2 short version.

This study makes an important contribution to the literature by adapting this second version of the scale, the SMS-PA2, for the Brazilian context and by providing evidence demonstrating its potential for assessing two key dimensions of the state of mindfulness during the practice of physical activity. Ullrich-French et al. (2021) proposed the differentiation between monitoring (mental and body) and acceptance (mental and body), and this model was tested in the present research. According to the theory commonly used to define mindfulness, Monitor and Acceptance Theory (MAT: Lindsay & Creswell, 2017), there is the need to include items on acceptance due to its importance for understanding positive outcomes. In this sense, the different factors include thoughts and emotions, which represent the mental aspects, and physical sensations, which represent the bodily aspects, as well as the levels of acceptance and non-judgment of each of these experiences (Ullrich-French et al., 2021; Lindsay & Creswell, 2017). To the best of our knowledge, this is the first instrument differentiating monitoring (mental and body) and acceptance to be available in the Brazilian culture. Thus, this study contributes to further evidence of this model.

This expanded SMS-PA2 assesses both monitoring and acceptance during movement practices, contributing to a more comprehensive understanding of state mindfulness in physical exercise (Ullrich-French et al., 2021). The inclusion of items that assess acceptance in the scale makes it possible to capture the core elements of mindfulness, including non-judgmental awareness and acceptance of present-moment experiences. This fosters a more effective understanding of how mindfulness affects the experience and the results of physical exercise in the Brazilian culture. In summary, acceptance is an important component of mindfulness, especially in physical exercise practice, when people may experience psychological and physical discomfort.

As proposed by Ullrich-French et al. (2021), the present research also evaluated the reduced adapted 15-item version of the SMS-PA2. The results showed the adequacy of the internal structure. A shortened version facilitates its use in situations where there is little time available, for example, exercise practices assessment of the association between levels of mindfulness and other psychological constructs. In this sense, it is worth noting that the factors in the short version of the SMS-PA2 showed positive correlations with external variables like those estimated using the full version. Thus, despite a reduced number of items, this version maintained psychometric quality.

Furthermore, we specifically examined the fit indices of the bifactor structure to investigate the common variance explained by the general factor (Mindfulness) and the specific factors (MM, MB, AM, AB). The results showed that the bifactor model was more suitable for the structure of the SMS-PA2 than a correlated factor model. This is because the indices reveal that, although mindfulness has a strong general component (captured by the GF factor, which explains 46.7% of the common variance in the original version and 49.2% in the shortened version), it is not dominant enough to justify a purely unidimensional interpretation (since the ECV is below .600). The reliability coefficients (ω) for the general factor are high (.937 in the original version and .931 in the shortened version), confirming its robust internal consistency. Additionally, the hierarchical omega (ωh) for the general factor (.690 in

the original version and .720 in the shortened version) indicates that total scores should not be treated as entirely unidimensional, as there is still a relevant influence from the specific factors.

Among the specific factors, monitoring the mind (MM) stands out with an ωh of .765 (original) and .804 (shortened), indicating a significant unique contribution, particularly in the abbreviated version. On the other hand, monitoring the body (MB), although exhibiting high reliability (ω ≈ .890 – .900), has a lower ωh (.404 – .489), reflecting a greater shared variance with the general factor. The acceptance factors (AM and AB) show very low ωh values (.241 – .295 for AM and .094 – .246 for AB), signaling that they are not distinct from the global construct, which raises questions about their practical utility as independent dimensions.

The Percent of Uncontaminated Correlations (PUC = .770 – .800) shows that, despite the multidimensionality, it is not strong enough to invalidate the interpretation of the general factor, especially in the shortened version. Thus, the bifactor model provides a more balanced approach: using the total score of the general factor for a broad view of mindfulness, while the specific factors (primarily MM) can be explored for more detailed analyses. In contrast, a correlated factor model would overlook the hierarchy of the construct and overestimate the independence of minimally distinct dimensions (such as AM and AB), leading to less accurate interpretations. Therefore, the bifactor structure is the most appropriate, as it integrates the global influence of mindfulness with specific nuances, without distorting the reality of the data.

It is important to note that the bifactor model addresses limitations of traditional approaches by allowing specific factors to be analyzed independently of the general factor, without overlap or confusion between their contributions. For example, in an athlete, the global mindfulness score may indicate their overall level of mindfulness, while specific factors, such as body monitoring, reveal their ability to perceive physical sensations during exercise, independent of global awareness. This structure is particularly useful in practical contexts because it provides separate reliability estimates for both the general score and the subscales. This means that professionals can rely on the global measure for broad assessments, as well as on specific scores for targeted interventions. Therefore, while the general factor explains much of the common variance, specific factors, such as mind monitoring (with ωh ≈ .760 – .800), add critical information for understanding the nuances of the construct. In this way, it avoids distortions from correlated models, which would treat minimally distinct dimensions as entirely independent, disregarding their interdependence with the general factor. In sports environments, this translates into more precise interventions.

Our results corroborated the evidence of a positive association between mindfulness, positive affect, and satisfaction with exercise practice (Cox et al., 2016) which works as convergent validity for the scores of the instrument. In a Brazilian sample of physical activities practitioners' similar results were found, except for monitoring of the mind, which negatively correlated with negative affect (Peixoto et al., 2023). The authors reference the literature on mindfulness (Tanay & Bernstein, 2013), which suggests that heightened mental awareness does not always guarantee a positive perception. This is because mental mindfulness encompasses a variety of mental experiences that can range from positive to negative. Additionally, the study emphasizes the backdrop of the COVID-19 pandemic during which the research was conducted. Physical activity routines underwent adjustments, like transitioning to home-based training, due to the closure of sports centers, gyms, and other exercise venues. This altered social context potentially played a role in fostering negative emotions during these practices.

Mindfulness factors were positively associated with positive affect and satisfaction with physical exercise and negatively associated with negative affect. This suggests that the scale is capturing expected aspects of conscious and positive experiences, not related to not measuring dysfunctional emotional aspects during physical activity which supports the convergent and discriminant validity of the instrument. Studies indicate that mindfulness practices have the potential to promote increases in positive affect and emotion regulation (Li et al., 2022). Specifically, these practices have been associated with increases in the activities in brain regions related to positive

affect while decreasing activity in regions associated with negative affect. Additionally, the subjective evaluation of the self in either a positive or negative light serves as a signal of one's internal state. An enhanced capacity to focus on internal experiences may therefore facilitate more accurate identification and interpretation of these signals (Shiota et al, 2021). Considering that mindfulness also has a non-judgmental aspect, even a negative feeling can be acknowledged and accepted, which may support the integration of mixed feelings and contribute to emotional processing and regulation and coping (Sousa et al., 2024). Mindfulness-based interventions have been used as strategies to reduce depression and anxiety symptoms, resulting in elevated levels of well-being (Ullrich-French et al., 2017b). When practicing sports, high levels of mindfulness are experienced, suggesting a tendency for people to acknowledge and accept different internal and external stimuli, body sensations, and emotional and cognitive responses. In addition, practitioners might be able to redirect thoughts and behaviors by inducing state mindfulness, thus improving the chance of increasing positive affect and well-being levels (Brown & Ryan, 2003; Cox et al., 2016). Also, activity practice can improve the perception of subjective well-being and quality of life (Vaquero-Solis et al., 2024).

It is worth noting that the mind monitoring factor showed more modest correlations with exercise satisfaction, in contrast to the stronger correlations observed for body monitoring and mind-body acceptance. This discrepancy may be explained by the fact that mental monitoring during physical activity is not necessarily a positive experience. While body monitoring is often linked to objective physical sensations (e.g., heart rate, breathing), mind monitoring involves the observation of thoughts and emotions that may be either adaptive (e.g., motivation) or dysfunctional (e.g., self-criticism, worry). Without the concurrent practice of acceptance, mental monitoring can lead to rumination or hyperfocus on negative internal states, thereby reducing satisfaction with the activity (Peixoto et al., 2019; Ullrich-French et al., 2021). For instance, athletes who monitor thoughts of insecurity ("Will I be able to finish the workout?") without accepting them as transient may experience frustration, ultimately undermining satisfaction. This phenomenon is particularly relevant in non-competitive exercise contexts, where performance pressure is lower, yet self-criticism may still persist.

When it comes to the background of the body mindfulness experience in the context of sports, Peixoto et al. (2023) investigated the effects of intrinsic and extrinsic motivation (Pelletier et al., 2013), as well as indicators of harmonious and obsessive passion (Vallerand, 2015). The results indicated that intrinsic motivation positively and significantly predicted the body's mindfulness experience during sports practice. Additionally, this association was mediated by the harmonious passion established by the sports modality. No significant associations were observed between extrinsic motivation and obsessive passion. These findings suggest two engagement processes with sports practice: one associated with self-determined behavior mediated by harmonious passion, resulting in the experience of mindfulness, and another stemming from extrinsic motivation, resulting in an obsessive passion for the activity.

Finally, in the present research, it is evident that the body monitoring and body acceptance factors had the highest magnitudes of correlation with positive indicators (i.e., positive affect and satisfaction with exercise) when compared to the mental aspects, corroborating the results of Ullrich-French et al. (2022). The authors report that the factors that reflect body experience, monitoring, and acceptance seem to provide more robust associations with a positive experience in the exercise context compared to those that reflect mental experiences. Body experience is an essential component of physical activity itself and is perceived and accessed more directly during exercise. Thus, during physical activity, individuals may be more aware of their bodily sensations, such as breathing and heartbeat, than of their thoughts or emotions. Nonetheless, it is important to highlight that these perceptions may vary between people and are subject to the influence of different individual factors (Peixoto et al., 2023). In this sense, both monitoring and body acceptance play a key role in the mindfulness experience during physical exercise and contribute to a positive and healthy experience. Finally, the inclusion of acceptance items in the SMS-PA2 has important practical and theoretical implications. Researchers can use it to better understand phenomena related to mindfulness in physical exercise and to assess individual levels of mindfulness during physical activity, and it serves as a basis for adapting interventions as perceptions change.

## PRACTICAL APPLICATIONS

The adaptation of the SMS-PA2 to Brazilian Portuguese was a process that went beyond literal translation, incorporating cultural values and everyday expressions that uniquely shape how individuals reflect and experience the self. This approach not only ensured the psychometric validity of the scale, but also grounded it in the multifaceted reality of Brazil, where the body and mind are experienced through distinct social and aesthetic lenses. With respect to practical applications, the scale demonstrates strong potential to enhance mindfulness-based interventions in sport and physical exercise contexts. The bifactor structure of the scale, comprising a general mindfulness factor and specific subscales for monitoring and acceptance (both mental and physical), provides practitioners with a multidimensional tool for assessment and intervention (Ullrich-French et al. 2022).

For instance, in high-performance sports settings, coaches and sport psychologists may use the general factor scores to evaluate athletes' overall mindfulness levels, while the specific subscales allow for the identification of targeted difficulties (Reyes-Bossio & Vásquez-Cruz, 2024), such as challenges in accepting adverse physical sensations (e.g., extreme fatigue) or self-critical thoughts during training and competition or to overcome severe injuries (Marzorati & Lorusso, 2024). This facilitates the development of tailored interventions aimed at reducing pre-competition anxiety and enhancing emotional resilience during practice sessions; it can also help to improve techquines of ‘prep-talk’ of athletes (Ortíz-Velasco et al., 2025). In the context of exercise programs, the scale may be employed to foster adherence and safety, particularly among vulnerable populations. It can aid individuals undergoing rehabilitation in recognizing physical signals of exertion, thereby preventing injuries and promoting greater bodily awareness.

## FINAL CONSIDERATIONS AND LIMITATIONS

The present study brings new contributions by adapting and verifying new validity evidence for the State Mindfulness Scale for Physical Activity 2 (SMS-PA2). In general, the results obtained suggest the adequacy of the new version in a Brazilian sample, and the new acceptance items prove to be important for expanded coverage of the mindfulness experience, providing the expansion of knowledge in the theoretical and empirical field. However, some limitations should be pointed out, such as the fact that it was a convenience sample accessed through an online form. Furthermore, although the study achieved its methodological objectives, we recognize that the sample, while adequate for initial statistical analyses, has limitations in terms of representativeness and diversity, which may not reflect the heterogeneity of physical exercise and sports practitioners in Brazil. These aspects limit the generalization of the results to populations such as the elderly, elite athletes, or practitioners from regions with unequal access to sports infrastructure.

For future studies, we recommend stratified samples that include greater demographic and sports diversity, as well as comparative analyses between subgroups, thereby ensuring a more comprehensive understanding of the nuances of mindfulness in various physical exercise contexts. This approach would not only validate the results in various contexts but also allow for the exploration of how cultural and logistical factors influence the experience of mindfulness during physical activity. Additionally, considering the continuous advancement of technology and the rapid pace of information updates through social media, the ability to remain focused on the present moment and have a non-judgemental posture has become increasingly challenging. Therefore, future research should also explore how mindfulness training can contribute to other groups, such as coaches thar can beneficiate from midfulness training to improve their own performance and help with the emotional regulation (Díaz Ceballos et al., 2025), and other domains, such as the treatment of mental health disorders (Newton et al., 2024; Ríos Garit et al., 2024), and the development of psychological competencies like mental toughness (Stamatis et al., 2024) and physical activity enjoyment of (Bastos et al., 2025), which are essential for navigating the complexities of contemporary social dynamics.

Finally, there is a need for future investigations in which interpretive norms are established (through standardization studies), as well as invariance studies, to verify validity evidence as a function of sex, type of sport (modalities and sport participation) level) and exercise practiced, and international versions, in addition to verifying the level of difficulty of the new scale items through IRT. These investigations would enhance the utility of the scale and its alignment with international standards for cross-cultural validation. Furthermore, future studies could explore how cultural aspects shape the understanding of body–mind integration, particularly examining how perceptions of the body and mind in the Brazilian context may differ from those in other cultural settings.

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