SHORT VERSION OF THE PROFILE OF MOOD STATES (POMS-SV) IN PERSONS WITH SCHIZOPHRENIA: CONSTRUCT VALIDITY OF THE PORTUGUESE VERSION

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Abstract

The study aimed to assess the construct validity of the Portuguese short version of the Profile of Mood States (POMS-SV) for persons with schizophrenia. Additionally, a comparative analyse was conducted to explore the mood states according to different demographic variables. The sample consisted of 106 in and outpatients (n=47 women) with schizophrenia. Cronbach's alpha coefficient was used to assess internal consistency. Exploratory and confirmatory analyses were carried out to examine the factor structure and structural validity of the questionnaire, respectively. Mann-Whitney and Kruskal-Wallis tests were used to compare means differences of POMS subscales and total scales between sociodemographic groups. The Portuguese version of the POMS-SV revealed a model of 31 items and 6 factors with good internal consistency and good fit indexes for the application in persons with schizophrenia. Significant differences were found in gender, marital status, and engaged PA in the negative mood sub-scales. The POMS-SF exhibited good psychometric properties and appears to be a valid and reliable instrument to assess mood states in a population of both in and outpatients with schizophrenia. The results of the present study support its application in clinical practice and research with expanded usefulness in PA settings.

Keywords: POMS-SV, mood states, schizophrenia, structural validity, construct validity

Introduction

Moods refers to a host of short-term (within minutes to days) transient and fluctuating affective states that reflect how a person feels in general or at a particular moment (Searight & Montone, 2017). Moods range on a continuum from pleasurable to unpleasurable feeling states. Moods have also postural and behavioural indicators such as facial expressions and ways of walking (D. M. McNair, Lorr, M., & Droppleman, L. F., 1971; D. M. McNair, Lorr, M., & Droppleman, L. F. 1981, 1992). Shuare (1990) also argued that in moods coexistence different feelings in terms of type, meaning, and intensity affects both thought and behaviour concerning the environment and the person itself. Furthermore, moods represent a response to global analyses of everything that revolves around the subject (Bisquerra, 2000). Specific moods can be consistent over time and become permanent personality characteristics (Bisquerra, 2000).

Mood states can be positive and negative. Positive mood states are related to excited, alert, active, and vigorous

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moods. Negative mood states are related to angry, worn out, uncertain, grumpy, hopeless, fatigued, irritated, discouraged, exhausted, gloomy, tired, and furious (P. C. Terry, Lane A. M., Fogarty G. J. , 2003). Overall, mood is an integral component of daily life and is related to general behaviours, physical health, and mental well-being (Berger & Motl, 2000). People who have a higher level of satisfaction with physical and psychological health needs are associated with a better positive mood (Martinelli et al., 2023).

Physical activity (PA) is an essential key factor affecting mood (Berger & Motl, 2000; Wei et al., 2020) being advocated as a remedy for mood changes (Gerber, Holsboer-Trachsler, Puhse, & Brand, 2016). In a selective review of mood states (Berger & Motl, 2000), acute mood changes were reported in a variety of exercise types (e.g., aerobic dance, cycling, jogging, walking, Tai-Chi) for both men and women with different ages participating in moderate-intensity exercise for 20-75 minutes. Main acute mood benefits include decreases in tension, depression, anger, and confusion (Berger & Motl, 2000). It was demonstrated that higher intensity and expert-guided PA improves positive mood (Meyer et al., 2016). However, associations between exercise intensity and mood are not straightforward with only moderate exercise intensity being associated with improved mood (Searight & Montone, 2017). According to Berger and Motl (2000), mood changes are associated with exercise activities reported to be enjoyable and in which there is minimal interpersonal competition. Moreover, exercises characterized by routinized movements (e.g., swimming and jogging) seem to conduct to more consistent moods benefits compared with team sports (e.g., basketball) or fighting sport (e.g., fencing) due to the less predictable environment (Searight & Montone, 2017). Finally, it is also important to highlight that several studies also measure mood-associated exercise and health-related indices such as dietary intake, substance addiction, and the onset of specific diseases which are expected to influence mood fluctuation (Searight & Montone, 2017).

The Profile of Mood States Questionnaire (POMS) (D. M. McNair, Lorr, M., & Droppleman, L. F., 1971; D. M. McNair, Lorr, M., & Droppleman, L. F, 1981, 1992) is a multidimensional self-report psychological instrument assessing subjective feelings of mood. Both long and short forms of the instrument have been developed to target adolescents and adults (Heuchert & McNair, 2012; D. M. McNair, Lorr, M., & Droppleman, L. F. , 1981, respectively). Several studies explored the factorial structure of the POMS and provided support for the multidimensional structure of the questionnaire. The six POMS dimensions (Tension, Fatigue, Depression, Vigor, Hostility and Confusion) emerge as distinct mood factors (Heuchert & McNair, 2012; D. M. McNair, Lorr, M., & Droppleman,

L. F., 1971). However, depending on the study population characteristics or number of POMS items tested different factorial structures may be presented (e.g., D. M. McNair & Heuchert, 2013; Norcross, Guadagnoli, & Prochaska, 1984; Yokoyama, Araki, Kawakami, & Tkakeshita, 1990). Additionally, different correlational studies (Nyenhuis, Yamamoto, Luchetta, Terrien, & Parmentier, 1999; Patterson et al., 2006) demonstrated the construct validity of the POMS when crossing with other inventories assessing the affective domain such as the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) and the State-Trait Anxiety Scale (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Therefore, the POMS is considered a reliable and valid measure of mood (e.g., Andrade et al., 2010; Selvi, Gulec, Aydin, & Besiroglu, 2011; P. C. Terry, Lane, Lane, & Keohane, 1999; Viana, 2001).

The POMS has been widely used in trained individuals as a measure of mood in exercise settings (e.g., Chou et al., 2021; Samełko & Guszkowska, 2016; Selmi et al., 2023) and describes an "iceberg profile" (Bell & Howe, 1988; Morgan, 1985). This profile is described when athletes score highly on the vigor scale and lower on the negative mood subscales compared with the norms (Viana, 2001). The POMS "iceberg profile" is indicative of positive mental health (Martin, 2018).

Originally the POMS was developed to be used with the psychiatric population to assess the mood responses to pharmacology and psychotherapeutic treatment (D. M. McNair, Lorr, M., & Droppleman, L. F., 1971; D. M. McNair, Lorr, M., & Droppleman, L. F, 1981, 1992). Previous studies have adequately applied the POMS to the psychiatric population (e.g., Clausi et al., 2019; Patten et al., 2001), specifically psychosis (e.g.Bielinis, Jaroszewska, Lukowski, & Takayama, 2019) and schizophrenia (e.g., Kaneko & Okamura, 2019; Rokita et al., 2021). However, although exercise is considered the most effective technique for changing a bad mood in clinical settings (Thayer, Newman, & McClain, 1994), studies employing the POMS to examine the acute responses to PA in persons with schizophrenia are scant (i.e., Lavey et al., 2005; Maggouritsa et al., 2014). This is a considerable research gap that undermines the knowledge about the impact of regular practice of PA on the mental health of persons with schizophrenia.

Schizophrenia is a severe mental illness identified among the 10 leading causes of disability worldwide (World Health Organization, 2008). In 2019, 5% of the American population presented a diagnosis of severe mental illness, including schizophrenia. However, only 35% received proper treatment (American Psychiatric Association, 2022). This population is in a vulnerable status, with associated somatic health problems, poor mental health, and a lower average

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life expectancy compared with the general population (Thornicroft, 2011). Persons with schizophrenia can present with residual affective symptoms, fluctuating mood, or aggression, for which mood state can be tested (Wang, Xia, Helfer, Li, & Leucht, 2016). Depression is one of the main causes of mood disorders (Massoomi & Handberg, 2019) in this population. Decreases in depression symptoms are associated with increases in general mood (Carreno et al., 2023). Physical activity is recommended as an adjunctive treatment in persons with schizophrenia (Stubbs et al., 2018; Vancampfort, Probst, Knapen, Carraro, & De Hert, 2012). Firth, Cotter, Elliott, French, and Yung (2015) conducted a systematic review and meta-analysis about exercise intervention in persons with schizophrenia and concluded that any moderate to vigorous exercise, including jogging, cycling, sports, or resistance training, regardless of type and lasting at least 90 minutes per week, has a positive effect on mood symptoms supporting a general approach to PA. Therefore, PA can also be an important self-regulation of mood strategy for this population.

There is limited comprehensive psychometric analysis of the POMS in individuals with schizophrenia. To the best of our knowledge only study Norcross et al. (1984) explored the psychometric properties of the POMS in a sample of American psychiatric outpatients but it was not possible to conclude if persons with schizophrenia were included. Specifically in the Portuguese context, Viana (2001) proved the construct validity of the POMS in a sample of adolescents and adults' practitioners and non-practitioners of different sports and exercise programs. The previously mentioned authors also highlighted the need to validate the POMS for the Portuguese psychiatric population and in the field of psychology.

Overall, in both national and international contexts, there is a dearth of research exploring the psychometric features of the POMS in a specific psychiatric population with schizophrenia. Therefore, the purpose of the study was to examine the construct validity of the Portuguese version of Profile and Mood States-Short Version (POMS-SV) in persons with schizophrenia. Additionally, a comparative analysis was conducted to explore the mood states according to different demographic variables.

Methods

Participants

One hundred and six participants with schizophrenia were recruited from five different psychiatric rehabilitation units (in- and outpatients) situated in the northern region of Portugal. Different health professionals selected the participants according to the following the inclusion criteria: i) males and females more than 18 years old: ii) a diagnosis of schizophrenia (any type) according to the Diagnostic and Statistical Manual of Mental Disorders – 5 (DSM-5) established by experienced psychiatrists responsible for the patient´s treatment; and iii) psychiatrically stable on psychotropic medication (i.e., no medication changes within the last month).

Exclusion criteria: i) inability to provide informed consent or to speak Portuguese; ii) inability to concentrate for at least 20 minutes (as determined by the treating psychiatrist); iii) presence of neurological disorders; iv) substance abuse in the last six months; v) diagnosis of severe intellectual disability, or vi) hospitalization in the previous three months.

Data collection occurred twice during scheduled psychiatric visits in each rehabilitation unit.

The study was led following the Declaration of Helsinki. Written informed consent was obtained from all participants after understanding the risks and benefits of the participation. The study procedure was approved by the Ethics Committee of the Faculty of Sports (CEFADE 11.2022) and of each psychiatric unit

Instruments

The Profile of Mood States (POMS) (Lorr, 1988) is a measure of subjective feelings of mood. The Portuguese short version of the Profile of Mood States (POMS-SV) (Viana, 2001) consists of 42 mood-related adjectives which form the basis of 6 mood states each of them with 6 items: Tension-Anxiety (T), Fatigue-Inertia (F), Depressed-Dejected (D), Hostility-Anger (H), Confusion-Bewildering (C), Vigor-Activity (V) and a training distress subscale. Of the six factors analysed, only the Vigor factor is a positive mood state. A global score on Total Mood Disturbance (TMD) can be obtained by calculating the sum of the scores (T + D + H + F + C), except for Vigor-Activity, which is subtracted. A constant of 100 is added to obtain the final score and avoid an overall negative result (Viana, 2001). A higher TMD score indicates a greater degree of mood disturbance.

Participants were instructed to rate the mood-related adjectives in a 5-point Likert scale ranging from (0) "Not at all/Nada" to (4) "Extremely/Muitíssimo" for the period of the "past week, including today". The values of one item from the tension-anxiety factor (29 - Tranquilo) and two items from the confusion-bewildering (26 – Eficaz; 35 – Competente) are inverted to rate all the items in the same direction.

For the present study, only 36 items were considered. The training distress subscale was removed since it is a specific subscale of the Portuguese version of the POMS for trained athletes participating in a sports competition setting (Viana, 2001) which is not the setting of the present study.

Originally, the POMS was designed and validated for a psychiatric population showing an internal consistency ranging from 0.84 to 0.95 (D. M. McNair, Lorr, M., & Droppleman, L. F., 1971), test-retest reliability from 0.65 to 0.74, and concurrent validity with Minnesota Multiphasic Personality Inventory scales from -0.58 to 0.69. Similar results were reported by Norcross et al. (1984) and D. M. McNair, & Heuchert, J. W. P. (2005). More recently, the POMS was successfully applied in a psychiatric population (Patten et al., 2001), specifically psychosis (Bielinis et al., 2019) and schizophrenia (Kaneko & Okamura, 2019; Rokita et al., 2021).

The factor structure of the POMS was also evaluated in other clinical populations such as cancer (Baker, Denniston, Zabora, Polland, & Dudley, 2002; Cronbach's alpha = 0.78 to 0.91) and chronic pain (Lopez-Jimenez, Cano-Garcia, Sanduvete-Chaves, & Chacon-Moscoso, 2021; Cronbach's alpha = 0.75 to 0.91).

At the national level, the Portuguese version of the POMS-SV (Viana, 2001) is a considered valid and reliable instrument to be applied in a general population of athletes with an internal consistency ranging from 0.72 to 0.91. However, no psychometric features are available for the Portuguese psychiatric population.

Statistical Analysis

Descriptive analyses were used to describe the sociodemographic and clinical characteristics of the sample. Pearson's correlations were calculated in order to examine the associations between the POMS subscales. Mann-Whitney and Kruskal-Wallis tests were used to compare means differences of POMS subscales and total scales between sociodemographic groups.

An exploratory factor analysis (EFA) was used to analyse the main components of the Portuguese version of the POMS-SV factor structure, using varimax rotation and eigenvalues greater than 1. An item with a factor loading greater than 0.40 on a factor was considered to have a sufficiently high loading on the relevant factor. Cronbach's alpha was calculated to determine the internal consistency of the items in the retained factors. Values >0.90 were considered excellent; 0.80–0.90, good; 0.70–0.80, acceptable; 0.60–0.70, questionable; 0.50–0.60, poor; and <0.50, unacceptable (George & Mallery, 2024; Tavakol & Dennick, 2011). The significance level was set at 0.05 throughout the analyses. Statistical procedures were done using SPSS Statistics 29.0 (Chicago, IL)

To assess the factor structure of the Portuguese version of the POMS-SV (31 items), a confirmatory factor analysis (CFA) was applied. In this analysis, six continuous latent variables were regressed, utilizing the Maximum Likelihood Estimation (MLE) technique to examine the appropriateness of the model. Notably, MLE assumes a multivariate normal distribution of the data (Satorra & Bentler, 1994). To address potential deviations from normality, we opted for a more robust chi-squared statistic, namely the scaled Satorra-Bentler statistic (S-Bχ^2) (Satorra & Bentler, 1994). This statistical approach corrects for non-normality in the data distribution, providing more reliable results (Bentler, 2007).

The adequacy of fit for each factor structure was assessed through various descriptive criteria, including the Chi Square-to-degrees of freedom ratio (χ^2/df), the Normal Fit Index (NFI), Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA) along with its 90% confidence interval (90% CI RMSEA). Following Brown's recommendation (Brown, 2006), the model was deemed to have "an adequate fit" if the RMSEA was below 0.08 and the CFI exceeded 0.9. A "good fit" was indicated by an RMSEA below 0.05, a CFI surpassing 0.95, and (χ^2/df), values less than 3.

To further evaluate individual variables, the magnitudes of factor loadings were considered. Variables with a factor loading of 0.3 or greater (Brown, 2006) were considered indicative of the measured construct within each domain. The confirmatory factor analysis (CFA) was executed using EQS 6.1 software (Bentler, 2002).

Results

The analysis included 106 Portuguese with a diagnosis of schizophrenia from the DSM-5 (2017), with an average age of 43.37 years (± 9.98), of which 47 (44.3%) were women, 41 (39%) were inpatients, 47 (44.3%) had secondary education or more, 55 (51.9%) were non-smokers and 88 (83%) were single. Concerning medication, 2 participants (1.9%) were not taking any medication, 11 (10.4%) were taking first-generation medication, 55 (51.9%) were taking second-generation medication and 38 (35.8%) were combining first and second-generation. Forty-eight (45.3%) participants were engaged in PA at least once per week.

Exploratory factor analysis

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Initial exploratory factor analysis models were previously tested as part of the survey instrument development process. The analysis was conducted to identify the underlying structure of the data and determine the most appropriate number of factors. During this process, it was crucial to ensure the clarity and interpretability of the factors obtained. To achieve more distinct and informative factors, it was necessary to make a careful selection of items. Thus, given the data obtained, items whose factor loadings did not contribute significantly, or which introduced unnecessary complexity were removed from the instrument. This approach aimed not only to improve the effectiveness of the model but also to ensure that the factors identified reflected the underlying dimensions of the constructs under study in a more accurate and representative way. Thus, it was necessary to remove the inverted items: 29 (calm), 26 (effective), and 35 (competent), as well as items 8 (active) and 10 (energetic). Given the specific nature of the sample, we felt that the interpretation of these items might not be clear to the participants. A final number of 31 items were tested.

Table 1 presents the results of the exploratory factor analysis, for the final model. Kaiser-Meyer-Olkin (KMO=0.84) and Barlett's test of sphericity ($\chi2465=2099.716$, p < .0001) were calculated. These results showed a good suitability of the data for performing factor analysis (Osborne, 2014). Six factors were retained with an eigenvalue above 1 and 66.709% of the variance was explained.

Depression, Fatigue, Tension, Vigor, Hostility, and Confusion are loaded in a single factor representing each of the mood states. Factor 1 has an eigenvalue of 12.311 and explains 39.712% of the variance, corresponding to the Depression scale. Here the items sad/triste, discouraged/desencorajado, lonely/só, blue/deprimido, hopeless/desanimado, and unhappy/infeliz saturate, with values between 0.373 and 0.722. Factor 2 has an eigenvalue of 2.905 and a variance percentage of 9.370%, corresponding to the Fatigue scale. Here the items worn out/esgotado, fatigued/fatigado, exhausted/exausto, sluggish/sem energia, bushed/estourado, and weary/cansado saturate, with values between 0.482 and 0.794. Factor 3 has an eigenvalue of 1.780 and explains 5.743% of the variance, corresponding to the Tension scale. Here the items tense/tenso, restless/inquieto, nervous/nervoso, anxious/ ansioso, and impaciente saturate with values between 0.054 and 0.538. Factor 4 has an eigenvalue of 1.780 and explains 5.743% of the variance. This factor corresponds to the Vigor scale. Here the items are lively/animado, full of life/cheio de vida, cheio de boa disposição, and cheerful/alegre saturate, with values between 0.762 and 0.884. Factor 5 has an eigenvalue of 1.285 and explains a variance of 4.146%, corresponding to the Hostility scale. Here the items angry/irritado, grouchy/mal-humorado, annoyed/aborrecido, furious/furioso, bad tempered/com mau feitio, and enervado are saturated, with values between 0.281 and 0.770. Factor 6 has an eigenvalue of 1.010 and explains a variance of 3.259%, corresponding to the Confusion scale. Here the items confused/confuso, muddled/baralhado, bewildered/desnorteado, and uncertain about things/inseguro are saturated, with values between 0.304 and 0.430 (Table 1).

Descriptive statistics, internal consistency, and intercorrelations of the subscale were analysed (Table 2).

The internal consistency values for the factors, calculated using Cronbach's Alpha, were 0.861 for the Depression factor (6 items), 0.868 for Fatigue (6 items), 0.756 for Tension (5 items), 0.855 for Vigor (4 items), 0.839 for Hostility (6 items) and 0.823 for Confusion (4 items). The global reliability coefficient was 0.94.

Table 1. Results of exploratory factor analysis of the Portuguese version of POMS – 31 items in persons with schizophrenia.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
	Depression	Fatigue	Tension	Vigor	Hostility	Confusion
	Depressão	Fadiga	Tensão	Vigor	Hostilidade	Confusão
Sad/ Triste	0.57					
Discouraged/ Desencorajado	0.373					
Lonely/ Só	0.722					
Blue/ Deprimido	0.493					
Hopeless/ Desanimado	0.434					
Unhappy/ Infeliz	0.536					
Worn Out/ Esgotado		0.482				
Fatigued/ Fatigado		0.724				
Exhausted/ Exausto		0.794				
Sluggish/ Sem energia		0.624				
Bushed/ Estourado		0.736				
Weary/ Cansado		0.719				
Tense/Tenso			0.054			
Restless/ Inquieto			0.538			
Nervous/ Nervoso			0.527			
Anxious/ Ansioso			0.127			
Impaciente*			0.309			
Lively/ Animado				0.762		
Full of life/ Cheio de vida				0.772		
Cheio de boa disposição*				0.884		
Cheerful/ Alegre				0.852		
Angry/ Irritado					0.454	
Grouchy/ Mal-humorado					0.77	
Annoyed/ Aborrecido					0.401	
Furious/ Furioso					0.569	
Bad tempered/					0.49	
Com mau feitio						
Enervado*					0.281	
Confused/ Confuso						0.43
Muddled/ Baralhado						0.378
Bewildered/ Desnorteado						0.304
Uncertain about things/ Inseguro						0.389
Eigenvalues	12.311	2.905	1.78	1.389	1.285	1.01
% of Variance	39.712	9.37	5.743	4.479	4.146	3.259

* Due to the linguistic translation and adaptation of the items to the Portuguese language (Viana et al., 2001), no direct translation is available. Items are presented in both languages English/ Portuguese.

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Table 2. Mean (standard deviations), internal consistency, and intercorrelations of subscales of the Portuguese version of POMS in persons with schizophrenia.

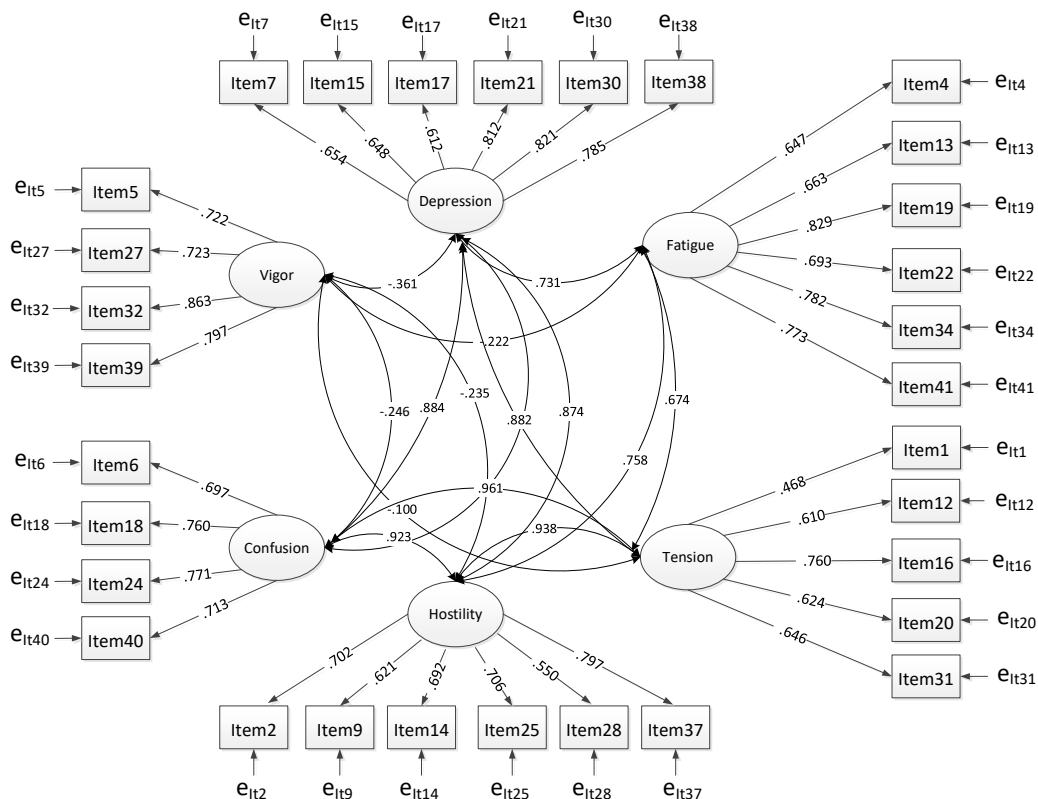|	Mean	SD	Cronbach's Alpha	1	2	3	4	5	6
1. Depression	7.09	5.82	0.861	1	0.656**	0.737**	-0.307**	0.739**	0.762**
2. Fatigue	8.08	5.79	0.868		1	0.580**	-0.217*	0.673**	0.661**
3. Tension	7.51	4.41	0.756			1	-0.104	0.753**	0.781**
4. Vigor	8.13	4.28	0.855				1	-0.182	-0.227*
5. Hostility	6.65	5.26	0.839					1	0.757**
6. Confusion	4.33	3.67	0.823						1
SD - standard deviation ** p<0.01; * p<0.05									

Figure 1. Factor loadings of confirmatory factor analysis for the Portuguese version of the POMS (Standardized Parameters Estimates).

The correlation between the negative subscales ranges from moderate to strong. The correlations between positive and negative subscales demonstrate inverse associations ranging from r= -0.104 to r= -0.307.

Confirmatory factor analysis

The results of the CFA for the Portuguese version of the POMS-SV (latent subscales: Depression, Fatigue, Tension, Vigor, Hostility and Confusion) revealed that the 36-item, 6-factor model showed a good fit for the data from people with schizophrenia (see Figure 1).

All the items loaded significantly on their hypothesised factors and good fit indices, (S-Bχ2) =532.4061, =419; p<0.001; (S-Bχ2) /df=1.27; CFI=0.917; RMSEA=0.051, 90%CI= [0.036; 0.063]. Standardized factor loadings greater than 0.3 were also observed for all items on the POMS-SV (Figure 1).

Comparative Analysis

(Table 3) Shows significant differences between the TMD score and each of the mood-stated subscales and gender (women vs men), marital status (single vs other), and engaged PA (yes vs no). Specifically, men comparing with women reported higher scores for depression (7.90 vs 6.09, p=0.036), fatigue (9.14 vs 6.77, p=0.039), tension (8.41 vs 6.38, p=0.013), and confusion (4.97 vs 3.53, p=0.021). Consequently, the TMD score was also significantly higher for men (129.78 vs 120.21, p=0.031). Concerning marital status, single people reported higher scores for depression (7.67 vs 4.28, p=0.015), tension (8.02 vs 5.00, p=0.005), hostility (7.20 vs 3.94, p=0.008) and confusion (4.68 vs 2.61, p=0.018) as well as for the TMD score (128.01 vs 113.44, p=0.010) when comparing with another status (i.e., married, divorced and widowed). Regarding PA engagement, participants who practice PA reported higher scores for fatigue

compared with non-practitioners (9.33 vs 7.05, p=0.037).

Discussion

The present study examines the construct validity of the Portuguese version of the POMS-SV in persons with schizophrenia. The POMS is an instrument composed of six mood scales that were developed using clinical populations but is widely applied to assess mood states in sports settings (e.g., Khemila et al., 2023; Miralles-Amoros et al., 2023). The POMS has been applied successfully in different clinical (e.g., Stephenson, Leicht, Tolfrey, & Goosey-Tolfrey, 2019; Zhao, Portier, Stein, Baker, & Smith, 2009) and non-clinical populations (e.g., Petrowski, Albani, Zenger, Brahler, & Schmalbach, 2021) and cultures (e.g., Barker-Collo, 2003; Selvi et al., 2011), providing evidence for the factorial validity of the questionnaire (P. C. Terry, Lane A. M., Fogarty G. J, 2003; Wyrwich & Yu, 2011).

POMS is sensitive in detecting mood fluctuations associated with exercise and different exercise features (duration, intensity, and type) and there is an extensive body of knowledge available about the application of the POMS which facilitates research in specific groups and cross-study comparisons. Moreover, the POMS offers a two-fold advantage for researchers interested in examining one single global estimation of the mood states (TMD) or for those interested in examining multiple mood states. Short versions of que POMS are also recommendable for being less time-consuming and less intrusive allowing repeated administrations (Berger & Motl, 2000). Finally, contrary to other psychopathology scales (e.g., The Positive and Negative Syndrome Scale (PANSS); Kay, Fiszbein, & Opler, 1987), the POMS can be applied by different researchers and mental health multidisciplinary teams, including exercise professionals.

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Table 3. Sample description (mean ± SD) with group comparisons for the mood states subscales.

		n (%)	Depression	Fatigue	Tension	Vigor	Hostility	Confusion	TMD
Gender	Woman	47 (44)	6.09 ± 6.10	6.77 ± 5.37	6.38 ± 4.67	8.13 ± 4.01	5.57 ± 4.92	3.53 ± 3.50	120.21 ± 22.94
	Men	59 (56)	7.90 ± 5.52	9.14 ± 5.58	8.41 ± 4.01	8.14 ± 4.52	7.51 ± 5.41	4.97 ± 3.70	129.78 ± 22.47
	p		0.036	0.039	0.013	0.828	0.065	0.021	0.031
Age (years)	<35	23 (22)	9.04 ± 6.58	8.26 ± 5.93	9.09 ± 4.18	9.35 ± 3.96	7.39 ± 5.56	5.91 ± 4.06	130.35 ± 24.16
	[35, 50]	52 (49)	6.13 ± 5.53	7.35 ± 5.19	6.75 ± 4.19	7.37 ± 4.16	6.02 ± 4.76	3.73 ± 2.98	122.62 ± 20.66
	>=50	31 (29)	7.26 ± 5.51	9.19 ± 5.95	7.61 ± 4.75	8.52 ± 4.58	7.16 ± 5.87	4.16 ± 4.16	126.87 ± 25.99
	p		0.151	0.4	0.09	0.243	0.638	0.071	0.434
Marital Status	Single	88 (83)	7.67 ± 5.90	8.47 ± 5.58	8.02 ± 4.27	8.03 ± 4.14	7.20 ± 5.26	4.68 ± 3.74	128.01 ± 22.82
	Other	18 (17)	4.28 ± 4.59	6.22 ± 5.40	5.00 ± 4.34	8.61 ± 5.02	3.94 ± 4.50	2.61 ± 2.77	113.44 ± 20.90
	p		0.015	0.112	0.005	0.657	0.008	0.018	0.01
Education Level	<=2.º Cycle	36 (34)	7.17 ± 5.41	9.03 ± 5.39	7.94 ± 4.70	9.53 ± 4.14	7.03 ± 5.92	4.64 ± 3.80	126.28 ± 22.29
	3.º Cycle	23 (22)	7.04 ± 5.06	7.83 ± 5.41	6.70 ± 3.76	7.26 ± 4.31	6.35 ± 4.17	4.26 ± 3.36	124.91 ± 20.08
	Secundary	31 (29)	7.55 ± 5.88	7.13 ± 4.93	8.29 ± 4.11	7.16 ± 4.22	6.45 ± 4.50	4.10 ± 2.77	126.35 ± 20.82
	Higher Education	16 (15)	6.13 ± 7.80	8.19 ± 7.43	6.19 ± 5.08	8.13 ± 4.21	6.63 ± 6.74	4.19 ± 5.31	123.19 ± 33.15
	p		0.46	0.438	0.307	0.157	0.968	0.723	0.759
Clinical Setting	Outpatients	65 (62)	7.03 ± 5.47	8.14 ± 5.40	7.94 ± 4.34	8.40 ± 4.18	6.89 ± 5.10	4.31 ± 3.52	125.91 ± 21.53
	Inpatients	41 (38)	7.20 ± 6.41	8,00 ± 5.94	6.83 ± 4.49	7.71 ± 4.47	6.27 ± 5.55	4.37 ± 3.94	124.95 ± 25.59
	p		0.85	0.699	0.1	0.31	0.292	0.832	0.615
Engaged (PA)	Yes	48 (45)	7.33 ± 5.35	9.33 ± 5.84	7.83 ± 4.11	8.94 ± 4.15	7.44 ± 5.71	4.56 ± 3.89	127.56 ± 22.57
	No	58 (55)	6.90 ± 6.23	7.05 ± 5.19	7.24 ± 4.67	7.47 ± 4.31	6.00 ± 4.81	4.14 ± .3.5	123.86 ± 23.54
	p		0.392	0.037	0.388	0.081	0.23	0.683	0.236

SD= standard deviation; PA= physical activity; TMD= Total mood disturbance

In health care and rehabilitation settings, the POMS is suited to examine the mood states and can be used to explore the beneficial effect of PA on the mental health of persons with schizophrenia (Lavey et al., 2005; Maggouritsa et al., 2014). However, due to the inexistence of scientific evidence about the factorial structure of the questionnaire in this population, an item selection was implemented to get the best factorial structure. Based on an exploratory and confirmatory factor analysis a set of 31-items demonstrated that the Portuguese POMS-SV provided a good fit for the data. The 6-factor model of the POMS-SV (latent subscales: Depression, Fatigue, Tension, Vigor, Hostility and Confusion) met the criteria for good fit reliability and factorial structure when applied to in- and outpatients with schizophrenia.

P. C. Terry, Lane A. M., Fogarty G. J. (2003) defined each emotional state assessed by the POMS. Tension is characterised by feelings such as nervousness, worry, and anxiety. Hostility is defined by feelings that range in intensity from annoyance to fury and irritation. Confusion refers to feelings of indecision associated with a decreased ability to control alertness and emotions. Depression is associated with a negative self-concept characterised by disappointment, ineffectiveness, and self-blame. Fatigue is characterised by the perception of mental and physical tiredness. Vigor represents a state of well-being, energy, excitement, concentration, and vitality (P. C. Terry, Lane A. M., Fogarty G. J., 2003). However, the structural factor of the mood states is different when comparing samples of clinical and healthy adults, with the non-clinical population being able to establish clearer differences between the different mood states (Martínez-Soto, Cruz Torres, & de la Roca Chiapas, 2022). The authors also suggested that the constructs underlying the experience of mood states may be different in healthy persons and those with clinical conditions. Moreover, mild mood changes are normal in the general population, while extreme mood changes are characteristic of the population with disorders (Jukic et al., 2005). Therefore, in persons with schizophrenia, the confluence of the psychopathology and the complexity of the mood state dimension is unavoidable. This may justify a shorter version of the POMS that may lead to better psychometric properties and account better for possible cultural differences in the Portuguese population with schizophrenia.

Regarding reliability measures, the subscale's internal consistency presented acceptable borders (α = 0.76 – 0.87) ranging from good to excellent (George & Mallery, 2024; Tavakol & Dennick, 2011). On the other hand, the individual subscales were discriminated against and measured distinct mood states. According to Vallerand (1989), high scores of Cronbach's Alpha (above 0.90) demonstrated the redundancy of the items and consequently, the repetition of the items in each subscale which is not the case. The POMS appears to be a robust reliable scale for persons with schizophrenia for which no normative data are available. Even so, the results of the present study are in line with previous research. Lopez-Jimenez et al. (2021) with patients with chronic pain reported internal consistency ranging between 0.75 and 0.91 and Baker et al. (2002) with cancer survivors reported internal consistency values ranging between 0.78 and 0.91. In a similar clinical group, Norcross et al. (1984) found slightly higher internal consistency, with values ranging between 0.86 and 0.95 in psychiatric outpatients.

Based on the exploratory factor analysis, the POMS-SV exhibited a stable structure of six-mood states subscales that accounted for a high percentage of the total variance (66.709%). The factorial structure of the POMS-SV for persons with schizophrenia is aligned with the original theoretical structure of the questionnaire (D. M. McNair, Lorr, M., & Droppleman, L. F., 1971) and no major discrepancies were observed. However, small inconsistencies were identified in a group of five items with factor loading values below 0.4. This may be related to differences regarding age, health status, and clinical features of the participants of the present study concerning the original study. Norcross et al. (1984) explored the psychometric properties of the POMS in a group of American psychiatric outpatients (n=165) and reported 66% of the total variance but for a seven-component structure. However, specific information about the mental illness of the participants was not reported and only outpatients were included. In the present study, both in- and outpatients with schizophrenia were included. Once again, the differences in the participant's features may be related to the different factorial structures.

Regarding the intercorrelation between the different mood subscales, weak to moderate significant correlations were found in the present study (r = -0.217 to r = 0.762). As expected, the different subscales measured different types of moods. Positive and moderate to strong (r = 0.580 to r = 0.781) correlations were found between all the negative mood scales (Depression, Fatigue, Tension, Hostility, and Confusion) while all negative mood scales showed a negative and weak (r = -0.217 to r = -0.307) correlations with the Vigor subscale. The correlations were especially high among Confusion and Depression, Tension, and Hostility subscales. Similarly, Norcross et al. (1984) reported positive and moderate to strong correlations (r = 0.59 to r = 0.81) among all the negative mood subscales and negative and weak correlations (r = -0.34 to r = -0.50) among the Vigor and the negative mood subscales.

The confirmatory factor analysis showed good goodness-of-fit indices and confirmed the six-factor structure which demonstrates that the POMS-SV is an appropriate psychometric tool to asses mood in the population with schizophrenia. Therefore, the study presents a valid, reliable, short, and cost-effective instrument with expanded usefulness in epidemiological studies exploring the impact of PA on the mood of persons with schizophrenia. To the best of our knowledge, there is no research in clinical settings exploring the psychometric properties of the POMS in a specific psychiatric group (e.g., depression, anxiety, eating disorders).

Group Comparative Analysis

Finally, due to the POMS-SV good psychometric properties found in the present study and the limited comprehensive knowledge available in the literature about mood states in persons with schizophrenia, an additional study goal was defined. Group comparisons were conducted to explore the mood states

according to gender, age, marital status, education level, clinical setting, and PA engagement. Significant differences were found in gender with men reporting worse TMD and in most of the negative mood states scores compared with women. The present findings are aligned with a recent systematic review aiming to identify predictable variables of key outcomes in mental disorders including schizophrenia (Solmi et al., 2023). Male gender is associated with poor prognostic factors namely more clinical symptoms and comorbid mental disorders (Nietola, Nordstrom, Miettunen, Korkeila, & Jaaskelainen, 2022; Solmi et al., 2023). Moreover, there is a tendency for men to develop schizophrenia earlier, have more cognitive deficits with the antipsychotic treatment being less effective (Seeman & Gonzalez-Rodriguez, 2021), and have higher rates of drinking and smoking (Aguocha, Aguocha, Igwe, Uwakwe, & Onyeama, 2014) when comparing to women. Also, men are more likely to die by suicide than women (Dickerson et al., 2018). Therefore, poor mood and affective states may also be hindered in this sub-group of persons with schizophrenia.

Concerning marital status, participants were mainly represented by singles (n=88) which is following previous epidemiological data reporting that the rate of marriage in serious mental illness, especially schizophrenia, is lower than in the general population (Bhatia, Franzos, Wood, Nimgaonkar, & Deshpande, 2004). Single persons reported higher scores for Depression, Tension, Hostility, and Confusion as well as for the TMD score when comparing with other status (i.e., married, divorced, and widowed) suggesting that single persons may be more affected by isolation and lack of social support with possible negative effects in the psychological well-being and mood states. Unfortunately, it was not possible to identify in the literature studies with similar research goals which limits the discussion of the present findings. However, it is important to highlight that families assume responsibility for extensive monitoring and supervision of a severely and chronically mentally ill relative. Clinical, social, family, and economic benefits are achieved by adding family in psychiatric treatment and rehabilitation (Santos, Medeiros, & Gomes, 2021). The recovery is more likely to become a reality when patients and families are actively involved in treatment establishing a care system that meets the requirements and needs of both patients and family members (Lowyck et al., 2004). For example, Japanese couples reported feeling increased closeness and support resulting from caregiving activities with persons with schizophrenia (Yamashita, 1996) On the other hand, in Western cultures, the care burden is frequently identified and family responses include an array of problems such as fear of unpredictable mood changes including violent outbursts (Holzinger, Kilian, Lindenbach, Petscheleit, & Angermeyer, 2003; Saunders & Byrne, 2002). Therefore, future studies should clarify the contribution of the care system and families' social support in the mood states of persons with schizophrenia.

Regarding PA engagement, participants who practice PA reported higher scores for fatigue compared with non-practitioners which seems to be contradictory in relation to previous research. Maggouritsa et al. (2014) examined the effect of an multicomponent exercise program on improving mood in persons in schizophrenia. Comparing with the control group participants, who were not attending to training sessions, the exercise group significantly decreased fatigue approximately one month after the beginning of the program. Considering that fatigue affects an individual's physical, cognitive and emotional functioning and subsequent ability to complete activities of daily living (Sevy et al., 2005), the higher fatigue scores in the practitioners of PA group are a concerning fact. Moreover, low mood and fatigue are common barriers to exercise in individuals with schizophrenia (Busch et al., 2016). The functional consequences of fatigue include considerable impairment and disability, such as amotivation to engage in PA (Firth et al., 2016). In the present study, inpatients were included and exercise was part of their rehabilitation process. Possibly, these participants were more controlled and extrinsically motivated towards PA undermining the potential positive effects of exercise in the mood states.

Finally, the results must be interpreted with caution due to some methodological issues. Also, psychopathology can be understood as socially undesirable behavior, which may lead to the possibility that the results of this study could be influenced by the impact of social desirability. Consequently, further analyses, including cross-cultural psychometric properties and concurrent validity are imperative for a complete understanding of the mood state construct in person with schizophrenia.

Conclusion

Overall, the short version of the Portuguese Profile of Mood States (POMS-SV) appears to be internally consistent and exhibits a stable structure that accounts for a high percentage of the total variance. The POMS is a multidimensional instrument with a good fit for persons with schizophrenia in both community and clinical settings. A final item selection of 31 items for the six subscales was the shortest and best factorial structure achieved. However, some items exhibited low factor loadings (i.e., below 0.4). Considering this is the first attempt to explore the factorial structure of the POMS in persons with schizophrenia and the complexity of the dimension's psychopathology in this population, future research should replicate the factorial structure in a larger

sample with more national representativeness. This would be an important step to ultimately validate the questionnaire.

Statements and Declarations

The authors report no conflicts of interest.

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