

Application of mood states validation instruments in the detection of the overtraining syndrome

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ABSTRACT

The pressures tempted by the exigencies from the competitive sport lead many athletes to exceed the limits of their physical and psychological capacity, causing the manifestation of overtraining syndrome. The purpose of this review article is to discuss, through the original material, the validation process of the Profile of Mood States-Adolescents (POMS-A) for use with adults⁽¹⁾. This instrument was developed to serve as a brief measure of mood states among adolescents and adult populations, and had already demonstrated, in recent researches, effectiveness in the diagnosis of these altered states by intensive training. The POMS-A was administered to adult athletes prior to competition, adult student athletes, adolescent athletes prior to competition, and adolescent students. A subset of adult student athletes was used to test the criterion validity of the POMS-A. Confirmatory factor analysis provided support for the factorial validity of 24-item, six-factor model using both independent and multi-sample analyses. Relationships between POMS-A scores and previously validated measures, that were consistent with theoretical predictions, supported the criterion validity. Evidences were found in support of the psychometric integrity of the POMS-A when extended from adolescent to adult populations. It is suggested that the POMS-A is an appropriate tool with which mood profiles will be tested, besides the brevity of the test facilitates data collection in research environments. Subsequent studies aim the validation and applicability of the instrument BRUMS (current name of the POMS-A) in detection of

overtraining syndrome in Brazilian athletes, for what already exists authorization by the authors Terry, Lane and Fogarty⁽¹⁾.

Key words: Measurement. Physical exercise. Emotion. Physical performance. Scales.

INTRODUCTION

Harmful consequences have been found in high-level athletes as result of pressures tempted by the current context of the high exigency sportive practice. It is quite usual athletes to exceed the limits of their physical and psychological capacity before the challenge of excessive training quantities, anxiety, and competitions accumulation, in addition to the recovery insufficient intervals.

The clinical manifestation as result of such excesses is observed through a set of signs and symptoms known as overtraining syndrome. The overtraining syndrome is defined as a neuroendocrine disturbance (hypothalamo-hypophyseal), which results in an unbalance between the exercise demand and the functional capacity, worsened by an inadequate recovery, leads to a decrease on the performance, persistent muscular pain, immunological and neuroendocrine alterations, mood state alterations, constant fatigue, etc. All performance levels athletes run the risk of developing this syndrome, and despite the large list of symptoms and signs, there are no well-established diagnostic criterions usually used⁽²⁻⁴⁾.

Sportive psychology measurements and methods are parameters identified and considered not only to compare normative values, but also to identify difficulties and to indicate latent characteristics, in combined works with the sportive sciences⁽⁵⁾. De Rose Jr.⁽⁶⁾ elucidates that the association between emotion and the sportive performance emerged when a group of researchers was interested by the performance-dependent variables (motor area), while another group focused on the independent variables that influence the performance (sociocultural aspects). The motor and motor control apprenticeship area approached to

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the psychological studies with regard to the cognitive and neuropsychological processes involved in the movement^(6,7).

One of the psychological instruments quite useful for the study of several sportive sciences is the POMS. In 1980, William Morgan, an American sports psychologist, began using the POMS test (Profile of Mood States) in the physical activity and sports area in order to evaluate the mood states of American athletes. This test was initially developed for the observation of different mood states in psychiatric patients by McNair *et al.*⁽⁸⁾. The 65-item instrument measures six mood factors: tension, depression, anger, vigor, fatigue and mental disturbance. The mood transitory factors that the test evaluates are set in an individual graphic, where a type of curve that differs from the non-athletes' may be observed. In this curve, the vigor factor remains above the percentile 50, while the other factors remain below, forming an ideal graphic, called as "iceberg" type⁽⁹⁾.

Through the studies, it was observed that the elevated fatigue factor compared to the elevated depression factor, presented in the POMS individual graphic, seems to be the result of the overtraining and that the test may detect the psychological alterations prior to the syndrome, inverting the "iceberg" profile in the graphic. Starting from a qualitative epistemological analysis, in other words, from the athletes' perception with regard to the psychical (mood alterations, repression, anxiety) and physical (fatigue, exhaustion) signs, this measure has been, since then, quite effective and sensible in quantifying the distress associated to the overtraining in researches with athletes.

Gould⁽¹⁰⁾ defines the stress, in a psychological perspective, as an individual who perceives an unbalance between the physical or psychological demands and his resources to face it, in an activity considered important such as the sportive action, for the athlete. According to Seyle⁽¹¹⁾, the distress is a type of stress that represents a hazardous situation for the organism, being acute when intense, which is short-term installed, or chronic when it is long-term and progressively installed.

Brandão and colleagues studied the POMS among Brazilian populations of athletes in the year of 1993, as for the 300 athletes from the Brazilian teams in 1996⁽¹²⁾, enabling the POMS adaptation for high-performance adult athletes. The POMS application in a study with athletes from the State of Santa Catarina showed that this acceptance threshold of the six factors is different from the observed in international studies, especially with regard to the vigor, whose value was shown below the validated average⁽¹³⁾. Thus, further studies will be necessary with the objective of establishing an average threshold for athletes from different sportive contexts in the Brazilian population.

However, the brevity required by the psychometric tests in some field researches has generated several condensed POMS⁽¹⁴⁻¹⁷⁾ versions. One of them, the POMS-Adolescents (POMS-A⁽¹⁷⁾) was submitted to a validation rigorous process, and in the year of 2003, it was also validated for use with adults⁽¹⁾, being called BRUMS – Brunel Mood Scale⁽¹⁾, since then. This 24-item instrument was developed in order to allow a quick measuring of the six mood states among adolescent and adult populations, and through recent researches, it has demonstrated efficiency on the diagnosis of these altered states due to overtraining.

Since it perceived the need of developing one more possibility of measuring the psychological evaluation of adolescent and adult athletes in order to contribute for the development of the Brazilian sports, this review article aims, through the original material, to discuss the validation process of the Profile of Mood States-Adolescents (POMS-A) for use with adults⁽¹⁾. Subsequent studies aim the validation and applicability of the BRUMS instrument (current name of the POMS-A) in the detection of the overtraining syndrome in Brazilian athletes, for what already exists authorization by the authors Terry, Lane and Fogarty⁽¹⁾.

POMS-A VALIDATION PROCESS

The POMS-A validation process by Terry *et al.*⁽¹⁾, passed by three stages. The stage 1 established a satisfactory validity when a council of specialists evaluated a set of initial items elaborated for the comprehension of adolescents and a sample of adolescents identified those items that better described each mood dimension. On stage 2, with 24 items, a six-factor structure was tested using the confirmative factor analysis (CFA) in adolescents in classroom environment and in adolescent athletes prior to competition. The hypothetical model was supported in both groups independently and simultaneously. On stage 3, relationships between POMS-A scores and previously validated measures were consistent with theoretical predictions, supporting the criterion validity of the test measure.

The establishment of the factorial validity is a pre-requirement necessary for the use of any scale in a second population and, therefore, the use of a psychometric perspective; this was important to guide the question of whether the measurement model for the POMS-A, which was supported among adolescent and adult samples, could also be confirmed among adults⁽¹⁷⁾. This question has determined the core of the POMS-A validation study for the use in adults.

According to Terry *et al.*⁽¹⁾, an important step to establish the validity of a questionnaire is to show that it actually measures the construct that it intends to measure. Criterion validity tests aid to clarify the meaning of the construct measured, evaluating relationships with other measures

against theoretical prognostics. Although Terry *et al.*⁽¹⁷⁾ have tested the POMS-A against three related scales, it was important to test the new scale in criterion measures, especially because the measure was being applied in a different population. Therefore, the second objective of this study was to evaluate the POMS-A validity criterion among adult participants.

Terry *et al.*⁽¹⁾ described the six POMS-A factors from studies of other authors. Spielberger⁽¹⁸⁾ defines the *anger* factor as an emotional state that ranges from slight irritation feelings until rage associated to stimuli from the autonomous nervous system; Beck and Clark⁽¹⁹⁾ define *mental disturbance* as an uncertainty feeling, instability for the attention and emotions control, and the *depression* as the depreciation or negative self-image. For the *fatigue* factor, Terry *et al.*⁽¹⁾ elucidate the meaning of physical and mental exhaustion; for the *tension* factor, as feelings experienced of apprehension and anxiety; and for the *vigor* factor, as being characterized by feelings of excitement, disposition and physical energy.

Based on findings of Terry *et al.*⁽¹⁷⁾, it was established that, in this study, depression would show positive moderate relation with anger, disturbance, fatigue and tension and a weak inverse relation with vigor, while vigor would show a moderate inverse relation with fatigue, but no relation with anger, disturbance and tension whatsoever. These authors divided the entire work development for the validation of the psychological measure into four procedures: (a) method used on the model test, (b) method used on the validity of the criterion test, (c) results of the instrument validation and (d) discussion on the POMS-A validation study for use with adults.

METHOD USED ON THE MODEL TEST

For the validation, the strategy of evaluating the structure constancy of the POMS-A factor between different samples and of testing the relationships with simultaneous measures was used. The POMS-A was administered to 2,549 participants from four samples: adult athletes (n = 621), recruited from cycling, distance running, kick-boxing, rowing and swimming, with the aim of reflecting a wide range of age, experience and abilities; Sports Sciences graduation adults students (n = 656); adolescent athletes (n = 676) who participated on the London Youth Games at the following modalities: bow and arrow, hockey, judo, netball, soccer, table tennis, walking, springboard, triathlon and volleyball; and adolescent students (n = 596) from West London high schools.

Due to the wide reach of potential use in which only one mood measure may be applied, it is desirable that the validity tests be conducted to more than one situation. There-

fore it was decided that the mood would be evaluated in competitions and non-competition situations.

Participants from Sample 1 (adult athletes) and from Sample 3 (adolescent athletes) accomplished POMS-A approximately one hour prior to competition. Participants from Sample 2 (adult students) and from Sample 4 (adolescent students) accomplished POMS-A at the beginning and at the end of one class. All participants answered the following question: "How do you feel now?" with regard to the 24 mood descriptions. The POMS-A has a 5-point response scale, from 0 (absolutely not) to 4 (extremely). The participants were instructed to respond to all items and a list of alternative words was available to the participants as a reference, in case the mood descriptions could not be comprehended.

Following the recommendations of Byrne, the 24 hypothetical items of the six-factor mood model were firstly tested in each sample independently before being conducted to multi-sample analyses in which the hypothetical model was tested to all four samples simultaneously. The confirmatory factor analysis (CFA) using EQS V5 from Bentler and Wu authorship in 1995 was used to test the model⁽¹⁾.

According to the theoretical base and with the previous empirical support, it was possible to correlate the following latent factors: anger, disturbance, depression, fatigue and tension⁽¹⁾. The vigor factor was only correlated to depression and fatigue and the relationships between vigor and anger, disturbance and tension did not differ significantly from zero, as it had been supposed.

The authors selected the four indexes strategy to evaluate the model adjustment. The first index used was the χ^2 ratio to the degrees of freedom. Two additional indexes were used: the comparative fitting index (CFI) from Bentler in 1990 and the Tucker-Lewis index (TLI) from Tucker and Lewis in the year of 1973. The fourth index used was the root mean squared error approximation (RMSEA) from Steiger in the year of 1990, that indicated the average discrepancy between the covariances observed and those involved in the model by degrees of freedom, therefore with the advantage of being sensible to the model complexity⁽¹⁾.

The multi-sample confirmatory factor analysis (CFA) was used to test the factor solution power in all four samples simultaneously.

METHOD USED ON THE CRITERION TEST VALIDITY

A subset of 382 adult student athletes was used to test the POMS-A criterion validity. The subset accomplished the POMS-A and a second questionnaire, and 84 participants accomplished the Positive and Negative Affect Schedule – PANAS, of Watson, Clark and Tellegen, from the year of

1988; other 97 accomplished the State-Trait Anger-Expression Inventory, called STAXI, of Spielberg from the year of 1991, and 110 participants accomplished the Hospital Anxiety and Depression Scale – HADS, of Zigmond and Snaith, from the year of 1983. All participants accomplished the questionnaire according to procedure adopted by the student athletes on stage 1⁽¹⁾.

All selected criterion measures considered that a given criterion scale should be a valid and safe measure itself and it should be possible to foretell the relationship between the scores of the measure that is being validated and the criterion measure. The original POMS was an obvious choice, once it evaluates the same six mood dimensions, compared to the POMS-A. The PANAS was selected because it evaluates two wide affective dimensions that are conceptually related in a presumable path for the POMS-A scales. The STAXI and the HADS were selected because they evaluate specific constructs, which are part of the POMS-A, and, for that reason, they should present strong relations with some POMS-A scales. It is unquestionable that these arguments are equally applied to other potential criterion measures. The four criterion measures used are elucidated as follows.

The original POMS-A, which was used as basis for the POMS-A validation study has 65 items⁽⁹⁾, was developed through analytical studies of the six factors. McNair *et al.*⁽¹⁵⁾ showed evidences of confirmatory and simultaneous validity and produced normative data for athletes and psychiatric patients in medical clinics. Yet, the authors supported that the POMS was valid for the use in sports and exercises and provided an abstract of findings on this area as support of this proposition. A set of answers of “How are you feeling now?” was used in this study. Due to the fact that the POMS-A is derived from the original POMS, strong positive relations were established between the respective factor scales: anger, disturbance, depression, fatigue and tension. A moderate positive relation was established between two vigor scales because the original scale evaluated a wide positive mood basis (including items such as jovial and carefree), while the POMS-A vigor scale evaluates the most restricted constructs (vigorous, alert, smart, encouraged).

Watson and Tellegen in the year of 1988 developed the 20 items of PANAS to evaluate independent markers of negative and positive influences. In this study, it was supposed that the POMS-A vigor scale would be correlated with the positive influence scale of PANAS, while the tension, depression, anger, fatigue and disturbance scales would be correlated with the negative influence scale of PANAS.

The 10 items from the anger state scale of STAXI⁽¹⁸⁾ were validated in a 550-participants sample. In this study, it was

determined that the POMS-A scale would be strongly correlated with the STAXI scores, whereas the other five POMS-A scales would have no relation with or would be moderately correlated with the STAXI scale.

The HADS scale from Zigmond and Snaith, in 1983, cited by Terry *et al.*⁽¹⁾, includes seven items to evaluate depression among clinic medical patients from the population in general. The HADS anxiety scale was not used in this study. Due to the axis position of depressed mood proposal in the mood-performance relation⁽²⁰⁾, the validity criterion of the POMS-A depression scale was particularly interesting. As the depressed mood was evaluated using both sets of answers (“How are you feeling now?” for POMS-A and “How did you feel during the last week?” for HADS), it was established that both scales would be moderately correlated rather than highly correlated. It was also supposed that the other five POMS-A scales would have no correlation with or would be weakly correlated with the HADS depression scale.

RESULTS OF THE INSTRUMENT VALIDATION

Collectively, the results of CFA (simple-sample confirmatory factor analysis) provided support for the confirmation of the hypothetic model and the next step was to investigate the congruence of the hypothetic model against data for the four samples simultaneously, using multi-sample CFA.

Some researchers such as Comrey (1988), Gerbin and Hamilton (1996), cited by Terry *et al.*⁽¹⁾, suggest the use of the CFA and the EFA (exploratory factor analysis) together in the scales validation and construction. The EFA was used to aid in the identification of differences potentially important among samples. The EFAs results supported to elucidate differences between samples. These authors demonstrated that the POMS-A structure was easily recovered by all samples and showed that the sets of crossed variables that caused some unsuitability on the CFAs were relatively smaller.

The EFAs point at the difficulties of fitting one single factor for the fatigue markers due to the conceptual superposition among adolescent students of terms such as “tired” and “sleepy”. On the other hand, the EFAs indicated that for all samples, especially from adults, the item “uncertainty” was added to the factors tension (lowest scale) and disturbance (highest scale) in order to improve the measure model.

In the criterion validity, there was a strong relation between the POMS-A depression scales and the original POMS scale, suggesting that they evaluate similar constructs. It is worthy emphasizing that the POMS-A does not provide a clinic depression measure, but a depressed mood measure.

Correlations between the scores of POMS-A, PANAS and STAXI were consistent with those found by Terry *et al.*⁽¹⁷⁾. It is suggested that the correlation model between scores on the POMS-A and the criterion measures would provide strong evidence of simultaneous validity.

DISCUSSION OF THE POMS-A VALIDATION STUDY FOR USE WITH ADULTS

The findings of the study of Terry *et al.*⁽¹⁾ indicate that the factorial validity was confirmed in different samples and the hypothetic relations between the mood dimensions were collectively demonstrated. They also supported the notion that the POMS-A has shown validity acceptable indicators on the mood measure for both adults and adolescents.

The preceding analyses, using the tests STAXI, HADS, PANAS and the original POMS, comparing to the constructs of the six factors of POMS-A (anger, fatigue, vigor, depression, disturbance and tension), confirmed that the POMS-A is an instrument adequate for the mood profiles evaluation, besides the fact that the tests brevity facilitates the data collection in field researches.

The proposal of the study of Terry *et al.*⁽¹⁾ was to extend the POMS-A validation for the use with adults. The procedures demonstrated by the authors supported the six-factor model validity, from both statistical analyses: the independent and the multi-sample analyses. The validation was performed through the relation of factors with inventories previously validated.

Yet, this study indicates that the POMS-A construct validity adapted for the use with adults seems to be satisfactory and, therefore, the scale may improve a mood usable measure for further researches and works with adults.

CONCLUSIONS

The measures and instruments of psychological evaluation available to evaluate a given behavior or construct are submitted to a series of statistical analyses in order to group or to establish the items regarding the dimensions of the measured categories. Once the scale psychometric properties, the questionnaire or the test are evaluated, the selection of the analysis unit will depend on the objective of the evaluation. This was the procedure used on the POMS-A validation for the use with adults, as already discussed.

The POMS-A for the use with adults, currently called BRUMS, may be used shortly before competition, where examinations of the relation between the mood states and the performance have been remarkable in studies and practices of the Sports Psychology.

In Brazil, the sportive psychology is strongly influenced by practices of pioneer countries, especially in instruments

of psychological evaluation. Before the specificity of the psychological phenomenon, directly influenced by sportive training contexts and cultures from different regions in Brazil, the BRUMS instrument, derived from the POMS-A, should be adapted for further studies, focusing Brazilian athletes and their training models, as well as the conditions of the Brazilian sportive institutions.

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