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Could the profile of mood states predict performance in training and competition of professional goalball athletes?

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BEATRIZ MATIAS AVELINO DO BONFIM[1], GIORDANO MÁRCIO GATINHO BONUZZI[2,3], CARLOS BANDEIRA DE MELLO MONTEIRO[1], CASSIO DE MIRANDA MEIRA JUNIOR[1]

[1] School of Arts, Sciences and Humanities, University of Sao Paulo, Sao Paulo, Brazil
[2] Department of Physical Education, State University of Piaui, Picos, Brazil
[3] Physical Education Postgraduate Program, Federal University of Vale do São Francisco, Petrolina, Brazil

ABSTRACT

Purpose. Morgan's iceberg profile of mood states (low scores in tension, depression, anger, fatigue and confusion, and high scores in vigour) may influence skilled athletes' performance. Aims: The present study aimed to examine in 30 professional goalball athletes whether: (1) there is an 'iceberg mood profile', (2) the profile of mood states predicts the motor performance, (3) the experience level (international or national) and the condition (training or competition) modulate the relationship between the profile of mood states and the motor performance.

Methods. We used Brunel Mood Scale (BRUMS) to evaluate the profile of mood states and successful actions, errors and goals to assess motor performance. Measurements were obtained during official competition and pre-competition training with similar game rules.

Results. Athletes demonstrated the 'iceberg mood profile' regardless of the experience level and contextual condition. Additionally, tension seems to be associated with motor performance during training, whereas vigour predicts successful action in competition.

Conclusions. Iceberg mood profile characterises the profile of mood states of professional goalball athletes independent of experience level (international and national) and contextual conditions (pre-competition training and competition).

Key words: paralympics, emotion, paralympic sport, iceberg mood profile, sport performance

Introduction

Classic studies developed by William P. Morgan [1, 2] suggested that the profile of mood states could predict athletic performance and be a critical differential aspect between high-level and amateur athletes, and between athletes and the average population. Morgan's findings suggest that elite athletes from diverse sports would score lower in negative mood states (tension, depression, anger, fatigue and confusion) and higher in vigour state than the average population and amateur athletes. These scores would compose the iceberg profile, which, according to Morgan, characterises the mood state of prosperous athletes.

A recent systematic review corroborates that Profile Of Mood States (POMS) predicts athletic performance consistently [3], in line with a robust body of knowledge [3–6]. POMS has also been considered a tool to support training demands management and facilitate physical and mental recuperation [7, 8]. Moreover, POMS has been used to avoid management overtraining, impulsivity, burnout, risk of staleness [1, 8], and pathogenic behaviours in athletes (e.g., eating disorders and muscle dysmorphia) [9].

On the other hand, Morgan's model has received several criticisms, such as the inconsistency in the rationale and the lack of evidence regarding the relationship between mood and performance [10–12], the general negative orientation of the dimensions that compose the POMS [13], and the inconsistent terminology of the POMS dimensions because it could be characterised as emotion instead mood state [14].

Correspondence address: Giordano Márcio Gatinho Bonuzzi, State University of Piauí, Professor Barros Araújo Campus, BR-316, KM 299, Altamira, Picos, Piaui 64602-000, Brazil, e-mail: giordanomgb@gmail.com; https://orcid.org/0000-0002-3751-2857

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Regarding the inconsistent terminology, the Brunel Mood scale (BRUMS), formerly referred to as The Profile of Mood States–Adolescent (POMS–A) [15], has been indicated as a better tool to measure the profile of mood state. The BRUMS is a 24-item inventory that assesses mood dimensions of Anger, Confusion, Depression, Fatigue, Tension, and Vigour. Although BRUMS assesses the same mood dimensions as POMS [16], Terry et al. [15] argued for a need to develop a new inventory for two reasons. First, the original POMS was developed and validated for use with psychiatric outpatients, and its validity for use in sports settings is unknown. Second, the original POMS has been criticised for containing items not easily understood by other cultures than North American, posing a challenge to extrapolate its findings to different countries and cultures.

Another aspect that may be related to the inconsistency of the findings between the profile of mood states and athletic performance is the characteristics of the sport and the athlete [13]. In this sense, Paralympic sports represent a psychological scenario that may engage particularities in the athletes [17]. For example, they are frequently exposed to stereotypes associated with emotional and mental health symptoms and disorders [18], besides ableism, which are incorrect and lead to discrimination and social prejudice [19]. In addition, these athletes may have specific stressors, such as discomfort from the disability and sport-specific injuries, lack of sufficient adaptative facilities and financial resources, the recent rapid escalation of Paralympic sports competitiveness and associated rapid increases in training demands, malfunctioning sports equipment, and negative coaching behaviours [19]. Furthermore, Paralympic athletes have fewer opportunities to train mental and psychological skills than athletes without disabilities, limiting their psychological and affective strengths [20].

Paralympic athletes experience particular psychosocial demands that may induce differential conditions in their profile of mood state [21]. For example, wheelchair basketball athletes demonstrate a better mood state profile than non-disabled counterparts [22]. Yet, wheelchair sports athletes tend to report lower scores of negative mood states (anger, confusion, depression, and tension) and higher vigour if compared to wheelchair users who are not athletes [23–25].

Therefore, given the above: 1 – competitive athletes seem to demonstrate an 'iceberg mood profile', 2 – Paralympic athletes may experience specific psychological demands, which may be related to different mood states, and 3 – the mood state profile may be associated with the athletic performance. We aimed to investigate whether competitive goalball athletes: (a) demonstrate an 'iceberg mood profile', (b) profile of mood state predicts the training and competition performance, and (c) level of experience (international experience versus national experience) impacts the relationship between the profile of mood state and motor performance during training and competition. Our hypotheses were the following: (A) there is an 'iceberg mood profile' in goalball competitive athletes [1–3, 5, 7, 24, 26, 27]; (B) the profile of mood state predicts the training and competition performance of goalball competitive athletes [3, 5, 7]; and (C) international level goalball athletes score low in negative mood states (tension, depression, anger, fatigue, and confusion) and high in vigour when compared to national level athletes [28].

Material and methods

Participants

We recruited a convenience sample of thirty partially or totally vision-impaired professional goalball athletes (18 men and 12 women, M age = 28.88 years, *SD* = 7.88 years). We selected the athletes from the best-classified teams in 2015 in Brazil's most competitive state tournaments (Rio de Janeiro and Sao Paulo). These state tournaments are mandatory for participating in national competitions. The Sao Paulo and Rio de Janeiro teams have consistently been the champions of national competitions and comprised the national team's base that participates in international tournaments (such as the Paralympic tournament). The demographic characteristics of the participants can be found in Table 1.

All participants received detailed explanations of the research. The consent form for athletes with impaired vision was provided in large letters and for blind athletes in braille documents. All athletes signed or fingerprinted the consent form. This study was approved by the Institutional Ethical Committee from the University (n. 1.291.695).

Measures

We assessed the profile of mood states of the participants at the time points of interest using BRUMS. BRUMS evaluates the individual's mental disposition, identifies personal and professional relationship problems, mood control, training load management and emotional responses to injuries, and assists in individualising the training [29, 30]. Multisample

Table 1. Demographics information

Characteristics	Males (*n* = 18) (mean ± *SD*)	Females (*n* = 12) (mean ± *SD*)	Total (*n* = 30) (mean ± *SD*)
Age (y)	28.88 ± 8.10	26.41 ± 6.74	27.9 ± 7.57
Body weight (kg)	79.10 ± 13.29	69.18 ± 7.53	75.46 ± 12.36
Height (cm)	174.63 ± 8.87	167.81 ± 7.05	172.13 ± 8.78
Blindness functional classification (*n*)	b1: 5 b2: 6 b3: 7	b1: 5 b2: 5 b3: 2	b1: 10 b2: 11 b3: 9
Competition experience (y)	7.88 ± 4.86	8.5 ± 5.82	8.13 ± 5.17
Experience level (*n*)	State level: 1 National level: 11 International level: 6	State level: 1 National level: 2 International level: 9	State level: 2 National level: 13 International level: 15
Brazilian goalball team member (*n*)	12	10	22

confirmatory factor analysis has demonstrated factorial invariance among samples of adult students, adult athletes, young athletes, and school children [15].

Given that athletes generally exhibit fluctuations in their profile of mood states due to the competitive moment [30], we attempted to minimise the influence of the competitive moment on the interaction between the profile of mood states and the competition status by reducing the period between training and competition. Thus, we evaluated the participant's mood states and motor performance in the last training session before the competition and the first game of the competition.

We assessed the training and competition performance based on individual observations obtained by recording with two cameras placed in the athletes' frontal and posterior views (GoPro® 1080P/ 30 FPS/ 720P). Simultaneously, these recordings allowed athletes from both teams to be recorded during the official game situation in the Brazilian Goalball Championship for competition performance and during a training session in a pre-competitive period. Each athlete was evaluated for 12 minutes (equivalent to an official playing time).

A Physical Education professional with eight years of experience with goalball coaching and professional performance analysis performed all analyses and captured the performance measures. We decided to keep the assessment performed by only one person, given their extensive experience in goalball as a professional performance analyst. Code–recode reliability was established for the performance data by two independent coders. They analysed 60 random actions twice, with an interval of three months between analyses. Both intraobserver and interobserver intraclass values (Cronbach's alpha) were .999.

The assessment was defined as: Correct Defence (CD) – defence without errors in positioning the arms and legs, controlling the ball after the defence, or performing the defence by throwing the ball out of the playing area. Assistance to other players (ball pass) (ASS) – When the athlete performed the defence correctly and passed the ball to a partner correctly. Correct Throw (CT) – When the player threw the ball to the adversary area correctly, without penalty, or directed the ball out of the playing area. Incorrect Throw (IT) – When the athlete threw the ball out of the playing area or performed it with a penalty. General Errors (GE) – Wrong passes or similar. Wrong Positioning during defences (WRP) – Errors in body alignment during defences and late reaction time. GOAL – When the player threw the ball past the defence of the adversary team and the team scored.

From these variables, the following performance metrics were computed: Total of Successful Actions (CD + ASS + CT), Total of Errors (IT + GE), Total of Actions (CD + ASS + CT + IT + GE), Proportion of Successful Actions (total of success action / total of actions); Proportion of Errors (total of errors / total of actions), and Proportion of Goals [GOAL / (IT + CT)].

Statistical analysis

Data were organised in Microsoft Excel spreadsheets and analysed in SPSS version 24(IBM). We ran (1) exploratory (to check for outliers and normal distribution), descriptive (means and standard deviations), and inferential analyses (analyses of variances

for performance variables), (2) Mann-Whitney and Wilcoxon tests for mood variables, and (3) regression analysis for performance and mood variables. Where appropriate, the homogeneity of variances was checked through Levene's tests. When the sphericity assumption was violated, we reported Greenhouse-Geisser corrected values. We also reported partial eta-squared (η^2) as an estimate for effect sizes. Effect sizes for the non-parametric analyses were performed via the R v3.2.5 64-bit software. Sidak post hoc procedures were used when necessary. After checking for significant Pearson's values among the performance and mood variables, we also conducted a regression analysis. For all analyses, the alpha level was set at 5%.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Ethics in Research on Human Beings Committee at the University of São Paulo (approval No.: 48443915.6.0000.5390).

Informed consent

Informed consent was obtained from all individuals included in this study.

Results

Identification of the iceberg mood profile (test of hypothesis A)

Our descriptive analyses revealed that athletes demonstrated the iceberg mood profile characteristics independently of the level of expertise (international or national) and situation (training and competition). Although, we observed a high level of tension that was distinguished from other negative mood states (Figure 1).

Prediction of training and competition performance by mood states (test of hypothesis B)

Two moderate but significant Pearson correlations between performance and mood states were detected: Proportion of Errors X Tension (r = –0,37; p < 0.05) during training, and Proportion of Successful Actions X Vigour (r = 0.41; p < 0.05) during competition. The remaining correlations between mood states and performance during training and competition were not statistically significant. Therefore, we ran regression analyses with the mood variables that reached statistical significance in the Pearson correlations as predictors for performance variables (Table 2 depicts the regression values). The analysis showed that when one Tension unit increases, the Proportion of Errors during training decreases a number of 0.02. In addition, when one Vigour unit increases, the Proportion of Successful Action during the game rises 0.04. The input of other mood variables in the models did not change the parameter values.

Table 2. Regression analyses values

Main effect	Performance metric	Model	β scores	CI 95% (scores)	p
F (1, 28) = 5.55	Vigour (competition)	Adjusted	0.04	0.01; 0.07	0.026
F (1, 28) = 4.41	Tension (training)	Adjusted	–0.02	–0.02; –0.01	0.045

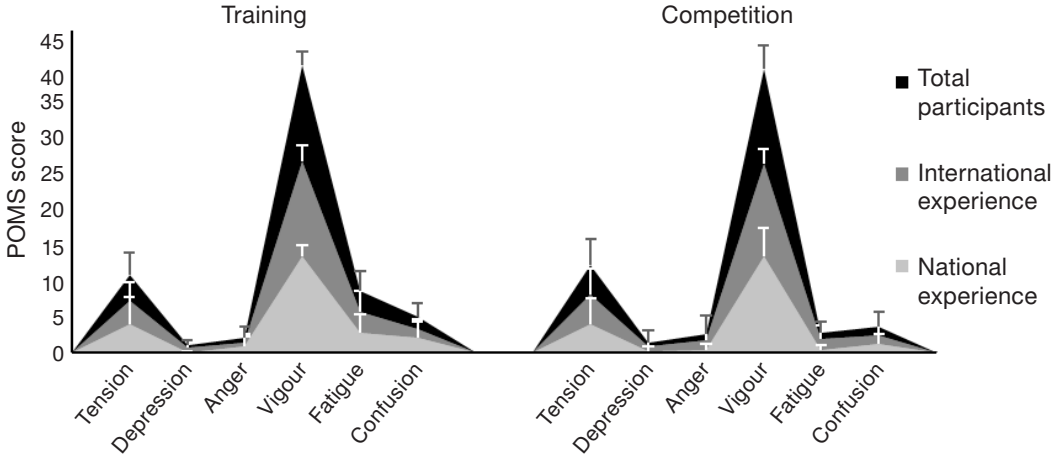

Figure 1. Mood profile for total goalball athletes, international experience goalball athletes, and national experience goalball athletes during training and competition. Data represent mean and standard deviation

Table 3. Mood state score by experience level and contextual condition

Conditions	Participants	Tension (mean ± *SD*)	Depression (mean ± *SD*)	Anger (mean ± *SD*)	Vigour (mean ± *SD*)	Fatigue (mean ± *SD*)	Confusion (mean ± *SD*)
Training	National experience	4 ± 3.8	0.07 ± 0.2	0.93 ± 1.7	13.53 ± 1.4	2.73 ± 2.6	2.07 ± 2.3
	International experience	3.2 ± 2.6	0.6 ± 1.1	0.53 ± 0.9	13.13 ± 2.3	3.07 ± 2.9	1.33 ± 1.3
	Total participants	3.6 ± 3.2	0.33 ± 0.8	0.73 ±1.4	13.4 ± 1.9	2.9 ± 2.7	1.7 ±1.9
Competition	National experience	4 ± 3.6	0.2 ± 0.7	0.33 ± 0.9	13.40 ± 4.0	0.33 ± 0.8*	1.2 ± 1.4
	International experience	4.20 ± 3.5	0.73 ± 2.5	1.4 ± 3.5	13 ± 2.	1.53 ± 2.0*	1.27 ± 2.6
	Total participants	4.1 ± 3.5	0.47 ± 1.8	0.87 ± 2.6	13.20 ± 3.3	0.93 ± 1.6	1.23 ± 2.1

* statistical significance

Table 4. Performance in competition and training by experience level

Condition	Participants	Total of successful actions (mean ± *SD*)	Total of errors (mean ± *SD*)	Total of actions (mean ± *SD*)	Proportion of errors (mean ± *SD*)	Proportion of successful actions (mean ± *SD*)	Proportion of goals (mean ± *SD*)
Training	National experience	26.73 ± 9.6	3.6 ± 2.5	30.33 ± 10.2	3.6 ± 2.5	26.73 ± 9.64	1.46 ± 2.0
	International experience	23.6 ± 11.4	2.73 ± 2.2	26.3 ± 11.9	2.73 ± 2.2	23.6 ± 11.46	2.06 ± 2.1
	Total participants	23.4 ± 9.3	3.16 ± 2.3	26.5 ± 9.8	0.87 ± 0.09	0.12 ± 0.09	0.14 ± 0.1
Competition	National experience	26.93 ± 12.9	2 ± 2.5	28.9 ± 14.0	2 ± 2.59	26.93 ± 12.9	1.53 ± 1.8
	International experience	28.93 ± 17.6	3 ± 2.5	31.9 ± 17.7	3 ± 2.5	28.93 ± 17.6	2.4 ± 3.04

Impact of the international and national level of experience on training and competition mood states and motor performance (test of hypothesis C)

The descriptive values of mood states and motor performance in training and competition are shown in Tables 3 and 4. In competition, the athletes with international experience self-reported higher fatigue levels than those with national experience ($U = 70$; $p < 0.05$; $MD = 1.2$; $\eta^2 = 0.05$). There were no significant differences between athletes with international and national experience during training or competition for the other mood states. The comparisons between international and national athletes did not show significant differences in any performance metrics in any condition (training and competition).

Discussion

The present study investigated whether competitive goalball athletes demonstrate an 'iceberg mood profile' and whether mood state profiles predict motor performance in training and competition. We also investigated the influence of goalball athletes' experience on the relationship between mood state and motor performance in training and competition conditions. Based on the 'iceberg mood profile' model [1, 2] and its predictive condition for athletic performance in non-disabled [3, 5, 7] and disabled athletes [22, 24, 26, 27], we expected (hypothesis A) that goalball athletes would demonstrate the 'iceberg mood profile'. Additionally, according to Beedie et al. [5], Hall and Terry [7], and Lochbaum et al. [3], our hypothesis B was that the profile of mood states would be predictors of training and competition performance of goalball athletes. Given that elite and finalist Paralympic athletes report less tension and confusion, and higher vigour than non-finalists [28], we also put forward hypothesis C: the goalball athletes with international experience would exhibit lower scores in negative mood states (tension, depression, anger, fatigue, and confusion) and higher vigour levels than those with national expertise.

Our findings corroborated hypothesis A and gave partial support to hypothesis B, given that only vigour predicted the proportion of successful actions, and tension predicted the proportion of errors. Nevertheless, we did not find evidence to corroborate our hypotheses C. Next, we analysed hypotheses A, B, and C separately.

Do competitive goalball athletes demonstrate an iceberg mood profile?

Our study found evidence of the 'iceberg mood profile' in goalball athletes, consistent with research on this phenomenon in competitive sports [3]. Interestingly, the training season (training or competition) and expertise level (national or international) did not influence the 'iceberg mood profile' in our goalball athletes, revealing the stability of these athlete's characteristics in different contextual athletic circumstances.

Descriptively, our athletes reported augmented tension levels, independently of the training season and expertise level. In general, tension can be determined as a negative mood state. However, depending on the depression state, the anger or tension can facilitate or inhibit the performance [31, 32]: A depressed mood tends to suppress anger and tension, promoting self-blame, which induces a performance detrimental; whereas cheerful mood states tend to transform tension or anger into a booster arousal component, which can facilitate performance [31, 32]. Thus, given the lower level of depression mood state in our participants, tension may not necessarily be related to detrimental performance. We discuss this issue further in the following sub-section.

Does the profile of mood state predict the training and competition performance of goalball athletes?

When examining each mood state and its influence on performance metrics during training and competition, our results indicated minor positive influences of vigour on the proportion of success during competition and tension on the proportion of errors during training. These findings align with a metanalytic study developed in non-disabled athletes [5], in which performance was influenced moderately by the vigour and slightly by the tension. Our results suggest that Paralympic athletes may have specific interactions between the profile of mood states and performance, which is not quite similar to non-disabled athletes [19, 26, 27, 33].

It has been described that Paralympic athletes tend to decrease vigour levels across the competition, as reported at the end of the competition compared to the pre-competition period [21]. Our findings demonstrated that this mood state could be strongly related to physical conditions that support athletic performance, once vigour can be interpreted as a mood state with a substantial physiological influence [34].

The competition results indicated a poor relationship between tension and performance. However, these two variables were significantly related during the pre-competition training, in which tension predicted better performance (higher tension scores were associated with lower error scores). The association between tension and performance could be interpreted as circumstantial since it might be linked to the psychological demands of the pre-competition training period, as Paralympic athletes report high levels of state anxiety and tension during this specific period [33]. Then, in pre-competition training, tension mood state seems to be an enhancement mechanism in non-depressed goalball competitive athletes, as expected in Lane and Terry's model [31].

Does the level of experience (international experience versus national experience) impact the relationship between the profile of mood state and motor performance in training and competition?

The analysis did not reveal significant differences in the profile of mood states between international and national experience athletes during the pre-competitive training. International athletes demonstrated higher fatigue levels than their national-level counterparts in competition. Thus, our data suggest that mood state profiles are not sensitive enough to differentiate international from national competitive goalball athletes. These findings are in line with Rowley et al. [10], who demonstrated in a meta-analytic study a small and non-robust effect of the POMS in predicting the performance of successful versus less successful athletes. Further, the profile of mood states seems to be limited as predictive of athletic performance in Paralympic athletes. In contrast, our findings show that the profile of mood states was influenced by the competitive context (it may vary depending on whether it is training or competition). The fact that all the athletes in our study had already participated in high-level competitions could explain the absence of differences between international and national experience athletes regarding the profile of mood states. Therefore, the difference in the profile of mood states between these professional Paralympic athletes could be less detectable than the differences found by Paulsen et al. [24] in amateur athletes or the average population.

The 'iceberg mood profile' was not correlated to the performance of international and national experience athletes. Even with a lower score of negative mood state (fatigue), national experience athletes did not

demonstrate better motor performance than international experience athletes. In fact, there were no significant performance differences in training and competition between these sub-groups.

Limitations and direction for future research

One limitation of our study is that we only had performance evaluations conducted by one professional. Typically, at least three evaluators are recommended to ensure consistency of observational assessment. However, due to the limited availability of professionals with extensive experience in Paralympic sports, we decided to prioritise the evaluation by a high-quality professional with academic and professional expertise, without discrepancies, compared to other less-experienced goalball professionals. Nevertheless, we tested the reliability of the assessment with an extensive number of observations (60 trials) with another goalball professional, and the correlation level was highly satisfactory (0.999).

Another limitation of our study is the window time for performance assessments. Athletes demonstrate mood fluctuations during pre-competitive and competitive periods [30]. Considering only the final matches in our analyses could also reduce our sample size, given the lower number of players in the final competitions. To avoid these issues, we tried to perform assessments during training and competition as closely as possible. However, we do not have enough data to extrapolate our findings to the initial training phase or the final competition stage. For future studies, we suggest examining the profile of mood states and performance of goalball players, considering the moment of training (beginning or end of the training season) and competition (classification and finals).

Despite some limitations (use of self-report questionnaires, reduced sample size), our study can instigate further investigations of other psychological characteristics of Paralympic athletes, which can influence athletic performance. Some interesting questions remain regarding this issue, such as the influence of the disability aetiology (congenital or acquired) or characteristic (physical, motor, or mental disability), as well as the social condition that involves the athlete, such as mental training and preparation, family support, and the lack of sufficient adaptative facilities and training structure or financial resources.

Implications for policy and professional practice

Our findings provide strong evidence for the influence of mood states on performance, strengthening the role of sport psychologists and their implications for policy and professional practice in goalball with regard to mood regulation. By collaborating with coaches and administrators to develop guidelines for managing mood states, providing personalised support to athletes, and addressing mental health stigma, sport psychologists can enhance athlete well-being and performance. These efforts may contribute to the growth and success of the sport, as well as the mental and physical health of participating athletes.

Conclusions

This study suggests that the 'iceberg mood profile' seems to characterise the profile of mood states of professional goalball athletes, regardless of experience level (international and national) and contextual conditions (pre-competition training and competition).

Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

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