Does the Iceberg Profile Discriminate Between Successful and Less Successful Athletes? 
A Meta-Analysis

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The Profile of Mood States (POMS) is commonly used to measure mental health in athletes. Athletes scoring below norms on scales of tension, depression, confusion, anger, and fatigue, and above norms on vigor, are said to possess a positive profile that graphically depicts an iceberg. However, the predictive power of the iceberg profile has recently been questioned. A meta-analysis was conducted on 33 studies comparing the POMS scores of athletes differing in success to estimate the magnitude of the findings. The overall effect size was calculated to be 0.15. Although this value was significantly different from zero, the amount of variance accounted for was less than 1%. The results suggest that across many different sports and levels of performance, successful athletes possess a mood profile slightly more positive than less successful athletes. However, with such a small and nonrobust effect, the utility of the POMS in predicting athletic success is questionable.

Key words: Profile of Mood States, mental health model

Morgan’s (1985) mental health model states that “positive mental health enhances the likelihood of success in sport, whereas psychopathology is associated with a greater incidence of failure” (p. 79). In examining the mood states of athletes and nonathletes, Morgan found that athletes, especially successful ones, possessed a unique mood profile which he labeled the iceberg profile. This term refers to the graphic picture that raw scores on the Profile of Mood States (POMS) create when they are plotted on a profile sheet (McNair, Lorr, & Droppleman, 1971/1981), with the test norms representing the “water line.” If an athlete scores low on “negative” mood scales (tension, depression, anger, fatigue, confusion) and high on the “positive” vigor scale, the plotted curve resembles an

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iceberg. Using this terminology, Morgan’s hypothesis can be simplified as follows: Successful athletes possess more of an iceberg profile than less successful athletes.

Textbook reviews of personality and sport research have given the mental health model considerable attention. Gill (1986) stated that “Morgan offers the most systematic and strongly supported work on the relationship of personality to success in sport” (p. 31), and Cox (1990) stated that “the research evidence is very convincing that the successful athlete is likely to enjoy positive mental health” (p. 38). Others have described the consistency of Morgan’s results as “remarkable” (Eysenck, Nias, & Cox, 1982, p. 19).

Claiming that successful athletes tend to be mentally healthy is not a provocative concept, and surely, psychopathology and success at nearly anything should be inversely correlated. Yet, when examining the mental health model, a question arises as to whether the relationship between mental health and athletic performance is correlated highly enough to make fine-grain distinctions between athletes possessing similar psychological profiles. After all, athletes do not fall into two categories: psychopaths and normals. Mental health is a continuum, and athletes may fall very close to each other in their overall rating of mental health, or they may be very different. The point is, the smallest divisions between levels of mental health are nearly indistinguishable. Can the mental health model detect fine-grain distinctions among successful and less successful athletes with similar mental health profiles? The empirical evidence presented by Morgan (1985) in support of the mental health model, in fact, came from studies examining fairly homogeneous groups of athletes (elite or advanced athletes from relatively few sports) whose profiles were likely to be similar. The results from these studies, in terms of the ability to predict success from these similar profiles, were very impressive.

The general acceptance of the mental health model is based largely on seven of Morgan’s early studies that provided convincing research support. In the years following Morgan’s early research, however, conflicting evidence has generated criticism and concern as to the usefulness of the mental health model (Landers, 1991; Prapavessis & Grove, 1991). Criticism is leveled at five problem areas in the research: the measures of mental health, the measures of performance, the time span between the measurement of these variables, the interpretation of the findings, and the design methodology.

Although other psychological measures have been used to assess mental health, the POMS has been the inventory of choice because of its success in Morgan’s early studies. Morgan (1980b) stated that “of all the psychological tests my colleagues and I have experimented with, we have found the Profile of Mood States (POMS) to be the most highly predictive of athletic success” (pp. 93, 97). However, situational factors, such as completing the POMS before team selection, can influence the results. The validity of the POMS in such environments is questionable because, according to Boyle (1987), “the instrument is highly susceptible to distorting influences such as effects of social desirability and other response sets, inadequate self-insight, and even downright dissimulation, given the obvious item transparency” (p. 353). In fact, undergraduate students were able to “fake good” and produce an iceberg profile when asked to imagine themselves as elite athletes who suspected that POMS data would influence their being selected for a team (Miller & Edgington, 1984).
A second concern with past research is related to the measures of performance that were used. Specifically, successful performance, which the mental health model claims to predict, was never directly assessed in Morgan’s research. Instead, success was inferred from placement in a competition (e.g., Morgan & Johnson, 1978; Morgan, O’Connor, Sparling, & Pate, 1987). This definition fails to account for the nonqualifiers and nonplacers who produced career-best performances. As Krane (1992) points out, this use of a between-subjects comparison in terms of performance does not adequately account for how well the athlete actually performs. Thus, the measures of success that have typically been used are not appropriate, nor is it appropriate to rely upon between-subjects comparisons rather than within-subjects analysis. There is a need to incorporate within-subjects analyses rather than between-subjects analyses because precompetitive mood profiles related to successful and unsuccessful performances may vary between individuals. For instance, one athlete may perform quite well when angry, whereas another athlete with the same mood state may perform poorly.

The third criticism of the research in this area is that the time span between the assessment of mental health and performance has been inconsistent (Landers, 1991). Administration of the POMS, a paper-and-pencil measure, is limited to times outside an athlete’s precompetition preparatory period and has occurred anywhere from 1 week to 4 years (Morgan & Johnson, 1978) prior to performance. Often, the wording of the instructions for the POMS did not direct athletes to report their moods for the time in which the performance occurred. Additionally, empirical evidence has shown that mood states measured by the POMS are influenced by time of day (Hill & Hill, 1991) and, in swimmers, by level of training intensity (Morgan, Brown, Raglin, O’Connor, & Ellickson, 1987). Therefore, since the mood state likely changes between the time of psychological test administration and the time of performance assessment, the relationship between a “snapshot” of mental health and performance is tenuous at best.

Another criticism of research in this area is that early researchers may have misinterpreted their results. In fact, the initial praise for Morgan’s research may have resulted from these faulty interpretations. Prapavessis and Grove (1991) indicated that past researchers have wrongly interpreted correlational findings as causal by assuming that a certain mood profile produces good performances. An athlete’s outstanding performances and training in the past may cause both a positive mood profile and a successful performance, without the mood state actually causing the performance. Heyman’s (1982) reanalysis of a series of articles on the relationship between psychological states and performance support this contention. Heyman (1982) found that athletes exhibiting successful performances had significantly better season records, more experience, and came from superior training programs when compared to unsuccessful athletes. As Heyman concluded “the psychological patterns and cognitions may themselves reflect previous experiences rather than cause or facilitate performance in most of the participants” (p. 299). This evidence supports an overlooked concept in the psychological testing of athletes: the impact of an athlete’s physical skills and abilities upon psychological parameters.

The final criticism against studies that have investigated the mental health model is that they have been plagued with methodological problems. In spite of Morgan’s consistent results, many of the studies claiming to support the iceberg
profile made no statistical comparison to an appropriate control group (Landers, 1991). Rather than compare groups of athletes, researchers have often contrasted an athletic group’s scores with POMS norms generated in 1967 by participants in psychological tests and students in psychology classes (e.g., Morgan & Johnson, 1978; Morgan, O’Connor, et al., 1987). As Landers (1991) argued, the normative sample reported in the POMS manual is an inappropriate comparison group for research on athletes. McNair et al. (1971/1981), the authors of the POMS, even cautioned that the normative information “should be considered as very tentative” (p. 19) because the data were obtained from only one university at one point in time.

In fact, since Morgan’s early work, few studies have found the iceberg profile to be successful at predicting athletic performance. In a review of research, Landers (1991) discovered that only 53% of the comparisons were in the predicted direction. This percentage is not significantly different from the total that would be expected from chance. Unfortunately, a traditional narrative review of the literature is unable to determine the magnitude of an effect, and Landers (1991) could not conclusively estimate the predictive import of the mental health model. However, Glass’s (1977) quantitative review method, meta-analysis, integrates the findings of multiple studies that meet present selection criteria in a particular domain in order to arrive at general conclusions on a topic.

Meta-analyses quantify the results of all relevant, appropriate, and available studies with a standard metric, the effect size (ES), that can later be subjected to statistical analysis. Combining the ESs of many studies is equivalent to combining all of the participants from all of the studies. This then augments the statistical power of the analysis, which is useful in detecting small, significant trends and which allows for the use of multivariate techniques. Meta-analysis, therefore, can provide what traditional reviews cannot: in this case, a replicable, relatively objective, scaled measure of the mental health model’s efficacy in discriminating among athletes. None of the methodological concerns with the past research can be corrected through meta-analysis; however, these concerns can be coded so that the impact that they have on the ESs can be examined.

The extent to which mental health, as measured by the POMS, is predictive of athletic performance was tested using meta-analytic techniques. It was hypothesized that, as predicted by Morgan (1985), successful athletes would possess a more positive mood (i.e., iceberg) profile when compared to less successful athletes. Additional a priori hypotheses were proposed with regard to characteristics that could potentially moderate the effects outlined in the original hypothesis. Referring to the mental health model, Morgan (1985) stated that “specific responses will be dependent upon specific stimulus conditions” (p. 71). This suggests that the model’s predictive utility may be limited to certain types of activities (Landers, 1991). Therefore, it is hypothesized that the ability of the POMS to predict athletic success will be influenced by the type of activity (endurance or strength) being observed.

Additionally, because mood states change over time (Hill & Hill, 1991) and because the mood of the athlete is thought to influence the athlete’s performance capability, it is hypothesized that studies that assess mood immediately before competition will be better predictors of performance than those that assess mood well before competition or after competition.

As evident in previous meta-analyses in sport psychology (Feltz & Landers,
1983; North, McCullagh, & Tran, 1990), published studies have a larger overall ES than unpublished studies. Thus, it is predicted that effects from published studies will be significantly larger than effects from unpublished studies.

Finally, since the POMS is susceptible to distorting influences (Boyle, 1987; Miller & Edgington, 1984), it is hypothesized that the POMS will be less effective as a predictive instrument in environments with strong demand characteristics (i.e., during team selection) because all athletes may respond in a "desirable" manner if they feel that their responses may impact their chances of, for example, making the team. This idea is also supported by Morgan’s (1974) caution that studies reporting null findings often do not use lie, guess, or random response scales. Without such safeguards, the truthfulness of the responses may be questioned, and the variability in the responses may be misleadingly small. As such, studies that include any of these distortion scales should produce larger ESs than studies without safeguards.

Method

Selection and Inclusion of Studies

All available literature from 1971 (the copyright date of the POMS) through January 1992 were located using computer databases (PsychLIT, ERIC, Medline, and Dissertation Abstracts International); AAHPERD Convention Abstracts of Research Papers; Completed Research in Health, Physical Education, Recreation, and Dance; Psychological Abstracts; Social Sciences Citation Index; Current Contents; and Microform Publications. Systematic searches of reference lists were also conducted to locate studies not located through the computerized data sets.

Glass (1977) has recommended that a priori exclusions of research should be minimized. As such, inclusion criteria were kept broad so that studies included in the analysis had to assess mental health only with the POMS and with at least two groups of athletes (i.e., any individual who is a regular participant in a sport at the time of mood assessment) in the same sport at different levels of success.

A total of 94 studies were located using the search strategies described. However, 8 studies could not be included in the analyses because they did not include sufficient data for the calculation of ESs. Additionally, 52 studies were not included because they did not include any comparison of POMS scores between athletes who differed in success. Finally, one study was excluded because the data were presented in another study included in the analysis. Therefore, 33 studies yielding 411 ESs were subjected to further analysis. These studies are identified in the reference list by an asterisk.

Coding Characteristics

Studies were coded for variables that could potentially moderate the effect of mental health on athletic performance. Publication status referred to whether the study was published in a journal or book or was an unpublished thesis, dissertation, or professional presentation. Participant characteristics included the following:
1. The difference between the groups on the level of expertise (see bulleted list), which was coded as same level, one level different, or two levels different
2. The confidence in the expertise level categorization which was simply coded as questionable (unclear) or valid (clear)
3. The sex of participants, which was coded as men only, women only, or men and women combined

Activity characteristics included the following:

1. Aerobic (training consists of continuous rhythmic movements using major muscle groups) or strength (any activity not meeting the aerobic definition)
2. The operational definition of performance, which was coded as personal best, ranking, selection for team, starters/nonstarters, placement in a race, finishing/not finishing a race, winning/losing, or a subjective measure of performance
3. The confidence in this definition of performance, which was coded as questionable (unclear) or valid (clear)

Methodological characteristics included the following:

1. Time of mood assessment, which was coded as more than 24 hours prior to performance, less than 24 hours prior to performance, or postperformance
2. Presence of a lie scale, which was coded as included or not
3. Presence of demand characteristics (any situation in which athletes were being evaluated for selection to a team) as present or not
4. Differences in physical training state between groups as different or the same
5. Internal validity, as good (0 threats), moderate (1–2 threats), or poor (3 or more threats) based upon the number of threats to internal validity which existed

Effect sizes were calculated for each scale of the POMS (i.e., tension, depression, anger, vigor, fatigue, and confusion). Expertise categories were based upon the following operational definitions:

**Elite**

- Ranked in the top 10 in the United States
- Member of a national team or professional
- Best marathon: men: under 2.5 hours; women under 2.75 hours
- Best 10K: women: under 35 minutes

**Advanced**

- Ranked, but not in top 10
- Member of a state team or winner of a state tournament
- College athletes
- High School: member of a national team or nationally ranked
- Black belt in martial arts
Iceberg Profile

- Best marathon: under 4 hours
- Able to run an ultramarathon (50 miles or more)

**Intermediate**
- High school athletes
- Colored belt in martial arts
- Able to run a marathon, triathlon, or 15 miles per week regularly

**Novice**
- Ranked as novice
- Regular participant for less than one year at time of assessment

**Analyses**

ESs were calculated using Hedges and Olkin’s (1985) extension of Glass’s (1977) original technique. The pooled standard deviation (weighted to correct for sample size bias) was used in ES calculation because it provides a more precise estimate of the population variance (Hedges, 1981). The formula for this calculation is:

$$\text{ES} = \frac{M_E - M_C}{SD_p}, \text{where } SD_p = \sqrt{\frac{(N_E - 1) \cdot SD_E^2 + (N_C - 1) \cdot SD_C^2}{N_E - N_C - 2}},$$

and where $M_E$ = mean of the experimental group; $M_C$ = mean of the control group; $SD_p$ = pooled standard deviation; $N_E$ = number of participants in the experimental group; $N_C$ = number of participants in the comparison group; $SD_E$ = standard deviation of the experimental group; and $SD_C$ = standard deviation of the comparison group. To ensure that ESs in support of the iceberg profile were positive values, the means of the successful group were subtracted from the means of the less successful group for all scales except “vigor,” in which the less successful group was subtracted from the more successful group. Because studies with small samples sizes may have a biased effect size (Thomas & French, 1986), each effect size was then multiplied by a correction factor designed to yield an unbiased estimate of effect size (Hedges, 1981). This correction factor is: $c = 1 - [3/(4m - 9)]$ where $m = N_e + N_c - 2$.

Studies that reported more than one set of six ESs (representing the six POMS scales) can pose a threat to the statistical validity of the results. This situation violates the assumption of independence of data points (Bangert-Drowns, 1986). To control for this problem, overall ES was calculated twice. First, all ESs were combined to determine overall ES. Then for the remainder of the analyses only one ES (reflecting the two most extreme success groups) per study was included. The decision to use this particular set of ESs was made to give the mental health model the greatest likelihood of showing an effect. That is, since Morgan (1980a) contends that the relationship between psychological state and performance is linear, greater differences between performance outcome should be reflected in greater differences in POMS scores. Additionally, while effects could be calculated for total mood disturbance scores, these scores represent a sum of the six aspects of the mood scale and thus would not be independent scores. Therefore, these scores were only used in the overall average of effects and were not included in any subsequent analyses.
Results

The overall average ES ($n = 411$) was calculated to be 0.15 ($SD = 0.89$), which indicates that successful athletes possess a mood profile approximately one sixth of standard deviation healthier than less successful athletes. Based on the preceding rationale, which prescribed the elimination of the total mood disturbance score and the use of only one set of ESs for the most extreme groups, the overall ES was 0.19 ($SD = 1.09, n = 198$). The average ES for each study and the coding of the moderating variables can be found in Table 1.

Next, three outliers (ESs falling outside of three standard deviations from the mean) were identified and omitted. This did not change the mean ES, but the SD was decreased to 0.71. Following the procedures outlined by Thomas and French (1986), the H-statistic was calculated and found to be significant, $\chi^2(194) = 817.69, p < .05$, with a critical value of 227.21, indicating that ESs were not homogeneous. This lack of homogeneity warranted further examination of moderator variables.

One-way analyses of variance (ANOVAs) were conducted on all of the coded variables to test for significant differences in ESs among the levels of each variable. ANOVAs were used because the distribution of the effects was reasonably close to normal to warrant the use of parametric techniques rather than necessitating the use of nonparametric techniques (Wolf, 1986).

The only moderating variable that was found to significantly impact the ESs was the moderating variable that reflected the confidence the coder had in the value assigned to the performance variable, $F(1, 193) = 5.652, p < .05$. The studies in which the categorization was questionable (i.e., in which performance scores were unclear) had larger ESs ($M = 0.51, SD = 0.78, n = 29$) than did studies in which the categorization was not questionable (i.e., in which performance scores were quite clear) ($M = 0.13, SD = 0.69, n = 166$).

Discussion

All available research included in the meta-analysis indicated that successful athletes, in general, report POMS scores one sixth of a standard deviation higher than less successful athletes in the same sport ($ES = 0.15$). Despite biasing analyses to allow the mental health model to demonstrate an effect (by using the largest possible set of ESs from each study in the analysis), these results show that POMS scores for successful athletes are less than one fifth ($ES = 0.19$) of a standard deviation higher than POMS scores for unsuccessful athletes. The magnitude of this effect, according to Cohen’s (1988) classification, is very small. Of additional concern is the fact that larger effects were found in those studies in which the definition of success was of questionable clarity ($M = 0.51$) as compared to studies in which the definition of success was clear ($M = 0.13$). This does not encourage the use of the mental health model as an instrument to predict performance, or as a dimension for team selection.

The lack of strong support for the POMS in predicting athletic success reflects poorly on the mental health model proposed by Morgan (1985). Given that prediction rates of the model have been reported to range from 70% to 80% (Morgan, 1985) and 70% to 90% (Raglin, Morgan, & Luchsinger, 1990), the
ESs generated by the meta-analytic procedures should have been larger. Further, when these ESs are converted to a Pearson’s $r^2$, they account for less than 1% of the variance explained for performance outcome. That is, of all the factors that determine an athlete’s performance, precompetitive mood states as measured by the POMS accounted for less than 1%, and the remaining 99% could be explained by other components (e.g., physiological characteristics, biomechanical status, practice, diet, or other psychological variables).

Eight studies were excluded from the analysis due to insufficient data for the calculation of ESs. Four of these studies (DeMers, 1983; Morgan, O’Connor, Ellickson, & Bradley, 1988; Nagle, Morgan, Hellickson, Serfass, & Alexander, 1975; Silva, Shultz, Haslam, Martin, & Murray, 1988) reported that the POMS discriminated between successful and less successful athletes, with the successful athletes possessing a more pronounced iceberg profile. The other four studies found that mood profiles either did not differ between athletes of different levels (Berger & Owen, 1986; Craighead, Privette, Vallianos, & Byrkit, 1986; Durtschi & Weiss, 1986) or that less successful athletes had a more pronounced iceberg profile than did more successful athletes (Riddick, 1984). It appears that, had these studies been included in the analysis, they would not have significantly affected the overall ES.

The results of the present analysis mirror Landers’s (1991) traditional review of the mental health model. Landers (1991) identified 14 studies that compared the POMS scores of two groups of athletes representing two levels of performance outcome, and a total of 148 comparisons between successful and less successful athletes were made for the six scales of the POMS. Of these comparisons, only 18% were statistically significant, with 16% of the significant results in the direction predicted by the mental health model. Since the sample sizes of the studies were so small, Landers (1991) conducted a second analysis in which statistical significance was ignored, and the 148 comparisons were divided into those that supported and those that did not support the mental health model. As already mentioned, when examined in this manner 53% of the results supported the mental health model. The present meta-analysis yielded a total of 411 comparisons, with 54% in the predicted direction. The striking similarity of results adds credence to Landers’s (1991) conclusion that the findings “fail to clearly support the predictions of the mental health model” (p. 197).

Based on the results of this analysis, future research would benefit from using larger samples. To ensure that adequate statistical power exists (i.e., 0.80), approximately 100 participants are required for 95% confidence in the results (Kraemer & Thiemann, 1987). However, there appears to be little promise in using the POMS and the mental health model in attempts to predict performance in athletes. Although a series of studies with strong research designs may be helpful in demonstrating a larger effect, it is likely to be moderate at best, and the resources may be better spent on more promising endeavors.

However, Morgan and his colleagues have recently shifted their focus to a more “dynamic” mental health model, which proposes a within-subjects approach to predicting individual performance by means of consistent monitoring of the athlete’s psychological states across different training conditions (Morgan, O’Connor, et al., 1987). The dynamic mental health model accounts for an athlete’s individual differences by tracking his or her unique level of success and mood profiles. As such, each athlete will generate his or her own graphic
Table 1  Effect Size, Standard Deviation, and Moderating Variables by Study

<table>
<thead>
<tr>
<th>Study</th>
<th>Publ. status</th>
<th>No. subjects</th>
<th>Overall ES</th>
<th>Overall SD</th>
<th>Diff. in Conf.</th>
<th>Conf. in diff.</th>
<th>Sex</th>
<th>Task</th>
<th>Operational def. of perf.</th>
<th>Clarity of measure</th>
<th>Time of mood assessment</th>
<th>Lie scale included?</th>
<th>Demand char.?</th>
<th>Diff. in training?</th>
<th>Internal validity</th>
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<td>Pub</td>
<td>160</td>
<td>1.59</td>
<td>2.06</td>
<td>Same</td>
<td>Quest</td>
<td>M</td>
<td>Aerobic Placing in race</td>
<td>Valid</td>
<td>After perf.</td>
<td>No</td>
<td>No</td>
<td>NR</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Berer &amp; Owen (1983)</td>
<td>Pub</td>
<td>27</td>
<td>-0.13</td>
<td>0.41</td>
<td>One</td>
<td>Quest</td>
<td>F</td>
<td>Aerobic Ranking</td>
<td>Valid</td>
<td>After perf.</td>
<td>Yes</td>
<td>No</td>
<td>NR</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Boyce (1987)</td>
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<td>66</td>
<td>-0.20</td>
<td>0.21</td>
<td>Two</td>
<td>Valid</td>
<td>M</td>
<td>Aerobic Personal best Starters/ non</td>
<td>Valid</td>
<td>≤ 24 before</td>
<td>Yes</td>
<td>No</td>
<td>Same</td>
<td>Poor</td>
<td></td>
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<tr>
<td>Cavanaugh (1982)</td>
<td>Unpub</td>
<td>201</td>
<td>0.13</td>
<td>0.18</td>
<td>Same</td>
<td>Valid</td>
<td>Mx</td>
<td>Strength Ranking</td>
<td>Quest</td>
<td>&gt; 24 before</td>
<td>No</td>
<td>No</td>
<td>NR</td>
<td>Mod</td>
<td></td>
</tr>
<tr>
<td>Daiss, LeUnes, &amp; Nation (1986)</td>
<td>Pub</td>
<td>72</td>
<td>0.55</td>
<td>0.27</td>
<td>Two</td>
<td>Quest</td>
<td>M</td>
<td>Strength Ranking</td>
<td>Quest</td>
<td>After perf.</td>
<td>No</td>
<td>No</td>
<td>NR</td>
<td>Poor</td>
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<td>0.21</td>
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<td>Quest</td>
<td>M</td>
<td>Strength Subjective</td>
<td>Quest</td>
<td>NR</td>
<td>No</td>
<td>No</td>
<td>NR</td>
<td>Poor</td>
<td></td>
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<td>0.15</td>
<td>Two</td>
<td>Valid</td>
<td>Mx</td>
<td>Aerobic Ranking</td>
<td>Valid</td>
<td>≤ 24 before</td>
<td>No</td>
<td>No</td>
<td>NR</td>
<td>Poor</td>
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<td>0.01</td>
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<td>M</td>
<td>Aerobic Personal best Starters/ non</td>
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<td>After perf.</td>
<td>NR</td>
<td>No</td>
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<td>Valid</td>
<td>Mx</td>
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<td>After perf.</td>
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<td>No</td>
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<td>Poor</td>
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<td>16</td>
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<td>0.16</td>
<td>Same</td>
<td>Valid</td>
<td>Mx</td>
<td>Aerobic Win/lose Personal best</td>
<td>Quest</td>
<td>&gt; 24 before</td>
<td>No</td>
<td>No</td>
<td>NR</td>
<td>Poor</td>
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<td>396</td>
<td>0.17</td>
<td>0.13</td>
<td>One</td>
<td>Quest</td>
<td>M</td>
<td>Aerobic Selection</td>
<td>Quest</td>
<td>≤ 24 before</td>
<td>No</td>
<td>No</td>
<td>NR</td>
<td>Poor</td>
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<td>Valid</td>
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<td>Aerobic Selection</td>
<td>Valid</td>
<td>&gt; 24 before</td>
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Note. Pub = published; Unpub = unpublished; Quest = questionable; Diff = difference; Expert. = expertise; Conf = confidence; Def = Definition; Perf. = performance; Char. = characteristics; Mod = moderate; M = male; F = female; Mx = mixed.
profile of POMS scores that is consistent with success, which may or may not depict the classic iceberg profile. The dynamic mental health model is likely a more appropriate and effective application of the POMS as it relates to athletic performance.

References


References marked with an asterisk were included in the meta-analysis.


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**Author Note**

This article is based on a master’s thesis completed by the first author at Arizona State University under the guidance of the second author.

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