

with testosterone levels immediately before and several days after delivery (Hohlagschwandtner et al. 2001).

Factor analytic studies provide support for the POMS as a multidimensional instrument. Heuchert and McNair (2012) report that of six factor analytic studies, three analyses confirmed the six POMS dimensions. Confusion – bewilderment, however, did not consistently emerge as a distinct factor corresponding to the subscale (Heuchert and McNair 2012). In two independent samples, consisting of psychiatric outpatients and a group of adults who were regular smokers, confirmatory factor analyses found three factors corresponding to the POMS subscales – anger-hostility, vigor-activity, and fatigue-inertia. However, the remaining three subscales – tension-anxiety, depression-dejection, and confusion-bewilderment – loaded on a single dimension (Norcross et al. 1984). The authors attributed this pattern to high interscale correlations, the distinctive characteristics of the samples, and social desirability. In a Japanese sample, five factors emerged with confusion and depression-dejection loading onto a single factor (Yokoyama et al. 1990).

Short POMS versions (30 or 37 items), featuring six subscales developed through factor analyses, have exhibited equal or superior levels of internal consistency reliability. The brief POMS exhibits a more readily interpretable factor structure resulting from the elimination of items which do not load on a specific factor as well as items which appear redundant (Bourgeois et al. 2010). Five of the six POMS subscales also emerged as distinct dimensions in a confirmatory factor analysis (Bourgeois et al. 2010).

POMS Norms

Norms have been developed for several specific population and reveal age-related differences in POMS mood states. Relative to a middle-aged adult sample (mean age = 44.00 years), a geriatric sample (mean age = 68.1 years) exhibited significantly lower scores on tension- depression, fatigue, and total mood disturbance (Nyenhuis

et al. 1999). However, further analyses indicated that this difference was attributable solely to differences between older and younger males with no age-related disparities among the women.

Relative to adults 25 years and older, college-aged individuals (ages 18–24 years), exhibited significantly higher scores on all the scales except vigor on which a significantly lower mean score was obtained (Nyenhuis et al. 1999).

Because of its wide use with athletes, there was concern that the published POMS norms based on college students (McNair et al. 1971) were not useful in discriminating mood states among athletes. A large sample of international and recreational athletes scored significantly higher on all the POMS dimensions suggesting that norms should be revised when applying the scale to athletes (Terry and Lane 2000).

The Iceberg Profile and Competitive Athletes

The use of the POMS to discriminate between elite and less successful athletes was a popular research topic in the late 1970s and early 1980s. Morgan (1985) described the POMS “iceberg profile” which was touted as a key discriminator between successful and less successful athletes. Characterized by high scores on vigor and low scores on the negative mood subscales, this POMS configuration was presented as a key discriminator between athletes who qualified for elite teams such as national Olympic teams compared with others who try out but are not selected. Successful athletes were those who were selected for the US Olympic team or who had won multiple varsity letters. Data were presented for elite runners, wrestlers, and rowers who had been selected for Olympic competition or who had earned multiple collegiate athletic letters, with some evidence that successful athletes in these sports were more likely to exhibit this distinct POMS configuration. Morgan also noted that these successful athletes scored lower than the population norms for negative affect (Morgan and Johnson 1978; Morgan and Pollock 1977; Terry 1995). However, the ability of various POMS subscales to actually

predict successful performances was between 70% and 80%. While intriguing, subsequent studies failed to find that the POMS accurately discriminated between differing levels of athletic expertise (Terry 1995). The iceberg profile's generalizability is further challenged by the finding that mood states associated with success vary by sport. For example, successful karate and cross-country running performance has been associated with elevated levels of POMS anger (Terry 1995). Additionally, within seemingly homogeneous groups of athletes, there is a good deal of variability. Terry (1995) found that approximately 25% of successful athletic performers did not exhibit the iceberg profile and that over half of unsuccessful performers did exhibit POMS icebergs.

Exercise and Mood

The POMS has been widely used in research examining the effect of exercise on mood. The scale's widespread acceptance has led to multiple studies attempting to determine the types and parameters of exercise associated with improved mood. Activities involving regular abdominal breathing such as yoga, meditation, and Tai chi have shown similar patterns of mood benefits as established aerobic activities such as walking or swimming (Berger and Owen 1992; Berger and Motl 2000; Jin 1992). Routinized activities such as yoga, jogging, and swimming appear to have more consistent mood benefits than sports with less predictability requiring outward attention such as fencing (Berger and Owen 1988) or possibly, basketball.

While perhaps predictable, desirable POMS mood changes are associated with exercise activities reported to be enjoyable and in which there is minimal interpersonal competition (Berger and Motl 2000). The association between exercise intensity and mood is not straightforward. While high intensity activity appears to be optimal from a cardiovascular perspective, improved mood is only achieved with moderate exercise intensity. For example, experienced cyclists exercising at 69% of maximum heart rate demonstrated significant improvement on the POMS dimensions of

anger, vigor, fatigue, and confusion while higher intensity was associated with no changes in mood and maximal intensity (work out to the point of exhaustion) was linked to increased negative mood (Motl et al. 1996).

A practical question is the length of time necessary to produce positive POMS changes. The association appears to follow an inverted U pattern. While short/brief activity of 5 to 10 minutes has shown some association with positive mood change, the effect size appears to be relatively small while "overload" training has been associated with either the absence of mood improvement or deterioration in mood. In terms of improving mood, optimal exercise duration appears to be of about 20–30 min (Berger and Motl 1998).

Finally, competition appears to diminish the emotional benefits since mood is highly dependent upon competition outcome. While winners exhibited improved mood on all six of the POMS subscales, members of losing teams exhibited declines in vigor and increases in anger. These negative effects on mood continued to be present two hours after the competition ended (Berger and Motl 1998; Hassman and Blomstrand 1995).

Use of the POMS in Medical Settings

Because of its sensitivity to emotional changes, the POMS has been used in multiple studies of patients' responses to both conventional and alternative medical intervention for serious and /or chronic illness. Most POMS studies investigate coping with a cancer diagnosis as well as the impact of various types of psychosocial interventions among patients with cancer histories.

Coping with cancer often requires managing chronic pain. Compared with pain-free patients, patients reporting higher levels of pain also exhibited higher scores on POMS anxiety, anger, confusion, and total mood disturbance. Among these patients with cancer, pain duration in hours and number of days of reported pain were moderately correlated with POMS depression, fatigue, confusion, and total mood disturbance (Glover et al. 1995).

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