©Journal of Sports Science and Medicine (2005) **4,** 223-228
http://www.jssm.org

Research article

PERSONALITY DOES NOT INFLUENCE EXERCISE-INDUCED MOOD ENHANCEMENT AMONG FEMALE EXERCISERS

Andrew M. Lane [1]✉, Karen E. Milton [1] and Peter C. Terry [2]

[1] University of Wolverhampton, UK
[2] University of Southern Queensland, Australia

Received: 18 January 2005 / Accepted: 04 May 2005 / Published (online): 01 September 2005

ABSTRACT

The present study investigated the influence of personality on exercise-induced mood changes. It was hypothesised that (a) exercise would be associated with significant mood enhancement across all personality types, (b) extroversion would be associated with positive mood and neuroticism with negative mood both pre- and post-exercise, and (c) personality measures would interact with exercise-induced mood changes. Participants were 90 female exercisers (M = 25.8 yr, SD = 9.0 yr) who completed the Eysenck Personality Inventory (EPI) once and the Brunel Mood Scale (BRUMS) before and after a 60-minute exercise session. Median splits were used to group participants into four personality types: stable introverts (n = 25), stable extroverts (n = 20), neurotic introverts (n = 26), and neurotic extroverts (n = 19). Repeated measures MANOVA showed significant mood enhancement following exercise across all personality types. Neuroticism was associated with negative mood scores pre- and post-exercise but the effect of extroversion on reported mood was relatively weak. There was no significant interaction effect between exercise-induced mood enhancement and personality. In conclusion, findings lend support to the notion that exercise is associated with improved mood. However, findings show that personality did not influence this effect, although neuroticism was associated with negative mood.

KEY WORDS: Mood, exercise, personality, mental health, POMS, BRUMS, EPI.

INTRODUCTION

Numerous studies have reported positive mood benefits from exercise (Berger and Motl, 2000). Mood-enhancing effects have been evidenced in many different physical activities, including jogging, swimming, yoga, and weight lifting (Berger and Owen, 1988; Dishman, 1988; North et al, 1990). In their extensive review of the salient literature, Berger and Motl (2000) emphasized that mood enhancement is dependent upon interactions between participant, exercise modality and practice conditions; and made several recommendations for structuring an exercise session to maximize mood enhancement. They suggested that activities should be non-competitive, rhythmic, and predictable, should last for at least 20 – 30 minutes, and should be moderately intense. However, despite considerable research into the mood-enhancing benefits of exercise, the role of individual factors such as personality remains unclear.

Research in general psychology has identified relationships between mood responses and the personality dispositions of extroversion and neuroticism (Costa and McCrae, 1980; Eysenck, and Eysenck, 1975; Hepburn and Eysenck, 1989; McFatter, 1994). For example, Eysenck and Eysenck (1975) reported that individuals high in extroversion are typically active and lively, while individuals high in neuroticism tend to be apprehensive,

anxious, depressed, and tense. In short, there is compelling evidence that extroversion tends to be associated with positive mood, and neuroticism with negative mood (Costa and McCrae, 1991; Hepburn and Eysenck, 1989; Larsen and Ketelaar, 1991; Matthews and Gilliland, 1999).

Williams (1990) proposed that above and beyond the pervasive relationship between personality and mood, intermittent effects also exist, which are triggered by particular events. These intermittent effects are proposed to influence both mood averages and mood variations. Williams suggested that neuroticism is associated with increased mood variability whereas extroversion is associated with decreased mood variability.

While it is known that personality influences mood responses and that certain types of exercise enhance mood, the influence of personality on exercise-induced mood changes has not been investigated. The present study therefore attempted to extend previous research by considering the effects of personality on changes in mood following exercise.

Three hypotheses were tested. First, it was hypothesized that exercise would lead to significant mood enhancement across all personality types. Second, it was hypothesised that a main effect of personality on mood responses would be found, whereby individuals scoring high in extroversion and low in neuroticism would display more positive mood before and after exercise. Third, it was hypothesised that an interaction between personality and mood enhancement would be found. More specifically, it was hypothesized that mood enhancement following exercise would be significantly greater among unstable introverts than other personality types.

METHODS

Participants

To avoid potential gender effects associated with personality and mood measures, an all-female sample (n = 90) was selected to participate in the study. Participants were aged between 17 and 55 years (M = 25.8 yr, SD = 9.0 yr) and were all regular exercisers, in that they had attended the exercise session used in the investigation for at least six months prior to the study. This was an important consideration; given recent findings that familiarity with the specific exercise session and preferred exercise modality can influence the extent of exercise-induced mood changes (Daley and Maynard, 2003; Parfitt and Gledhill, 2004). In the present study, all participants had previously attended the exercise session in question at least once per week of their own volition; hence, familiarity and preference for the exercise modality was assumed.

Measures

Personality was assessed using the Eysenck Personality Inventory (EPI) (Eysenck and Eysenck, 1964), a 57-item measure designed to assess the personality dimensions of Extroversion (E) and Neuroticism (N). The EPI also includes a Lie scale (L) to identify participants who tend to respond in a socially desirable fashion. The E and N scales of the questionnaire demonstrate test-retest reliability values of 0.89 and 0.86, respectively (Eysenck and Eysenck, 1975) Alpha coefficients in the present study were E = 0.70 and N = 0.77.

One of the most frequently used measures in the literature (Costa and McCrae, 1980; Hepburn and Eysenck, 1989; McFatter, 1994), the EPI was judged to be the measure best suited to the purposes of the present study. When completing the EPI, participants respond to *yes/no* questions such as "*Do you daydream a lot?"* and *"Are you an irritable person?"* Responses are combined to produce scores out of 24 for Extroversion and Neuroticism, and a score out of nine for the Lie scale.

Mood was assessed using the Brunel Mood Scale (BRUMS) (Terry et al., 1999; 2003), a 24-item mood adjective checklist, with four items relating to each of six transitory mood states (Anger, Confusion, Depression, Fatigue, Tension, and Vigor). The Anger scale includes items such as *bitter* and *annoyed*, the Confusion scale includes items such as *mixed up* and *muddled*, the Depression scale includes items such as *downhearted* and *miserable*, the Fatigue scale includes items such as *tired* and *worn out*, the Tension scale includes items such as *nervous* and *panicky*, and the Vigor scale includes items such as *active* and *alert*.

When completing the BRUMS, participants rate "*How are you feeling right now?*" for each mood descriptor on a scale anchored by 0 (*not at all*) and 4 (*extremely*). Six scores in the range 0 – 16 are produced, which were converted to T-scores using appropriate normative data (Terry et al., 2003). The BRUMS has shown strong psychometric properties in validation studies (Terry et al., 1999; 2003). Alpha coefficients for the present study ranged from 0.76 to 0.91 for both the pre- and post-exercise measures. Given its brevity and validation among a British population, the BRUMS was judged to be the most appropriate mood scale for the present investigation.

Exercise session

Participants completed an exercise session lasting 60 minutes, judged by the instructor and researchers to be moderately intense. The exercise session

comprised a warm-up, stretching, rhythmic exercises, and a cool-down, and complied with the recommendations suggested by Berger and Motl (2000) as conducive to mood enhancement. A great deal of research has investigated the influence of exercise intensity on mood changes. Some studies report that high intensity exercise is associated with negative mood (Bartholomew et al., 1999; 2001), whereas other studies report that intense exercise shows no adverse mood effects. Recent research has found that exercise preference rather than exercise intensity is the dominant consideration (Daley and Maynard, 2003; Parfitt and Gledhill, 2004; Thayer et al., 1994). For example, among a sample of the general population, Thayer et al (1994) found that only 44% reported exercise as an effective strategy to improve mood. It appears likely that individuals who use exercise for mood-enhancement have previously experienced positive mood following the same or similar exercise. Experimental or quasi experimental research where the mode of exercise is prescribed by the researcher among a sample recruited solely for research purposes appears likely to yield different results to similar studies in naturalistic settings where exercise mode is self-selected.

In the present study, participants were familiar with the specific exercise session as part of their normal exercise regimens. Effectively therefore, the mode and intensity of exercise was self-selected rather than been imposed by the researcher. It is suggested that allowing participants to self-select activities will enhance enjoyment and thereby increase the likelihood of mood enhancement occurring (Motl et al., 2000).

Procedure

Participants were informed of the purpose of the study, the procedures were fully explained, and written consent obtained. Data collection took place at the exercise site. Participants completed the EPI and the BRUMS approximately 15 minutes before exercise, and then completed the BRUMS again approximately five minutes after exercise. Participants completed the questionnaires alone and were given instructions to reduce the risk of responses being influenced by social desirability.

Median splits of scores on the EPI Extraversion and Neuroticism scales were used to group participants into four personality types: stable introverts (n = 25), stable extroverts (n = 20), neurotic introverts (n = 26), and neurotic extroverts (n = 19). A repeated measures factorial MANOVA was used to investigate the influence of exercise on mood, differences in mood by personality, and the interaction effect for mood changes over time by personality. To summarise the effects of personality on mood changes more succinctly, a measure of Total Mood Disturbance (TMD: Anger + Confusion + Depression + Fatigue + Tension – Vigor) (McNair et al., 1971) was also calculated. These data were analysed using repeated measures ANOVA.

RESULTS

Descriptive statistics of mood scores before and after exercise by personality group can be found in Table 1. Results of the repeated measures MANOVA showed no significant interaction effect between mood changes and personality (Pillais $_{6, 81} = 0.04$, $p > 0.05$, $Eta^2 = 0.04$), suggesting that the pattern and extent of exercise-induced mood changes did not vary significantly across the four personality types. There was, however, a significant main effect for mood changes over time (Pillais $_{6, 81} = 0.45$, $p < 0.05$, $Eta^2 = 0.45$), confirming a pattern of significant mood enhancement following exercise, regardless of personality type. Univariate analyses showed significant reductions in Anger ($F_{1, 86} = 7.00$, $p < 0.05$, $Eta^2 = 0.08$), Confusion ($F_{1, 86} = 13.78$, $p < 0.01$, $Eta^2 = 0.14$), Depression ($F_{1, 86} = 14.87$, $p < 0.01$, $Eta^2 = 0.15$), and Tension scores ($F_{1, 86} = 39.40$, $p < 0.01$, $Eta^2 = 0.31$), and increases in Vigor scores ($F_{1, 86} = 4.80$, $p < 0.05$, $Eta^2 = 0.05$) at the post-exercise stage.

A significant main effect of Neuroticism was found (Pillais $_{6, 81} = 0.22$, $p < 0.05$, $Eta^2 = 0.22$), which showed that participants high in neuroticism reported more negative moods than their less neurotic counterparts both before and after exercise. Univariate analyses showed that neurotics reported higher Anger ($F_{1, 86} = 8.96$, $p < 0.01$, $Eta^2 = 0.09$), Confusion ($F_{1, 86} = 5.05$, $p < 0.05$, $Eta^2 = 0.06$), Depression ($F_{1, 86} = 8.40$, $p < 0.01$, $Eta^2 = 0.09$), and Fatigue scores ($F_{1, 86} = 14.88$, $p < 0.01$, $Eta^2 = 0.15$), and lower Vigor scores ($F_{1, 86} = 5.17$, $p < 0.05$, $Eta^2 = 0.06$). Similarly, a significant main effect of Extroversion was found (Pillais $_{6, 81} = 0.16$, $p < 0.05$, $Eta^2 = 0.16$), with extroverts reporting lower Confusion scores than introverts ($F_{1, 86} = 6.50$, $p < 0.05$, $Eta^2 = 0.07$). No significant interaction between Extroversion and Neuroticism was found (Pillais $_{6, 81} = 0.08$, $p > 0.05$, $Eta^2 = 0.08$).

Analysis of Total Mood Disturbance scores showed exercise-induced mood enhancement regardless of personality ($F_{1, 81} = 24.43$, $p < 0.001$, $Eta^2 = 0.22$), mood disturbance associated with Neuroticism ($F_{1, 86} = 16.28$, $p < 0.001$, $Eta^2 = 0.16$), no mood effects associated with Extraversion ($F_{1, 86} = 0.34$, $p > 0.05$, $Eta^2 = 0.004$) and no interaction between exercise-induced mood changes and personality ($F_{1, 86} = 0.13$, $p > 0.05$, $Eta^2 = 0.002$).

Table 1. Exercise-induced mood changes among four personality types (n = 90). Data are means (±SD).

		Pre-exercise	Post-exercise
Anger	Stable Introverts	46.23 (5.10)	45.51 (2.45)
	Neurotic Introverts	49.50 (9.42)	47.86 (5.29)
	Stable Extroverts	46.26 (4.57)	44.46 (0.00)
	Neurotic Extroverts	51.36 (11.25)	48.26 (7.35)
Confusion	Stable Introverts	44.14 (4.13)	43.36 (3.53)
	Neurotic Introverts	48.30 (9.10)	44.54 (6.91)
	Stable Extroverts	42.14 (1.59)	41.66 (0.00)
	Neurotic Extroverts	45.26 (5.94)	41.66 (0.00)
Depression	Stable Introverts	45.65 (4.38)	44.42 (2.09)
	Neurotic Introverts	51.45 (10.84)	46.87 (7.51)
	Stable Extroverts	45.68 (5.32)	43.81 (1.05)
	Neurotic Extroverts	50.09 (11.64)	46.51 (6.60)
Fatigue	Stable Introverts	46.65 (5.42)	45.38 (4.36)
	Neurotic Introverts	49.46 (8.22)	50.86 (11.05)
	Stable Extroverts	44.44 (4.87)	44.44 (4.64)
	Neurotic Extroverts	48.51 (5.87)	49.83 (9.33)
Tension	Stable Introverts	48.92 (9.83)	42.62 (2.01)
	Neurotic Introverts	51.75 (12.50)	44.36 (6.69)
	Stable Extroverts	46.88 (9.28)	42.08 (1.18)
	Neurotic Extroverts	48.98 (7.24)	42.30 (1.93)
Vigour	Stable Introverts	55.59 (10.18)	55.04 (13.93)
	Neurotic Introverts	52.54 (8.85)	55.48 (10.71)
	Stable Extroverts	52.07 (8.79)	58.20 (11.15)
	Neurotic Extroverts	46.87 (7.56)	49.60 (10.00)
Total Mood Disturbance	Stable Introverts	176.20 (23.52)	166.24 (16.73)
	Neurotic Introverts	197.93 (39.76)	179.02 (32.45)
	Stable Extroverts	173.35 (20.36)	158.25 (12.72)
	Neurotic Extroverts	197.34 (33.55)	178.96 (26.09)

DISCUSSION

The present study investigated the influence of personality on mood changes following exercise among a sample of female exercisers. Three hypotheses were tested. Results showed support for the first hypothesis that exercise would be associated with mood enhancement. Participants reported significantly reduced anger, confusion, depression, and tension and increased vigor following exercise. This finding is consistent with the majority of research into exercise-induced mood changes (Berger and Motl, 2000). At least two explanations for this finding are viable. It is possible that regular exercise participants may learn to derive positive mood benefits from exercise through experience. Equally, it is possible that individuals who are sensitive to activity-derived mood enhancement are drawn towards exercise classes. When viewed in conjunction with previous findings, the present results suggest that exercise-induced mood effects are generalizeable across exercise domains, providing the specific exercise modality is consistent with the characteristics recommended by Berger and Motl (2000).

The second hypothesis was also supported. Results showed general support for the association between mood and personality, although this association was stronger for neuroticism than extroversion. Neuroticism was associated with higher levels of anger, confusion, depression, fatigue, and lower levels of vigor, a finding consistent with previous research (Costa and McCrae, 1980; Hepburn and Eysenck, 1989; McFatter, 1994). The relationship between extroversion and mood was relatively weak. This stronger association between neuroticism and mood may be a function of the orientation of the BRUMS, with five of the six sub-scales measuring mood states generally perceived as negative.

The third hypothesis was not supported. Contrary to expectations, no interaction between

exercise-induced mood changes and personality type was found. The anticipated greater mood variability among unstable introverts did not emerge; instead exercise was effective at promoting mood benefits in all personality types. Several explanations for this finding are possible. Firstly, this finding may simply reflect a genuine lack of association between personality type and exercise-induced mood responses. A second possible explanation for this finding, however, may lie in the notion that the influence of personality on mood changes is most noticeable following adverse experiences (Dodgson and Wood, 1998; Heimpel et al., 2002). For example, research has shown that increases in unpleasant psychological states following poor performance are greater among neurotics, whereas.positive events lead to positive psychological effects regardless of personality (Dodgson and Wood, 1998). Given the widespread mood enhancement among participants in the present study, it is possible that any interaction between personality and exercise-induced mood changes might only become evident in the absence of a main effect for mood enhancement (Bartholomew et al., 1999; 2001). It is also possible that, given the relatively small numbers in the four personality groups, the lack of association between personality type and exercise-induced mood enhancement may be explained by the limited statistical power of this analysis.

Several future studies could be conducted to further this line of investigation. First, research could replicate the methods used in the present study among a different sample, to determine whether the pattern of exercise-induced mood changes is truly generalizeable or whether the present findings are anomalous. Second, future research might address the potential moderating effects of familiarity with the exercise modality and exercise environment. If exercise is to be promoted for its mood-enhancing qualities it would be important to investigate the possibility of a dose effect. Would participants new to a particular exercise modality or exercise environment be likely to experience mood enhancement through a novelty effect or would such benefits accrue only after lengthier habituation to the specific activity or setting? A third area for future research is to address the mechanisms by which mood enhancement may occur. Relevant theories might include the Distraction Hypothesis, the Cognitive-Behavioural Hypothesis, and the Endorphin Hypothesis (Jin, 1992; Kreamer et al., 1990; North et al., 1990; O'Neal et al., 2000; Petruzzello, 1995; Tate and Petruzzello, 1995; Szabo et al., 1998).

CONCLUSIONS

The present findings lend support to the notion that exercise is associated with mood enhancement. Neuroticism, and to a lesser extent extroversion, was associated with reported mood, although personality did not moderate exercise-induced mood enhancement.

REFERENCES

Bartholomew, J.B. (1999) The effect of resistance exercise on manipulated preexercise mood states for male exercises. *Journal of Sport and Exercise Psychology* **21**, 39-51.

Bartholomew, J.B., Moore, J., Todd, J., Todd, T. and Elrod, C.C. (2001) Psychological states following resistant exercise of different workloads. *Journal of Applied Sport Psychology* **13**, 399-410.

Berger, B.G. and Motl, R.W. (2000) A selective review and synthesis of research employing the Profile of Mood States. *Journal of Applied Sport Psychology***12**, 69-92.

Berger, B.G. and Owen, D.R. (1983) Mood alteration with swimming– swimmers really do "feel better". *Psychosomatic Medicine* **45**, 425-433.

Berger, B.G. and Owen, D.R. (1988) Stress reduction and mood enhancement in four exercise modes: swimming, body conditioning, Hatha yoga and fencing. *Research Quarterly for Exercise and Sport* **59**,148-159.

Budaev, S.V. (1999) Sex differences in the Big Five personality factors: testing an evolutionary hypothesis. *Personality and Individual Differences* **26**, 801-813.

Costa, P.T. and McCrae, R.R. (1980) Influence of extroversion and neuroticism on subjective well-being: happy and unhappy people. *Journal of Personality and Social Psychology* **38**, 668-678.

Costa, R.R. and McCrae, P.T. (1991) Adding Liebe und Arbeit: The full five-factor model and well being. *Personality and Social Psychology Bulletin* **17,** 227-232.

Daley, A.J. and Maynard, I.W. (2003) Preferred exercise mode and affective responses in physically active adults. *Psychology of Sport and Exercise* **4,** 347-356.

Dishman, R.K. (1988) *Exercise adherence*. Champaign, Illinois: Human Kinetics Books.

Dodgson, P.G. and Wood, J.V. (1998) Self-esteem and the cognitive accessibility of strengths and weaknesses after failure. *Journal of Personality and Social Psychology* **75**, 178-197.

Eysenck, H.J. and Eysenck, S.B.G. (1975) *Manual for the Eysenck Personality Questionnaire*. Sevenoaks, Kent: Hodder and Stoughton Educational.

Eysenck, H.J. and Eysenck, S.G.B. (1964) *Manual of the Eysenck Personality Inventory*. London: University Press.

Heimpel, S.A., Wood, J.V., Marshall, M.A. and Brown, J.A. (2002) Do people with low self-esteem really want to feel better? Self-esteem differences in motivation to repair negative moods. *Journal of Personality and Social Psychology* **82**, 128-147.

Hepburn, L. and Eysenck, M.W. (1989) Personality, average mood and mood variability. *Personality and Individual Differences* **10**, 975-983.

Jin, P. (1992) Efficacy of tai chi, brisk walking, meditation, and reading in reducing mental and emotional stress. *Journal Psychosomatic Research* **36**, 361-370.

Kraemer, R.R., Dzewaltowski, D.A., Blair, M.S., Rinehardt, K.F. and Castracane, V.D. (1990) Mood alterations with treadmill running and its relationship to beta-endorphin, corticotropin, and growth hormone. *Journal of Sports Medicine and Physical Fitness* **30**, 241-246.

Larsen, R.J. and Ketelaar, T. (1991) Personality and susceptibility to positive and negative emotional states. *Journal of Personality and Social Psychology* **61**, 132-140.

Matthews, G. and Gilliland, K. (1999) The personality theories of H. J. Eysenck and J. A. Gray: *A Comparative Review. Personality and Individual Differences* **26**, 583-626.

McFatter, R.M. (1994) Interactions in predicting mood from extroversion and neuroticism. *Journal of Personality and Social Psychology* **66**,570-578.

McNair, D.M., Lorr, M. and Droppleman, L.F. (1971) *Manual for the profile of mood states*. San Diego, CA: Educational and Industrial Testing Service.

Motl, R., Berger, B. and Wilson, T.E. (1996) Exercise intensity and acute mood states of cyclists. *Journal of Sport and Exercise Psychology* **18**, S59.

Motl, R.W., Berger, B.G. and Leuschen, P.S. (2000) The role of enjoyment in the exercise-mood relationship. *International Journal of Sport Psychology* **31**, 347-363

North, T.C., McCullagh, P. and Tran, Z.V. (1990) Effects of exercise on depression. *Exercise and Sport Science Review* **18**, 379-415.

O'Neal, H.A., Dunn, A.L. and Martinsen, E.W. (2000) Depression and exercise. *International Journal of Sport Psychology* **31**, 110-135.

Parfitt, G. and Gledhill, C. (2004) The effect of choice of exercise mode on psychological responses. *Psychology of Sport and Exercise* **2**, 111-117.

Petruzzello, S.J. (1995) Anxiety reduction following exercise: methodological artefact or real phenomenon? *Journal of Sport and Exercise Psychology* **17**, 105-111.

Szabo, A., Mesco, A., Caputo, A. and Gill, E.T. (1998) Examination of exercise-induced feeling states in four modes of exercise. *International Journal of Sport Psychology* **29**, 376-390.

Tate, A.K. and Petruzzello, S.J. (1995) Varying the intensity of acute exercise: implications for changes in affect. *Journal of Sports Medicine and Physical Fitness* **35**, 1-8.

Terry, P.C., Lane, A.M. and Fogarty, G.J. (2003) Construct validity of the Profile of Mood States-A for use with adults. *Psychology of Sport and Exercise* **4**, 125-139.

Terry, P.C., Lane, A.M., Lane, H.J. and Keohane, L. (1999) Development and validation of a mood measure for adolescents. *Journal of Sports Sciences* **17**, 861-872.

Thayer, R.E., Newman, R. and McClain, T.M. (1994) Self-regulation of mood: strategies for changing a bad mood, raising energy, and reducing tension. *Journal of Personality and Social Psychology* **67**, 910-925.

Williams, D.G. (1990) Effects of psychoticism, extroversion, and neuroticism in current mood: *A statistical review of six studies. Personality and Individual Differences* **11**, 615-630

AUTHORS BIOGRAPHY

Andrew M. LANE
Employment
Prof. in Sport and Exercise Psychology, School of Sport, Performing Arts and Leisure, University of Wolverhampton, UK
Degrees
BA, PGCE, MSc, PhD.
Research Interest
Mood, emotion, measurements, coping, and performance
E-mail: A.M.Lane2@wlv.ac.uk

Karen MILTON
Employment
Postgraduate Researcher in Sport and Exercise Psychology, Sport and Exercise Psychology, School of Sport, Performing Arts and Leisure, University of Wolverhampton, UK
Degrees
BSc, MSc.
Research interest
Mood, emotion, exercise prescription and massage.

Peter C. TERRY
Employment
Professorial Research Fellow, Univ. of Southern Queensland Depart. of Psychology, Toowoomba, QLD 4350, Australia
Degrees
BA, PGCE, MSc, PhD
Research Interest
Mood, emotion, measurements, applied psychology, and performance
E-mail: terryp@usq.edu.au

KEY POINTS

- Research in general psychology has found that stable personality trait are associated changes in mood states. Ninety females exercisers completed a personality test and mood scales before and after exercise. Results indicated mood changes were not associated with personality, although neuroticism was associated with negative mood.

✉ **Prof. Andrew M. Lane**
School of Sport, Performing Arts and Leisure, Univ. of Wolverhampton, Gorway Road, Walsall, WS1 3BD, UK.