



## CHANGES IN MOOD STATES AND SELECTED PERSONALITY TRAITS IN WOMEN PARTICIPATING IN A 12-WEEK EXERCISE PROGRAM

DOI: 10.2478/v10038-009-0014-2

Monika Guskowska<sup>1\*</sup>, Sylwia Sionek<sup>2</sup>

<sup>1</sup> Department of Psychology, The Józef Piłsudski University of Physical Education, Warsaw, Poland

<sup>2</sup> Ph.D. student, The Józef Piłsudski University of Physical Education, Warsaw, Poland

### ABSTRACT

**Purpose.** The aim of the study was: (1) to investigate changes in mood and chosen personality traits in women participating in a 12-week exercise program; (2) to establish relationships between mood and personality traits; (3) to find personality factors predicting mood changes. **Basic procedures.** Subjects included 39 healthy female volunteers, aged 18–43, participating in a 12-week aerobic exercise program. The aerobics classes lasted 50 min each, including warm-up and cool-down, three times a week. Assessments of mood (UMACL by Matthews, Chamberlain & Jones), trait anxiety (STAI by Spielberger et al.), self-efficacy (GSES by Schwarzer, Jerusalem & Juczyński) and dispositional optimism (LOT-R by Scheier, Carver & Bridges) were obtained in the first and last weeks of the program. **Main findings.** The obtained results showed that (1) subjects' mood improved following the 12-week aerobic exercise program – tense arousal decreased, whereas hedonic tone and energetic arousal increased; (2) personality traits changed toward better personal adjustment: trait anxiety decreased, self-efficacy and optimism increased; (3) there were no significant relationships between changes in positive mood dimensions (hedonic tone and energetic arousal) and the negative one (tense arousal); (4) there were no correlations between mood changes and personality changes, but mood correlated with trait anxiety, self-efficacy and optimism in both measurements. **Conclusions.** Mood of healthy adult women improves significantly following a three-month aerobic exercise program, irrespective of positive changes in personality traits.

**Key words:** exercise, mood, personality, chronic effect, women

### Introduction

Results of experimental and correlative studies point to relationships between physical recreational activity and mood. Psychological benefits, especially emotional ones, such as reduction of anxiety or depressiveness can be observed even after one-time physical exercise. This is illustrated by results of studies on the so-called acute effects of exercise. Researchers have also been interested in chronic exercise effects, i.e. long-term outcomes after weeks or months of regular exercise. Chronic effects are mostly sought in mood states, i.e. affective states maintained for a moderately long time (hours or days) and states unrelated to any triggering stimuli.

A number of experimental studies have revealed that the mood state of participants in programs of systematic physical exercises for some weeks improves considerably. Mood improvement was noticed after aerobic exer-

cises in healthy subjects [1–3] or clinical subjects. A survey conducted by McDonald and Hodgdon [4] showed the biggest improvement in terms of vigor, confusion and tension. Not all studies, however, confirm the improvement in the mood state of regularly exercising individuals. Cramer, Nieman and Lee [5] did not observe any mood changes in women participating in a 15-week program of aerobic exercises of moderate intensity, during the sixth and the last week. The emotional state of women participating in an aqua-aerobics program did not change significantly after the 6<sup>th</sup>, 12<sup>th</sup>, 18<sup>th</sup> and 24<sup>th</sup> week of exercise; however, it greatly improved in comparison with the control group consisting of physically passive women [6].

Experimental studies allow establishing cause and effect relationships and controlling mediating and disturbing variables. They also reveal the efficiency of physical exercises of various character, intensity, duration and techniques aimed at improvement of psychological well-being such as relaxation or cognitive responses. Some researchers are ready to focus more on

\* Corresponding author.

external rather than internal accuracy of their studies and stress the significance of research in natural conditions. Their results confirm improvement of mood in individuals exercising regularly on their own [7] or participating in exercise groups [8], and give proof of the beneficial influence of physical exercise on diurnal variations in mood states in women [9]. In our earlier study carried out during a two-week recreation camp for exercising elderly women, a significant reduction of tension and confusion, and increase in vigor and friendliness was observed; however, these changes disappeared after completion of exercises [10]. An improvement in mood after a month of regular exercising was also noted in two groups of women practicing aerobics once and three times a week, respectively. In the former, positive emotional states improved (vigor, friendliness); in the latter, a decrease in the level of negative states (anger, confusion, tension, fatigue, depression) and an increase in vigor were observed [11].

Correlative studies focusing on relationships between physical activity and psychological well-being [12] or mental health [13] have also yielded interesting results. In a Finnish population study [14] it was noted that more physically active individuals experienced a much lower level of stress, displayed fewer symptoms of depressiveness, anger and hostility. College students who were physically active were less stressed and in a better mood [15]. Also active women during the menopause were in a better emotional state than their physically passive counterparts [16]. Physical activity is an important predictor of negative mood states in high school students: those more physically active featured a higher level vigor correlated with the amount of time devoted to physical exercises [17].

One of the most common diagnostic tools used in studies of the effects of physical activity on mood states is the Profile of Mood States (POMS) developed by McNair, Lorr and Droppleman to assess psychotherapeutic progress. The POMS was used in the study by Morgan [18], who noted that the profile of athletes' mood as compared with population norms and physically passive subjects resembled an "iceberg": athletes featured a higher level of vigor and lower than average level of negative mood states (anger, confusion, depression, fatigue and tension). The POMS allows monitoring acute and chronic exercise-induced changes. Unfortunately, the POMS authors failed to define the examined emotional states and the concept of mood itself. Thus the accuracy of the POMS scale can be question-

able. The Polish adaptation of the POMS [19] is an experimental version of the test rather than a satisfactory psychometric tool. It has been used in various studies for two reasons: first, it allows a comparison of the obtained results with results of other research studies in the area of sport psychology and physical activity; second, there had been no other versatile diagnostic tool for mood assessment. The latter problem was solved by Goryńska's Polish adaptation of the UWIST Mood Adjective Checklist (UMACL) developed by Matthews, Chamberlain and Jones [20]. The UMACL is based on a tri-dimensional model of mood involving three correlated bipolar factors: hedonic tone, tense arousal and energetic arousal. The last two dimensions were also considered in Thayer's model [21] which is sometimes referred to by researchers in their explanations of improvement of psychological well-being after exercise [22].

Comparative studies often reveal significant personality differences between physically active and sedentary subjects. Individuals who are highly and moderately physically active show a significantly higher level of optimism and physical self-efficacy as well as lower inclination towards anxiety than subjects who are passive or little physically active [23]. Correlative research can also reveal reverse relationships. More optimistic individuals may undertake physical activity more often because they engage more willingly in pro-health behaviors. A strong sense of physical self-efficacy leads to undertaking exercises more eagerly because we are convinced we can execute the exercises effectively.

Experimental studies point to insignificant personality changes or their absence in subjects who exercise regularly [24]. The changes examined in different studies concerned the emotional sphere. A review of studies on the impact of physical activity on emotional responses shows significant, however, weak anxiety-reducing chronic effects of regular exercise [25, 4]. The effects were more pronounced in the case of exercise programs longer than 10 weeks.

The aim of the present study was to determine changes in mood and chosen personality traits in women taking part in a three-month exercise program. The study also aimed at finding correlations between dimensions of mood and personality traits and personality predictors of mood changes. It also examined the applicability of the UWIST Mood Adjective Checklist (UMACL) in research of subjects undertaking physical activity.

## Material and methods

The study was quasi-experimental. The sample consisted of 39 women aged 18–43 years ( $M = 27.49$ ;  $SD = 5.642$ ), who volunteered to take part in a three-month program of aerobics training. The exercise sessions were 50 min each and took place twice a week. Initially, the sample included 50 subjects; however, 11 resigned from the program before its completion. The results of subjects who participated in at least 75% of the training program were analyzed.

The following psychological tests were applied in the study:

1. UWIST Mood Adjective Checklist (UMACL) (Polish adaptation by Goryńska) [20];
2. General Self-Efficacy Scale (GSES) by Schwarzer, Jerusalem and Juczyński [26];
3. Life Orientation Test – Revisited (LOT-R) by Scheier, Carver and Bridges (Polish adaptation by Juczyński) [26];
4. State Trait Anxiety Inventory (STAI) by Spielberger et al. [27].

The first measurement of variables (pretest) took place in the first week of the exercise program, the second measurement (posttest) in the last week, after three months of regular exercises.

## Results

Table 1 presents the pretest and posttest results for all the psychological variables under study. A comparative analysis of these results points to significant changes after three months of systematic aerobic training. The level of tense arousal was significantly reduced after three months of exercises. Tense arousal is a continuum ranging from calmness to anxiety. A reduction of tense arousal can be regarded as a positive change indicative of improvement of psychological well-being of women participating in the exercise program. The effect size

was calculated following the formula:  $ES = (M_{\text{pretest}} - M_{\text{posttest}}) / SD_{\text{pretest}}$ . The effect size below 0.39 was considered low, between 0.40–0.69 moderate, and over 0.70 high. In the case of tense arousal the ES amounted to 0.59 indicating a moderate reduction in tense arousal.

A statistically significant and high increase of energetic arousal ( $ES = -1.14$ ) was observed. Energetic arousal is a continuum ranging from tiredness to energy and its high level is indicative of a high level of vigor. There was also a higher level of hedonic tone ( $ES = -0.85$ ), i.e. measurement of subjective pleasantness (unpleasantness). All these changes are evident of improvement of mood of women taking part in the program.

The personality traits studied were also affected by the exercises, for example, the level of self-efficacy ( $ES = -1.04$ ), i.e. one's conviction about one's capacities to act pursuing a specific goal, regardless of any obstacles. The observed increase in self-efficacy suggests that the women improved their sense of control of their own behavior and environment as well as conviction about their problem-solving skills.

The obtained results also reveal an increase in the level of optimism ( $ES = -0.96$ ), understood as a personality trait expressing general expectations of positive occurrences combined with a tendency to experience positive feelings and life satisfaction. Optimism affects one's coping with stress and is associated with perseverance to act, readiness to face the reality of the situation, seeking social support and emphasizing positive aspects of stressful situations. The achieved results point to a significant but moderate ( $ES = 0.47$ ) decline in readiness of the women under study to react with anxiety (trait anxiety).

All changes in subjects' personality observed during the three-month exercise program can be considered positive from the standpoint of psychological adaptation.

The increase in hedonic tone and energetic arousal were estimated by subtracting the pretest results from

Table 1. Changes of mood and personality traits during a three-month exercise program

Variable	Measurement		Pretest		Posttest		Student's t-test	
	M	SD	M	SD	M	SD	<i>t</i>	<i>p</i>
Tense arousal	18.08	4.157	15.64	3.937	7.470	0.0001		
Energetic arousal	30.10	3.409	34.00	4.431	8.757	0.0001		
Hedonic tone	30.33	4.573	34.23	5.584	6.660	0.0001		
Trait anxiety	40.05	7.086	36.67	6.470	6.691	0.0001		
Self-efficacy	28.69	3.388	32.21	3.833	13.967	0.0001		
Optimism	15.64	2.879	18.41	3.118	15.563	0.0001		

Table 2. Results of stepwise regression analysis for mood changes

Dependent variable	Predictor	$\beta$	$t$	$p$	$R^2$	$F; p$
Increase in hedonic tone	Increase in energetic arousal	0.613	4.718	0.0001	0.359	22.258; 0.0001
Increase in energetic arousal	Increase in hedonic tone	0.613	4.718	0.0001	0.359	22.258; 0.0001

Table 3. Results of stepwise regression analysis for mood in the pretest

Dependent variable	Predictor	$\beta$	$t$	$p$	$R^2$	$F; p$
Tense arousal	Hedonic tone	-0.457	2.965	0.005	0.635	33.991; 0.0001
	Energetic arousal	-0.403	2.614	0.013		
Hedonic tone	Energy level	0.351	2.604	0.013	0.719	33.426; 0.0001
	Tense arousal	-0.452	3.445	0.002		
	Optimism	0.272	3.018	0.005		
Energetic arousal	Hedonic tone	0.467	3.079	0.004	0.640	34.789; 0.0001
	Tense arousal	-0.396	2.614	0.013		

Table 4. Results of stepwise regression analysis for mood in the posttest

Dependent variable	Predictor	$\beta$	$t$	$p$	$R^2$	$F; p$
Tense arousal	Energetic arousal	-0.454	3.383	0.002	0.455	16.857; 0.0001
	Self-efficacy	-0.360	2.678	0.011		
Hedonic tone	Energy level	0.748	8.000	0.0001	0.747	57.129; 0.0001
	Trait anxiety	-0.213	2.279	0.029		
Energetic arousal	Hedonic tone	0.852	9.897	0.0001	0.718	97.954; 0.0001

the posttest results. Additionally, an index of reduction of tense arousal was calculated (pretest – posttest). Analogically, the values of decline of trait anxiety and increase of optimism and self-efficacy were assessed. It was noted that the increase in energetic arousal is associated with the increase in hedonic tone ( $r = 0.613$ ;  $p < 0.001$ ), but not with the decrease in tense arousal ( $r = -0.020$ ;  $p = 0.905$ ). No significant correlations were found between the changes of tense arousal and hedonic tone ( $r = -0.057$ ;  $p = 0.728$ ). Only the increase in hedonic tone was correlated with the decrease in trait anxiety ( $r = 0.386$ ;  $p = 0.015$ ): the higher the level of trait anxiety, the higher the increase of the sense of pleasantness. The remaining indices of changes of personality traits do not reveal significant correlations with the indices of mood change.

The study also focused on predictors of mood changes among the personality traits examined. For this purpose a stepwise analysis of regression was carried out, with indices of changes of particular mood dimensions as dependent variables, and indices of changes of

other mood dimensions, changes of personality traits and age as factors (Tab. 2). An increase in hedonic tone can be predicted by an increase in energetic arousal and vice versa. No predictors of decline of tense arousal were found. No indices of changes of personality traits can be regarded as predictors of mood changes.

Correlations were also established between indices of mood and personality during the first measurement at the beginning of the exercise program (pretest). In line with expectations related to the tri-dimensional model of mood, negative correlations between tense arousal and energetic arousal ( $r = -0.754$ ;  $p < 0.0001$ ) and hedonic tone ( $r = -0.767$ ;  $p < 0.0001$ ) were noted. The last two dimensions were positively correlated ( $r = 0.771$ ;  $p < 0.0001$ ). The strength of these correlations was similar. Trait anxiety is positively correlated with tense arousal ( $r = 0.546$ ;  $p < 0.0001$ ), and negatively correlated with hedonic tone ( $r = -0.623$ ;  $p < 0.0001$ ) and energetic arousal ( $r = -0.517$ ;  $p < 0.0001$ ). The strong sense of self-efficacy is related to high hedonic tone ( $r = 0.392$ ;  $p = 0.014$ ) and low tense arousal ( $r = -0.348$ ;  $p = 0.030$ ).

Optimism is only correlated with hedonic tone ( $r = 0.457$ ;  $p = 0.003$ ).

In the analysis of the pretest results (Tab. 3) the predictors of mood dimensions are the remaining mood variables. Only the level of hedonic tone can be predicted through optimism. The analysis included results of the first measurement of mood states, personality traits and age.

The posttest results revealed a negative correlation between tense arousal and energetic arousal ( $r = -0.617$ ;  $p < 0.0001$ ) and hedonic tone ( $r = -0.573$ ;  $p < 0.0001$ ). Energetic arousal and hedonic tone are strongly positively correlated ( $r = 0.852$ ;  $p < 0.0001$ ). Similarly to the results of the first measurement, trait anxiety was correlated with all mood dimensions: positively with tense arousal ( $r = 0.546$ ;  $p < 0.0001$ ); and negatively with hedonic tone ( $r = -0.578$ ;  $p < 0.0001$ ) and energetic arousal ( $r = -0.488$ ;  $p = 0.002$ ). The correlations between mood dimensions and self-efficacy were strong. Self-efficacy was positively correlated with energetic arousal ( $r = 0.452$ ;  $p = 0.004$ ) and hedonic tone ( $r = 0.363$ ;  $p = 0.023$ ); and negatively correlated with tense arousal ( $r = -0.565$ ;  $p < 0.0001$ ). Optimism shows positive correlations with hedonic tone ( $r = 0.529$ ;  $p = 0.001$ ) and energetic arousal ( $r = 0.434$ ;  $p = 0.006$ ), and a negative correlation with tense arousal ( $r = -0.301$ ;  $p = 0.063$ ).

Mood predictors were also determined during the posttest, i.e. after three months of regular exercise. The analysis included results of the second measurement of individual variables and age (Tab. 4). Negative predictors of tense arousal in the posttest were energetic arousal and self-efficacy. Strong tense arousal can be predicted in women displaying a low level of energetic arousal and self-efficacy.

Predictors of hedonic tone include energetic arousal (positive predictor) and trait anxiety (negative predictor). Positive mood can be predicted in women with a high level of energy, who are less inclined to react with anxiety. The only (positive) predictor of energetic arousal in the posttest was hedonic tone.

During the first measurement, before the commencement of the exercise program, stronger correlations were noted between mood dimensions which can be regarded as predictors of one another in about 60–70%. During the second measurement (after three months of regular exercise) the correlations between mood dimensions become weaker but are stronger between mood dimensions and personality traits. The re-

gression models based on the stepwise analysis are the weakest in the case of indices of mood changes.

## Discussion

The obtained results indicate a significant improvement of mood states in women taking part in a three-month aerobics training. It was manifested by a significant decrease in tense arousal along increasing energetic arousal and hedonic tone. These results correspond to results of earlier experimental [1–4, 24] and quasi-experimental studies [7, 8, 10, 11] confirming the so-called chronic effects of exercise in the emotional sphere manifested by a low level of negative states and high level of positive states. Certainly, research studies carried out in natural conditions and not meeting the requirements of an experiment (no control group or randomization) failed to produce any cause and effect relations. Therefore, a significant improvement in mood states of the program participants was noted; however, regular aerobic exercises cannot be considered to be a causative factor.

The UWIST Mood Adjective Checklist (UMACL) turned out to be a tool sensitive to changes with time. The observed correlations between the dimensions of mood in the pretest and the posttest are in line with expectations related to the three-dimensional model of mood, and correspond with results obtained during the elaboration of the Polish version of the test. However, the coefficients of correlation between the scales in physically active women were significantly higher than the results attained by the author of the Polish adaptation [20], especially in the case of the negative correlation between tense arousal and energetic arousal ( $r = -0.27$  in Goryńska [20]). The obtained results prove a strong mutual correlation between the dimensions of mood: hedonic tone and energetic arousal being negatively correlated with tense arousal and positively correlated with each other.

These correlations could be seen during both measurements (pretest and posttest), however, not all of them were present between indices of changes of individual mood factors. The increase in hedonic tone was strongly correlated with the increase in energetic arousal, however, the changes in these two dimensions were independent of energetic arousal changes. Such results remain contrary to the predictions associated with Thayer's concept of mood [21] involving energetic arousal and tense arousal. Energetic arousal as a continuum ranging from

tiredness to energy is affected by physical and cognitive activity and changes in accordance with the diurnal rhythm of sleep and awakesness. Tense arousal as a continuum ranging from calmness to anxiety, associated with the reception of threat, is affected by psychological stress. According to Thayer the correlation between these two dimensions is inversely proportional. With the use of this concept researchers attempted to explain the improvement of mood states in subjects undertaking physical activity [22]. Physical activity has a direct positive impact on energetic arousal, which leads to a decrease in tense arousal. Energetic arousal has a positive emotional implication, whereas tense arousal a negative one. Thus exercise-induced changes are felt as mood improvements.

The present study however fails to reveal any significant correlations between changes in energetic arousal and tense arousal. These changes take place irrespective of each other, however, their direction remains in line with expectations. The fact of both mood dimension changes being independent of each other is confirmed by the regression analysis results. Significant positive correlations were found between the increase in energetic arousal and hedonic tone, as evidenced by coefficients of correlation between the indices of change and the regression analysis results. These issues require, however, further research.

The mood (not its changes) of the women under study is also related to the examined personality traits. In accordance with theoretical premises and results of earlier studies [20] trait anxiety was positively correlated with tense arousal, and negatively with hedonic tone and energetic arousal (pretest and posttest). These two correlations were slightly weaker during the posttest, however, still higher than correlations found by Goryńska [20]. The correlations between the remaining personality traits (self-efficacy, dispositional optimism) with mood dimensions were stronger during the second measurement. It is impossible to state whether this might be a general tendency or an effect confined to a specific sample. This issue also requires further research.

The last aspect of the study concerned personality changes in women undertaking regular physical activity. Despite reservations expressed by a number of authors who claim that personality traits are simply too solid to change during a long term exercise program, significant changes in all examined personality traits were observed. A declining tendency to respond with

anxiety has been noted in earlier research, also including experimental studies; however, the mean effect sizes in those studies were lower than in the present study [25 (ES = 0.34), 4 (ES = 0.25)]. Leith [24] claims that the declining tendency to react with anxiety can be predicted in participants in exercise programs lasting at least 9–10 weeks. Researchers have also underlined that in individuals with a normal level of trait anxiety, significant changes are not expected (floor effect). The mean pretest results in the present study are at the level of mean results (Sten 5) for women aged 21–40. The mean posttest results were, however, below average (Sten 4). Despite this moderate tendency to react with anxiety, a slight but nevertheless statistically significant reduction in trait anxiety was found. Certainly, the accepted research model is not sufficient grounds for stating that this was a purely exercise-induced change.

The obtained results indicate an increased level of optimism in the women under study. According to Kavussanu and McAuley [23] long-term and regular physical activity can contribute to the development of optimism. A physically active individual becomes “fluent” in performing exercises and thus physically self-efficacious. The GSES tool which allows determining the strength of general self-efficacy, also revealed a significant increase of this component. However, no correlation was found between the increase in optimism and self-efficacy (either in correlation coefficients or analysis of regression for the indices of change of personality traits). Positive correlations were found between absolute indices (optimism and self-efficacy scales) in the pretest ( $r = 0.301$ ;  $p = 0.62$ ) and posttest ( $r = 0.292$ ;  $p = 0.71$ ). Kavussanu and McAuley [23] also discussed a reduction in the anxiety and depression levels and displaying positive emotions associated with energetic arousal. No correlations between indices of mood change and dispositional optimism were, however, observed.

Precise determination of the significance of individual personality variables and correlations between them and mood requires further experimental studies and more advanced statistical analysis. The present research was a pilot study to verify the applicability of a new diagnostic tool in the area of psychology of physical activity. The study also aimed to examine whether group aerobic exercises can be used as potential means of improvement of the self-efficacy level. They are a significant factor of changes of pro-health behaviors [28], but they might also be used as ways of improving recreational physical activities of adult women and their

families. These questions will be addressed in our future research.

### Conclusions

1. The mood of adult women participating in a three-month aerobic exercise program improved significantly, regardless of changes of personality traits.

2. During the three-month exercise program the participants experienced beneficial personality changes from the standpoint of psychological adaptation.

3. Mood dimensions in a three-dimensional mood model are strongly correlated with one another, however, changes with time are irrespective of them.

4. After three months of regular exercises adult women reveal stronger correlations between mood dimensions, optimism and self-efficacy.

5. The UWIST Mood Adjective Checklist (UMACL) is sensitive to mood changes in subjects who exercise regularly.

### References

- DiLorenzo T.M., Bargman E.P., Stucky-Ropp R., Brassington G.S., Frensch P.A., LaFontaine T., Long-term effects of aerobic exercise on psychological outcomes. *Prev Med*, 1999, 28(1), 75–85. DOI: 10.1006/pmed.1998.0385.
- Brown D.R., Wang Y., Ward A., Ebbeling C.B., Fortlage L., Puleo E. et al., Chronic psychological effects of exercise and exercise plus cognitive strategies. *Med Sci Sports Exerc*, 1995, 27(5), 765–775.
- Murphy M., Nevill A., Nevill Ch., Biddle S., Hardman A., Accumulating brisk walking for fitness, cardiovascular risk, and psychological health. *Med Sci Sports Exerc*, 2002, 34(9), 1468–1474.
- McDonald D.G., Hodgdon J.A., Psychological effects of aerobic fitness training. Research and theory. Springer, New York 1991.
- Cramer S.R., Nieman D.C., Lee J.W., The effects of moderate exercise training on psychological well-being and mood state in women. *J Psychosom Res*, 1991, 35(4–5), 437–449. DOI: 10.1016/0022-3999(91)90039-Q.
- Piotrowska-Całka E., Guskowska M., Effects of aqua-aerobic on emotional states in women. *Physical Education Sport*, 2007, 51, 11–14. DOI: 10.2478/v10030-007-0016-9.
- Steptoe A., Kimbell J., Basford P., Exercise and the experience and appraisal of daily stressors: a naturalistic study. *J Behav Med*, 1998, 21(4), 363–374. DOI: 10.1023/A:1018778730309.
- Steinberg H., Nicholls B.R., Sykes E.A., LeBoutillier N., Ramlakhan N., Moss T.P. et al., Weekly exercise consistently reinstates positive mood. *European Psychologist*, 1998, 3(4), 271–280.
- Gauvin L., Rejeski W.J., Reboussin B.A., Contributions of acute bouts of vigorous physical activity to explaining diurnal variations in feeling states in active, middle-age women. *Health Psychology*, 2000, 19(4), 365–375.
- Guskowska M., Kozdroń E., Changes in mood states, needs' structure and intellectual level in physically active elderly women [in Polish]. *Gerontologia Polska*, 2001, 9, 28–33.
- Guskowska M., The effect of regular aerobic exercise on emotional states in women. *Med Sportiva*, 2006, 22, 163–168.
- Ransford H.E., Palisi B.J., Aerobic exercise, subjective health and psychological well-being within age and gender subgroups. *Soc Sci Med*, 1996, 42(11), 1555–1559. DOI: 10.1016/0277-9536(95)00252-9.
- Kull M., Physical activity and mental health: relationships between depressiveness, psychological disorders and physical activity in women. *Biol Sport*, 2003, 20(2), 129–138.
- Hassmen P., Koivula N., Uutela A., Physical exercise and psychological well-being: a population study in Finland. *Preventive Med*, 2000, 30(1), 17–25. DOI: 10.1006/pmed.1999.0597.
- Skirka N., The relationship of hardiness, sense of coherence, sports participation, and gender to perceived stress and psychological symptoms among college students. *J Sports Med Phys Fitness*, 2000, 40(1), 63–70.
- Slaven L., Lee Ch., Mood and symptom reporting among middle-aged women: the relationship between menopausal status, hormone replacement therapy, and exercise participation. *Health Psychology*, 1997, 16(3), 203–208.
- Guskowska M., Physical activity and the course of stress transaction among youth [in Polish]. AWF, Warszawa 2005.
- Morgan W.P., Affective beneficence of vigorous physical activity. *Med Sci Sports Exerc*, 1985, 17(1), 94–100.
- Dudek B., Koniarek J., The adaptation of Profile of Mood States (POMS) by D.M. McNair, M.Lorr, L.F. Droppelman [in Polish]. *Przeł Psych*, 1987, 30, 753–762.
- Goryńska E., Mood Adjective Check List UMACL by G. Matthews, A.G. Chamberlain, D.M. Jones. Manual [in Polish]. Pracownia Testów Psychologicznych PTP, Warszawa 2005.
- Thayer E.R., The biopsychology of mood and activation. Oxford University Press, New York 1989.
- Oweis P., Spinks W., Biopsychological, affective and cognitive responses to acute physical activity. *J Med Phys Fitness*, 2001, 41(4), 528–538.
- Kavussanu M., McAuley E., Exercise and optimism: Are highly active individuals more optimistic? *J Sport Exerc Psychol*, 1995, 17(3), 246–258.
- Leith L.M., Foundations of exercise and mental health. Fitness Information Technology, Morgantown 1994.
- Petruzzello S.J., Landers D.M., Hatfield B.D., Kubitz K.A., Salazar W., A meta-analysis on the anxiety-reducing effects of acute and chronic exercise: outcomes and mechanisms. *Sports Med*, 1991, 11(3), 143–182.
- Juczyński Z., The measurement instruments in health promotion and psychology [in Polish]. Pracownia Testów Psychologicznych PTP, Warszawa 2001.
- Wrześniewski K., Sosnowski T., Matusik D., State Trait Anxiety Inventory STAI. Polish adaptation of STAI. Manual [in Polish]. Pracownia Testów Psychologicznych PTP, Warszawa 2002.
- Łuszczynska A., The change of health behaviors [in Polish]. Gdańskie Wydawnictwo Psychologiczne, Gdańsk 2004.

Paper received by the Editor: January 15, 2009.

Paper accepted for publication: March 2, 2009.

Address for correspondence

Monika Guskowska

Zakład Psychologii

Akademia Wychowania Fizycznego Józefa Piłsudskiego

ul. Marymoncka 34

00-968 Warszawa, skr. poczt. 55, Poland

e-mail: mguskowska@wp.pl