



## MOOD CHANGES IN INDIVIDUALS WHO REGULARLY PARTICIPATE IN VARIOUS FORMS OF PHYSICAL ACTIVITY

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### ABSTRACT

**Purpose.** A number of mental and physical benefits arise from leading an active lifestyle. Many forms of therapies make use of physical activity to reinforce rehabilitation as well as improve the condition of the body and mind. It is in this way that an individual can improve their well-being through cleansing the body of negative emotions and seek inner harmony, which is one of the most important features of mental health. However, the question arises whether all forms of physical activity improve the emotional state of an individual in the same way. A qualitative change in mood may be in fact related to the methodical factors present in physical activity (the type of exercise, the training method or its intensity and frequency) but also an instructor's personality, the age and gender of the participant as well as their physical fitness and motor skills, the subject's current social and mental state, environmental factors or other factors related to everyday life such as work, family, etc. The aim of this study was to determine the changes in mood of physically active and highly fit people, aged 22–25 years, after various forms of physical activity and with different training methodologies. **Methods.** The Mood Adjective Check List (UMACL) was administered to 84 students before and after completing a course in a number of physical activities. Statistical methods were then applied to the results to measure the size of the differences and for any statistical significance. **Results.** The results found that regardless of the form of physical activity or class duration, there was a positive change in the mood of participants. Differences in size of the changes, when compared to the forms of physical activity and gender, were not found. **Conclusions.** The improvement in mood of fit and regularly physically active adults is observed regardless what form of physical activity is practiced.

**Key words:** physical activity, fitness, mood

### Introduction

The physical and psychological well-being of humans is dictated by many factors, key among them lifestyle and a number of different factors that compose everyday life. It is not without reason that physical activity plays a large role here, as it is the only one of numerous human needs that plays a role in maintaining both physical and mental health [1, 2]. In many therapies, physical activity is used to support not only the healing process but also improve both body and spirit [3–6]. It is in this way that an individual can improve their well-being through cleansing the body of negative emotions and seek inner harmony, which is one of the most important features of mental health [7, 8].

An additional factor that can also have a positive impact on mental health is music. The hedonic experience one can experience from moving to the rhythm of music was known already from antiquity. Plato himself (427–347 BC) makes mention of this, where “[...] gymnastics is for the body and music for the mind” [in 9, p. 25]. Nonetheless, the combination of music and

physical activity as a form of training (not including dancing) appeared only in the second half of the twentieth century. This itself is a part of the popular culture revolution that is occurring before our eyes, which includes physical culture, and is to a large extent conditioned by geopolitical, sociocultural and technological changes.

As a result of the dynamic changes in sport, new and more attractive forms of exercise are arising that utilize all of the aspects present in physical culture. Also evolving is our outlook on what it means to be healthy and on psychophysical well-being. One way of measuring this condition can be mood, although as unreliable as it may be, it can serve as an authoritative parameter for judging mental health [10]. In literature there are many well-known scientific reports that point to physical activity's influence in changing mood [11–14]. There is clear scientific evidence that shows a link between physical activity and improved mood and well-being, whether young, healthy and physically active women [15], middle-aged women [16] or women during menopause [17].

In addition, the therapeutic and preventive nature of physical activity was confirmed as a form of rehabilitation, in restoring physical health as well as controlling mental needs and well-being [18, 19]. Also studied were the psychological effects of physical training, including a significant reduction in stress, depression and anger

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after physical exercise [2, 20]. One of the scientific papers that stands out in this regard is LeUnes' study [21], in which the author presents 57 scientific papers on this subject. Significant changes in mood and emotion are noted among athletes who take part in intensive exercise whether as a part of training or athletic competition [21–24]. A large group of scientists versed in physical therapy stress the value of physical activity when dealing with anxiety, depression or pessimistic behavior [5, 25–28]. However, the question arises whether the mood of a healthy and abled individual is significantly affected depending not only on the form of physical activity but also its intensity. Also interesting is the axiological aspect that this question poses. A qualitative change in mood may be in fact related to the methodical factors present in physical activity in addition to the known influence of various psychosocial, environmental and sociocultural factors or components of everyday life [29–31].

Therefore the aim of this study is to determine what changes in mood occur after selected forms of physical activity, varied by types of exercise and different training methods, in a sample group of 22 to 25 year old individuals who are physically active and in excellent physical shape. Hypothetically, it was assumed that the mood of healthy and regularly exercising individuals would improve, but with different levels of improvement depending on the type of exercise as well as the volume and intensity of the workload.

### Material and methods

The study included 84 students aged 22–25 years (47 women and 37 men) who study physical education at the University School of Physical Education in Wrocław or the State Vocational College in Legnica, Poland. The study was conducted before the subjects began taking part in their selected forms of physical activity and again after in order to assess the change in mood by use of the UWIST Mood Adjective Checklist (UMACL) by Matthews, Chamberlain and Jones, as adapted by Goryńska [32]. The authors of this scale determined mood as a prolonged core emotion, consisting of three dimensions:

- a) TH – the hedonistic tone: moods associated with the intensity of feeling pleasure-displeasure
- b) PN – tense arousal: moods described as the emotions between being nervous-relaxed
- c) PE – energetic arousal: moods oscillating between feeling energetic-tired

The use of this concept assumes that good mood is viewed as having high TH and low PN. The authors pointed out that certain difficulties may arise from interpreting energetic arousal moods (PE). However, it was accepted that high or moderate values of this dimension are desired. The UMACL scale measures mood by the use of 29 adjectives which describe the various

types of moods that make up the three dimensions. The respondents indicate their current state of mood by use of a four-point scale (definitely yes, rather yes, rather not, definitely not) for each of the moods. Each of the measured dimensions of mood obtained a raw value on the UMACL scale, with the values of TH and PE ranked in the 10–40 range, while PN was ranked between 9–36. The obtained raw values were then transferred to a sten scale as a standardized scoring system for age and sex which was developed by the UMACL's authors [32]. The sten scale allows for the interpretation of the results, where an average value falls between 5 and 6 on the sten scale and is described as having a “neutral” mood. Values below 5 indicate that the test parameter is below average (which can be, e.g., a feeling of uncertainty, physical discomfort, a kind of nervousness or excitement), while a value above 6 is considered above average and suggests an increased mood state characterizing the evaluated dimension.

Statistical analysis was performed with the use of nonparametric tests. Differences in the changes in mood before and after physical activity were evaluated by the Wilcoxon signed ranks test, while evaluation of the differences in the change of mood, depending on the type of course and sex, was performed by univariate analysis of variance (Kruskal-Wallis test). All calculations and graphs were obtained with the use of Statistica ver. 9.0 software (Statsoft, USA). The significance level was set at  $p \leq 0.05$ .

The size of the individual components of mood (TH, PE and PN) was evaluated immediately (using unpublished software created by this author) before and after each physical activity class. The forms of physical activity that the sample group took part in were as follows:

BOXING – is a form of combat sport in which opponents use their gloved fists to deliver blows above the belt line as well as avoiding punches to their own head and body. Participants are required to have high strength-endurance levels and produce highly dynamic acyclic and asymmetrical movements. Effectively preparing for boxing depends mainly on coordinating such neurophysiological factors such as intramuscular and intermuscular coordination, the high speed delivery of a single move, response time (especially to visual-motor stimuli) and high levels of tactical skills. Energy production is alternatively provided by both aerobic and anaerobic processes. The course which the students took part in and which evaluated the change in mood, was to teach and improve simple punches (in the up and down direction) and two types of defense moves – one by capturing the blow and the other by use of an open block. In the final part of the course these fighting techniques were integrated in the so-called simple fighting style. The main emphasis was on dynamic strength of the upper limbs and neck, eye-hand coordination (by forming choice reaction time).

Twelve men took part in the course, with each class lasting 75 min. Intensity: moderate, high and submaximal. Training method: variable intermittent. Teaching method: stationary.

**BODYBUILDING (Strength Training)** – a set of weight training exercises using free and stationary weights designed to develop and display one's physique. The essence of bodybuilding is training to body to have a symmetrical muscular figure and encompasses a competitive aspect. Those who take part in bodybuilding are required to be knowledgeable in resistance exercises as well as be focused with full involvement of their psychomotor skills during training. Energy production comes from high-energy phosphate transfer during anaerobic metabolism where the main energy substrate is phosphocreatine. However, depending on both the goal and methods, another energy source can also be muscle glycogen. The predominant bodybuilding method is cyclical in nature and requires strict observance of the general principles of strength training [33]. The bodybuilding course in this study was aimed at teaching introductory methods by the adaptive method for an overall increase in muscle mass. The classes included moderately heavy training of all of the main muscle groups (three series of 8–12 repetitions). The class was composed of a mixed group ( $N = 24$ ; 12 men, 12 women) with each class lasting 90 min. The main emphasis was in training until failure of all limb flexors and extensors and the trunk as well as intramuscular and intermuscular coordination. Intensity: average and large. Training method: repetitive. Teaching method: circuit training.

**TBC (Total Body Conditioning)** – is a form of complex aerobic training aimed at uniformly stimulating the entire body. TBC classes usually consist of exercises set to a predetermined rhythm, where participants need to focus their attention on their starting position before each exercise. Mirroring proper technique and being fully concentrated minimizes the risk of injury as well as increases health gains. The structure of each class is dependent upon the instructor, but normally consists of six parts (an overall warm-up, a focused warm-up, the target exercise, a relief exercise, a cool down and then a relaxing part) and lasts 60 minutes. TBC can be performed with free weights up to 5 kg and can include gymnastics and music components. Since a participant does not need to be specially prepared to take part in the classes, TBC can be used for individuals regardless of their physical condition. The class structure also allows individuals to prepare for more intensive workouts by multiple repetitions of a specific set of exercises. The purpose of the TBC course within this study was to stimulate the body by reaching a heart rate of 150 bpm and to complete three series of exercises for four parts of the body at a variable heart rate of 80–140 bpm, with the rhythm set by using music. The main training emphasis was improving

strength endurance of the shoulder girdle muscles, the flexors and extensors of the lower limbs, the abdominal muscles and the back as well as auditory-motor coordination. This physical activity class had a mixed group of participants ( $N = 24$ ; 11 men and 13 women). Class time: 60 min. Intensity: moderate and high. Training method: continuously variable. Teaching method: instructional drill.

**HI LO COMBO (Dance Aerobics)** – is a group of rhythmic exercises involving the use of techniques from both dance and gymnastics which are choreographed by each participant during classes to create an individual gymnastic and dance routine. More advanced forms of Hi Lo Combo or Dance Aerobic are choreographed together, although each individual has their own different style, to create a group act. Depending on the type of accompanying music, there are many variations of dance aerobics (funky aerobics, street dance, hip-hop aerobics, Latin, salsa, afro, etc.). Choreography classes are based primarily on dance steps performed as marches in various directions using body rotation, in which a participant stays in constant rhythm to the music. The need for constant coordination leads to an improvement in both rhythmic and spatial orientation. Due to the analytical and rather comprehensive method of teaching dance aerobics, motor memory plays a large role in proper execution. TBC training primarily burns glycogen and fat as its main source of energy conversion. In addition, the average beat per minute during dance aerobic is around 130–134 bpm. The aim of the course, as a part of this study to evaluate changes in mood, was for participants to create their own form of individual choreography and perform it in full. The main emphasis was on long-term endurance of all parts of the body and auditory-motor coordination. Twelve women attended the course, with each class lasting 70 min. Intensity: moderate and low. Training method: continuously variable. Teaching method: instructional drill.

**STEP AEROBICS** – is a form of gymnastics set to music with a fixed or variable tempo and performed on a 100 × 15 × 30 cm step. The workout is dependent on how advanced the group is (time, tempo, step height, the use of additional equipment as well as its weight and elasticity, breaks, etc.). The parts of the body that are exercised in step aerobics are the front group of muscles of the lower limbs and the lower back, while the highest risk of injury is with the knees and ankles. Aerobics methodology recommends exercising in both high and low positions in order to activate the entire body, which can effectively improve the strength endurance of the lower limbs, the front and rear trunk muscles as well as auditory-motor coordination. The main source of energy during step aerobics is glycogen and fat in aerobic metabolism. The aim of the course in this study was to perform 8–12 series of 16–24 repetitions of a specific training exercise with increasingly

levels of difficulty for three parts of the body with a steady heart rate of 120–130 bpm. The main emphasis was in improving strength endurance of the front muscle groups of the lower limbs as well as the flexors and extensors of the trunk and sharpening intermuscular coordination. Twelve women participated in this course. Intensity: average and high. Training method: continuously uniform and variable. Teaching method: instructional drill.

**Results**

Analysis on the mood changes of the tested students found that the indicator values specific for good mood (TH and PE) significantly increased after all forms of physical exercise. This went in parallel with a drop in value of the PN dimension ( $p \leq 0.05$ ) (Fig. 1, 2, Tab. 1). Before exercise the mood values of the subjects were 5 or 6 on the sten scale for TH and PN and at a sten score of 4–5 for PN; after exercise the values on the whole changed, with an increase to 7 or 8 on the sten scale for TH and PE with a decrease down to 3

for PN. It can therefore be concluded that the mood of the participants clearly improved after physical activity. A better mood after exercising (especially with music) was found in women, while for men a marked improvement in mood was found after boxing. The large dispersion of the results as well as the significantly higher level of differences in the mood indicators in women suggests that women show slightly greater volatility in mood after physical activity.

Slight fluctuations in the changes of mood were observed depending on the form of physical activity (Fig. 2), however, these were largely negligible with no significant differences found among the various parameters in connection with an improvement in mood after physical exercise (Tab. 2). Taking into consideration both men and women who took part in various physical activities, no significant differences in mood change were observed between genders (Fig. 3). In addition, it was found that neither the intensively nor the duration of the class had any significant effect on the differences in improving mood in both women and men.

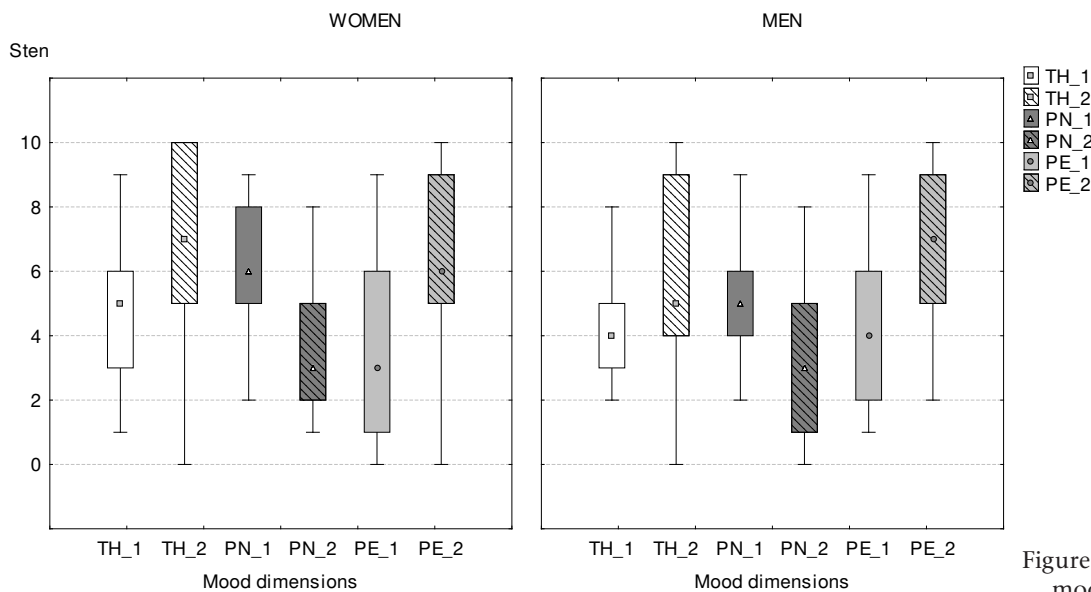


Figure 1. The range of the each mood dimension for men and women before physical exercise (1) and after (2)

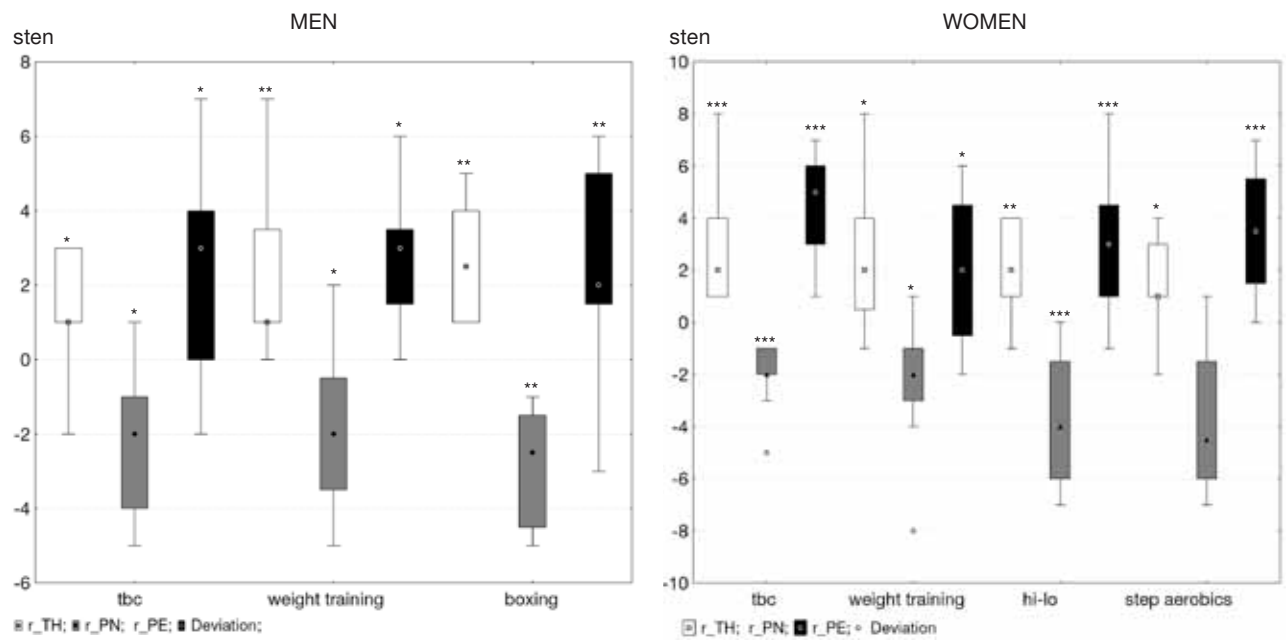
Median; Box: 25%x-75%; Plot: concentration of non-deviating values  
Mood dimensions: TH – hedonistic tone; PN – tense arousal; PE – energetic arousal

Table 1. The significance of differences between mood before and after specific forms of physical activity as based on the Wilcoxon matched pairs test

Measurements 1_2	Men									Women											
	TBC			Weight training			Boxing			TBC			Weight training			Hi-Lo Combo			Step aerobics		
	N	Z	p	N	Z	p	N	Z	p	N	Z	p	N	Z	p	N	Z	p	N	Z	p
TH_1 & TH_2	13	1.083	0.097	11	2.934	<b>0.003</b>	12	3.059	<b>0.002</b>	10	2.803	<b>0.005</b>	10	2.141	<b>0.032</b>	12	2.393	<b>0.017</b>	12	2.393	0.094
PN_1 & PN_2	13	2.236	<b>0.025</b>	10	2.191	<b>0.028</b>	11	2.934	<b>0.003</b>	11	2.934	<b>0.003</b>	12	2.510	<b>0.012</b>	12	0.078	0.937	12	0.078	<b>0.043</b>
PE_1 & PE_2	12	2.432	0.072	9	1.896	0.058	12	2.903	<b>0.004</b>	11	2.801	<b>0.005</b>	11	2.089	<b>0.037</b>	12	3.059	<b>0.002</b>	12	3.059	<b>0.002</b>

Bold signifies values at the adopted level of significance:  $p \leq 0.05$ .

Mood dimensions: TH – hedonistic tone; PN – tense arousal; PE – energetic arousal



\*  $p \leq 0.05$ ; \*\*  $p \leq 0.01$ ; \*\*\*  $p \leq 0.001$   
 Median; Box: 25%–75%; Plot: concentration of non-deviating values  
 Mood dimensions: TH – hedonistic tone; PN – tense arousal; PE – energetic arousal

Figure 2. The size of the differences of both men’s and women’s improvement in mood after physical exercise as assessed by the Wilcoxon test including a test for significance

Table 2. Analysis of the statistical significance of the changes in mood after various forms of physical exercise using the Kruskal-Wallis one-way analysis of variance by ranks (ANOVA)

Grouping variable	Participants	Difference TH; H (4. N = 84) = 2.51; $p = 0.6411$		Difference PN; H (4. N = 84) = 7.47; $p = 0.1126$		Difference PE; H (4. N = 84) = 2.34; $p = 0.6732$	
		Sum rank	Mean rank	Sum rank	Mean rank	Sum rank	Mean rank
Physical activity	N	Sum rank	Mean rank	Sum rank	Mean rank	Sum rank	Mean rank
TBC	24	949.00	39.54	1150.50	47.94	1079.50	44.98
Weight training	24	1028.00	42.83	1166.50	48.60	896.00	37.33
Step aerobics	12	441.50	36.79	375.00	31.25	592.50	49.38
Boxing	12	594.50	49.54	486.50	40.54	504.00	42.00
Hi-Lo	12	557.00	46.42	391.50	32.63	498.00	41.50

Mood dimensions: TH – hedonistic tone; PN – tense arousal; PE – energetic arousal



Median; Box: 25%–75%; Plot: concentration of non-deviating values  
 Mood dimensions: TH – hedonistic tone; PN – tense arousal; PE – energetic arousal

Kruskal-Wallis Test:  
 TH: KW-H(1;84) = 1,8768;  $p = 0,1707$   
 PN: KW-H(1;84) = 2,3997;  $p = 0,1214$   
 PE: KW-H(1;84) = 0,0082;  $p = 0,9279$

Figure 3. Comparison of the range differences of the changes in the mood parameters of men and women

## Discussion

Research on the various factors that can influence changes in mood are very popular in recent literature [1–6, 28, 34]. There is no doubt that recreational physical exercise has a positive impact on both the direction and magnitude of the various components of mood in humans [12–19, 25, 35]. Research found that there is an improvement in mood even after a single workout, as was shown by Guskowska [14, 36] in an experiment on the so-called acute effects of exercise as well as the effects of regular exercise in a month. A group of American researchers [37] confirmed this finding, where they attempted to assess the impact of multiple factors on an improvement in mood, focused on physical activity and an individual's external environment. By analyzing a large sample group of more than 1200 people of different age groups and different mental states, the group came to the conclusion that mood and self-esteem improved already after five minutes of physical exercise in a green environment such as a park. The health changes were particularly pronounced among young people and the mentally-ill. Moreover, the positive impact of being physically active in a natural environment was even further amplified when exercising in a body of water. Similar conclusions were reached by Thompson-Coon et al. [30] who conducted a comprehensive review of literature on the subject from the following sources: Medline, Embase, PsychInfo, GreenFILE, SportDISCUS, the Cochrane Library, the Science Citation Index Expanded, the Social Sciences Citation Index, the Arts and Humanities Citation Index, the Conference Proceedings Citation Index – Sciences, and BIOSIS. It was concluded that exercising in fresh air in a natural environment had a number of beneficial effects on health. This literature review found promising effects in training in a natural environment, effects which were not found when conducting the same activity indoors. Another important factor that had a substantial positive effect on mood and emotion during exercise was music. The therapeutic and hedonistic influence of music when exercising has been known for years [9, 38, 39].

This study attempted to assess the impact of different forms of physical exercise on changes in mood in young and active men and women. The physical activities the students took part in varied in intensity, volume and equipment and some also included music. The results of this study verified the hypothesis about the direction of mood changes and confirmed the findings of previous research by Lane and Lovejoy [12], and Piotrowski-Całki and Guskowska [28], who also pointed to an improvement in mental health during and after a series of physical exercises at moderate intensity. Not confirmed was the assumption that there would be differences in the size of the three mood dimensions depending on sex and the form of physical activity. This was similar to what Matthews et al. found [40], who

also received inconclusive results on the size of mood differences for both sexes. Their study emphasized that an improvement or decline, as well as the dynamics of the indicators mood, is dependent on a number of psychophysiological factors. Nonetheless, they verified previous research which assessed the impact of various factors on human mood [1–10]. Guskowska and Sionek [35] also addressed the influence of a training program on mood changes by searching for the relationships between a 12-week aerobics course and mood changes in correlation with certain personality traits. Among a number of conclusions, it was stated that the three months of exercise reduced the level of anxiety, improved self-efficacy and optimism.

In the Polish adaptation of the UMACL scale mood was defined as an “[...] affective experience of moderate duration (at least a few minutes) unrelated to the subject or related to a quasi-object that comprises of three dimensions of core emotion: a hedonistic tone, one of tense arousal and one of energetic arousal” [32, p. 7]. The above description indicates how mood is strongly conditioned by context and dependent on the surrounding circumstances or changes in stress one is subject to. Moreover, this state is determined by environment, social factors and personality traits [2, 31]. Watson [8] also described how an individual's daily and personal dependencies influence changes in mood. Extensive research was also conducted by Scully et al. [14] in searching for factors that change human mood. They determined that the relationships that exist between one's physical condition and depression, anxiety, response to stress, mood, self-esteem, assessing one's own body and premenstrual syndrome. In addition, researchers from Chicago under the direction of Reid et al. [42] successfully found the relationship between exercise and an improved quality of life and mood in people suffering from chronic insomnia. The above study highlighted the complexity of issues that exist when evaluating human well-being.

In view of the above, this study was conducted by taking into account the above factors by providing the right conditions in order to eliminate as much interference as possible. Special attention was paid to the respondents attending their classes, fully understanding the purpose of the study and knowing how to complete their mood assessments as well as ensuring anonymity and limiting the participation of psychologists in the study. Goryńska [32] allowed her study subjects to use their names or be anonymous; however, she found significant differences in all three mood dimensions of those who opted to take part in the test using their names. According to the author, “[...] named vs. anonymous individuals (who had a free choice) had strongly differentiated results. The results showed that anonymous individuals had higher tense arousal (PN) but lower hedonistic tone (TH) and tense arousal (PE) levels” [32, p. 53]. Due to the fact the participation in this

study was anonymous, there appears to be a possibility that the results could be in fact more varied in the size of mood change for each form of physical activity if the respondents had provided their personal names.

The results of this study suggest that further analysis is needed in this area, even though that research has been carried out for years on what factors determine an improvement in mood. Also interesting are the dependencies of changes in mood and emotion with age, which was demonstrated by Larsen and Diener [43] and Goryńska [32]. There also exists evidence that physical activity can have a negative impact on an individual's mental state [44]. Therefore, it is felt that the search for the various relationships between physical exercise and the psychological reactions of people ought to continue.

### Conclusion

An improvement in mood, characterized by high values of the hedonistic tone and energetic arousal and the decrease in the tense arousal mood dimensions, was found to occur in physically active young men and women regardless of the physical activity they took part in.

### References

- DiLorenzo T.M., Bargman E.P., Stucky-Ropp R., Brasington 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.
- 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.
- Berger B.G., Motl R.W., Exercise and mood: a selective review and synthesis of research employing the profile of mood states. *J Appl Sport Psychol*, 2000, 12 (1), 69–92, doi: 10.1080/10413200008404214.
- O'Connor P.J., Sleep, mood, and chronic pain problems. In: Poon L.W., Chodzko-Zajko W., Tomporowski P.D. (eds.), *Active living, cognitive functioning and aging*. Human Kinetics, Champaign 2006, 133–143.
- Lewandowska K., Specjalski K., Jassem E., Słomiński J.M., Style of coping with stress and emotional functioning in patients with asthma [in Polish]. *Pneumonol Alergol Pol*, 2009, 77, 31–36.
- Szczepańska J., Greń G., Woźniewski M., The effect of systematic physical exercise on the general mood and mood disorders in elderly people with mild cognitive deficiencies [in Polish]. *Fizjoterapia*, 2004, 12, 37–46.
- Trzebińska E., *Positive psychology* [in Polish]. Wydawnictwa Akademickie i Profesjonalne, Warszawa 2008.
- Watson D., *Mood and Temperament*. Guilford Press, New York 2000.
- Pańpuch Z., Sport according to the Plato and the Aristotle [in Polish]. *Wychowawca*, 2004, 7/8, 24–28.
- Goryńska E., Polish adaptation of the Mood Adjective Checklist [in Polish]. In: Ciarkowska W., Matczak A. (eds.), *Individual differences. Chosen studies inspired by the Regulating Theory of Temperament* by Jan Strelau, Interdisciplinary Centre for Behaviour Genetics, UW, Warszawa 2001, 155–164.
- 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.
- Lane A.M., Lovejoy D.J., The effects of exercise on mood changes: the moderating effect of depressed mood. *J Sports Med Phys Fitness*, 2001, 41 (4), 539–545.
- Netz Y., Lidor R., Mood alterations in mindful versus aerobic exercise modes. *J Psychol*, 2003, 137 (5), 405–419.
- Guszkowska M., Physical activity and the course of stress transaction among youth [in Polish]. AWF, Warszawa 2005.
- Kull M., Physical activity and mental health: relationships between depressiveness, psychological disorders and physical activity level in women. *Biol Sport*, 2003, 20 (2), 129–138.
- 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 Psychol*, 2000, 19 (4), 365–375, doi: 10.1037/0278-6133.19.4.365.
- Slawen L., Lee Ch., Mood and symptom reporting among middle-aged women: the relationship between menopausal status, hormone replacement therapy, and exercise participation. *Health Psychol*, 1997, 16 (3), 203–208, doi: 10.1037/0278-6133.16.3.203.
- Keyes C.L.M., The mental health continuum: From languishing to flourishing in life. *J Health Soc Behav*, 2002, 43 (2), 207–222.
- Thayer R.D., *Calm Energy: How people regulate mood with food and exercise*. Oxford University Press, New York 2003.
- Hassmén P., Koivula N., Uutela A., Physical exercise and psychological well-being: A population study in Finland. *Prev Med*, 2000, 30 (1), 17–25, doi: 10.1006/pmed.1999.0597.
- LeUnes A., Updated bibliography on the profile of mood states in sport and exercise psychology research. *J Appl Sport Psychol*, 2000, 12 (1), 110–113, doi: 10.1080/10413200008404216.
- Lane A.M., Terry P.C., Stevens M.J., Barney S., Dinsdale S.L., Mood responses to athletic performance in extreme environments. *J Sports Sci*, 2004, 22 (10), 886–897, doi: 10.1080/02640410400005875.
- Raglin J., Eksten F., Garl T., Mood state responses to a pre-season conditioning program in male collegiate basketball players. *Int J Sport Psychol*, 1995, 26, 214–225.
- Terry P., Mood state profiles as indicators of performance among Olympic and World Championship athletes. *J Sports Sci*, 1994, 12, 214.
- Park H.N., An H.G., Effects of the weight management program based self-efficacy for body composition, blood lipid profile, weight self-efficacy lifestyles, depression in middle-aged obese women. *Taehan Kanho Hakhoe Chi*, 2006, 36 (8), 1359–1366.
- Guszkowska M., Kozdroń A., The influence of physical exercise on emotional states in older women [in Polish]. *Gerontol Pol*, 2009, 17 (2), 71–78.
- Robakowski F., Robakowski J., Evolutionary concepts of affective disorders [in Polish]. *Psychiatria Polska*, 2006, 40 (3), 401–414.

28. Piotrowska-Całka E., Guskowska M., Effects of aqua-aerobic on emotional states in women. *Phys Educ Sport*, 2007, 51, 11–14, doi: 10.2478/v10030-007-0016-9.
29. Mejia R., Green exercise may be good for your head. *Environ Sci Technol*, 2010, 44 (10), 3649–3649, doi: 10.1021/es101129n.
30. Thompson Coon J., Boddy K., Stein K., Whear R., Barton J., Depledge M.H., Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A Systematic Review. *Environ Sci Technol*, 2011, 45 (5), 1761–1772, doi: 10.1021/es102947t.
31. Pretty J., Peacock J., Hine R., Sellens M., South N., Griffin M., Green exercise in the UK countryside: Effects on health and psychological well-being, and implications for policy and planning. *J Environ Plann Manag*, 2007, 50(2), 211–231, doi: 10.1080/09640560601156466.
32. Goryńska E., Mood Adjective Check List (UMACL) [in Polish]. Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa 2005.
33. Stefaniak T., Atlas of weight training. Part 1 [in Polish]. Wydawnictwo BK, Wrocław 1995.
34. McInman A.D., Berger B.G., Self-concept and mood changes associated with aerobic dance. *Austr J Psychol*, 1993, 45(3), 134–140, doi: 10.1080/00049539308259130.
35. Guskowska M., Sionek S., Changes in mood states and selected personality traits in women participating in a 12-week exercise program. *Hum Mov*, 2009, 88, 10 (2), 163–169, doi: 10.2478/v10038-009-0014-2.
36. Guskowska M., State/trait anxiety and anxiolytic effects of acute physical exercises. *Biomed Hum Kinet*, 2009, 1, 6–10, doi: 10.2478/v10101-009-0003-0.
37. Barton J., Pretty J., What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environ Sci Technol*, 2010, 44 (10), 3947–3955, doi: 10.1021/es903183r.
38. Schwartz S.E., Fernhall B., Plowman S.A., Effects of music on exercise performance. *J Cardpulm Rehabil*, 1990, 10, 312–316.
39. Seath L., Thow M., The effect of music on the perception of effort and mood during aerobic type exercise. *Physiotherapy*, 1995, 81 (10), 592–596, doi: 10.1016/S0031-9406(05)66640-0.
40. Matthews G., Jones D.M., Chamberlain A.G., Refining the measurement of mood: the UWIST Mood Adjective Checklist. *Br J Psychol*, 1990, 81 (1), 17–42, doi: 10.1111/j.2044-8295.1990.tb02343.x.
41. Scully D., Kremer J., Meade M.M., Graham R., Dudgeon K., Physical exercise and psychological well being: a critical review. *Br J Sports Med*, 1998, 32, 111–120, doi: 10.1136/bjism.32.2.111.
42. Reid K.J., Baron K.G., Lu B., Naylor E., Wolfe L., Zee P.C., Aerobic exercise improves self-reported sleep and quality of life in older adults with insomnia. *Sleep Med*, 2010, 11 (9), 934–940, doi: 10.1016/j.seep.2010.04.014.
43. Larsen B.J., Diener E., Promises problems with the circumplex model of emotions. In: Clark M.S. (ed.) *Review of Personality and Social Psychology: Emotions*. Sage, Newbury Park 1992, 13, 25–59.
44. MODOIO V.B., ANTUNES H.K., GIMENEZ P.R., SANTIAGO M.L., TUFIK S., MELLO M.T., Negative addiction to exercise: are there differences between genders? *Clinics (Sao Paulo)*, 2011, 66 (2), 255–260, doi: 10.1590/S1807-59322011000200013.

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