Journal of Combat Sports and Martial Arts
© MEDSPORTPRESS, 2011; 2(2); Vol. 2, 83-89

Personality traits and eye-hand co-ordination in less- and more succesful young male boxers

Zbigniew Obmiński[1], Helena Mroczkowska[2], Irena Kownacka[2], Janusz Stabno[3]

[1] Department of Endocrinology, Institute of Sport, Warsaw, Poland
[2] Department of Psychology, Institute of Sport, Warsaw, Poland
[3] Polish Boxing Association, Warsaw, Poland

Key words: boxing, psychological geatures, visual – motor ability

Summary

Introduction. The purpose of this study was to verify hypothesis, whether selected psychological features and visual-motor ability may be useful as predictors of success in boxing.

Material and methods. Thirty six young male young (age 15-17 years.) boxers varied by body mass (47-115 kg) were assigned to this examination. They underwent two psychometric tasks of various level of difficulty to assess eye-hand co-ordination and provided filled up standardized questionnaires for determination of personality profile comprised following traits: intelligence, trait anxiety, neuroticism, extraversion, aggression, negativism, suspiciousness, resentment, irritability, guilt sense. These variables were examined in two groups, one of lees- (n=19) and second of more (n=17) successful players. Over 2-year period each of examined boxer took part in various competitions, especially twice in these of the highest rank for youth: Polish Junior Championships and Polish Olympic Youth. To less successful group of boxers were assigned these players, who won only one bronze medal or had no medal on these four competitions, whereas more successful athletes won at least one gold or silver medal.

Results. The results showed, that both groups were not differ with respect to any psychological and psychometric features. Huge inter-subject variation was found for each variable in less- and more successful group.

Conclusions. Present finding support the notion that neither examined psychological traits, nor levels of eye-hand coordination were predictors of success among young boxers at the beginning of their sport carrier.

Introduction

Studies on psychological profiles among competitive athletes have long history and wide topical scope. In sport psychology majority of experimental studies have basal, theoretical purpose, but some finding may be utilized as a diagnostic tool for athletes and their coaches. At present, researches focus their attention on examination of profile mood state (POMS) that consistent of six components describing perceived psychosomatic stress; anger, depression, vigor, tension, confusion and fatigue scores. That psychological inventory of mood state is in common use during intensified training period. Another psychological tool covers some items of Recovery-Stress Questionnaire for athletes (REST-Sport) used after overloading followed by recovery period. These studies revealed individual training tolerance and rate of post-effort recovery. Investigation on precompetition stress, cognitive and somatic one explore intensity of emotions (mainly state of anxiety) which appear directly prior to an important competition showed, that hyperemotional state is associated with lower levels of coping effectiveness and outcomes. Obviously, the psychological states and emotions strongly depend on specific circumstances, hence, they mood states are not stable across a time, but fluctuate in relation to training activity, over pre-competition short-term period and during post-effort recovery [1-13].

The other directions of investigations take into consider more stable features of psychological profile, known as personality traits. Recognition of personality profile may be helpful for estimating of athlete`s coping with typical challenges in a future. Moreover, some coaches are of the opinion that identification of personality is a key for predicting of development of one`s sport carrier. That opinion seems to be confirmed by the others. Based on analysis of the results provided over last decades Raglin [14] come to the conclusion that more than 70%

successful and unsuccessful athletes can be indentified using general psychological measures of personality structures and mood state. Association of athletes` personality profile as a relative stable feature (traits) and/or selected measures of temporary psychological states with sport performance were also studied. These the first investigations was undertaken in the early 90`s. and are continued till now to find these features, which might be the best predictors of success in various sports [15-22]. In addition to the psychological profiles there are also another abilities which affects performance in combat sport athletes. Those abilities belong to a family of general visuo-motor abilities, which comprise important components like eye-hand coordination, single time response and choice time response [23-25]. These stimuli-responses tasks together with working memory, short-term memory and sustained attention during an exercise are utilized for assessing of cognitive functions in athletes, especially in these, who are at risk of head injuries like boxers or taekwondo players [26-31]. In scientific literature lack of studies which compare both personality traits scores with the levels of eye-hand performance among boxers in relation to their sport outcomes. Hence, this study aimed to assess personality profile and level of visuo-motor feedback in less- and more successful young male boxers at the beginning of their sport carrier.

Material and methods

A sample of thirty six Polish young male boxers (age 15-17 y, body mass 45-115 kg) were subjected to this study. Four boxers were left handed and thirty two right handed ones. Over 2-year period each boxer has been enrolled four times to participate in boxing tournaments, which were of the highest rank for the youth: twice in Polish Juniors Championship and twice in the Polish Olympic Youth. Based on attained results in these competitions the coaches qualified each boxer into less- or more successful group. Qualification into these groups meet the following criteria: less successful performers achieved only 1 bronze medal (3rd place) over 2-year period, whereas more successful contestants won at least one gold or one silver medal. Psychological profile and psychometric ability were examined in laboratory condition before noon. None of examined subject reported body mass reduction before testing, and none of them participated in an official competition on a last two weeks prior to this study.

Boxers completed the standardized questionnaires for estimating selected psychological attributes that were identified by boxers coaches as contributing to development of successful sport carrier. Based on that personality traits were examined as follows: intelligence (Raven J.C), trait anxiety (Spielberger C.D.), extraversion and neuroticism (Eysenck H.J), various types of aggression, negativism, suspiciousness, resentment, irritability, and guilty sense (Buss A.H. & Durkee A). Moreover, they underwent in a randomized order two visuo-motor timing tasks, named also eye-hand co-ordination of various extent of difficulty, and performed by their dominant hands. Rest period between these tasks was 20 minutes. To assess the level of eye-hand co-ordination the purpose-made electronic equipment was used as follows:

	1 x	2 x	3 x	4 x	5 x	6 x	7 x
1 y	o	o	o	o	o	o	o
2 y	o	o	o	o	o	o	o
3 y	o	o	o	o	o	o	o
4 y	o	o	o	o	o	o	o
5 y	o	o	o	o	o	o	o
6 y	o	o	o	o	o	o	o
7 y	o	o	o	o	o	o	o

	1 x	2 x	3 x	**4 x**	5 x	6 x	7 x
1 y	o	o	o	o	o	o	o
2 y	o	o	o	o	o	o	o
3 y	o	o	o	o	o	o	o
4 y	o	o	o	o	o	o	o
5 y	o	o	o	o	o	o	o
6 y	o	o	o	o	o	o	o
7 y	o	o	o	o	o	o	o

x, y – bulbs
o – push buttons

The both tasks, Task 1 and Task 2 consisted of series (n=49) consecutive, various stimulus-response events. A single stimulus was light signal: lighting two bulbs, one horizontal (x) and one vertical (y) which turns itself simultaneously for a short time in a randomized order, for example: 4x-4y …. The response to each of that stimulus is pressing an appropriate bottom which vertical and horizontal coordinates on a table were determined by lighting bulbs. The frequency of automatic changes between visual stimuli were 50 changes/1 min for Task 1, and 70 changes/1 min for Task 2. That means, each single light signal lasts 0.98 second and 0.70 second in Task 1 and Task 2. respectively. A correct response was, when an appropriate bot-

Table 1. Mean psychological variables and mean number of correct responses in the Tasks

Variables	Less successful (n=19)	More successful (n=17)	Total group (n=36)
Age (A)	16.6±0.7 15-17	16.0±0.7 15-17	16.3±0.7 15-17
Body mass (BM)	66.4±13.6 47-93	63.5±18.1 45-115	65.0±15.9 47-115
Training experience (TE)	3.2±0.9 2-5	3.6±1.5 2-7	3.4±1.2 2-7
Task 1 (T1)	36.6±12.0 6-48	38.8±9.6 18-49	38.8±9.6 18-49
Task 2 (T2)	17.4±11.0* 1-36	18.3±12.5* 3-47	17.8 ± 11.7* 1-47
Intelligence (IN)	42.4±8.6 14-54	43.9±8.3 19-56	43.2 ±8.3 14.0-56
Trait anxiety (TA)	35.8±7.2 26-52	36.1±4.5 28-43	35.9±5.9 26-52
Neuroticism (NU)	21.6±9.7 9-37	22.3±6.2 14-36	21.9±8.1 9-37
Extraversion (E)	32.0±5.6 23-42	30.5±7.1 14-42	31.2 ± 6.5 14-42
Index of overall Aggression (OA)	79.4±26.4 46-118	81.4±27.3 39-148	80.4 ±26.5 39-148
Physical aggression (PA)	15.1±6.3 2-24	14.6±6.2 6-28	14.8± 6.2 2-28
Verbal Aggression (VA)	14.0±5.5 (5-22)	13.7±5.4 3-26	13.9 ± 5.4 3-26
Indirect aggression (IA)	8.9±4.7 1-16	8.3±5.5 2-18	9.1 ±5.0 1-18
Negativism (NG)	11.6±5.1 3-20	11.7±5.2 4-24	11.7 ± 5.1 3-24
Suspiciousness (S)	8.1±5.0 2-20	10.0±3.9 4-18	9.1 ±4.6 2-20
Resentment (R)	7.6±4.1 2-15	7.6±4.1 2-15	7.6 ±4.2 2-16
Irritability (IR)	14.6±6.3 6-25	14.0±6.7 1-28	14.3 ±6.4 1-28
Guilty sense (GS)	16.6±4.8 2-22	16.6±4.8 2-22	11.3±5.5 2-24

* Significant differences ($p<0.05$) between Task 1 and Task 2

tom was pressed on time no longer than 0.98 and 0.70 second for Task 1 and Task 2 respectively. Incorrect one (error), when a response was delayed, omitted, or wrong bottom was pressed. Hence, time response to a single stimulus consist of two steps. Firstly , examined subject has to recognized appropriate bottom to press, that depends, in part, on a rate of informative processing that is related to cognitive functions. Secondly, he/she next has to execute a movement, as fast as possible, because of a time pressure. The level of task performance is expressed as number of correct responses. Psychological profile was estimated using appropriate, standardized questionnaires utilized also in our previous studies [2-5]. The program of STATISTICA software, version 9.0 (StatSoft USA) was used for calculations. Normal distribution of the variables was tested by means of Shapiro-Wilk test, comparison of between-group differences for each of examined variable was performed with Mann-Whitney U-test, and the strength of association between indices was expressed by Spearman correlations.

Results

Mean, standard deviation and range (min-max) of observed psychometric variables in more successful, less successful boxers and in the whole group are displayed in Table 1. Matri-

Table 2. Matrix of coefficients of correlations for variables in the whole group (n=36)

Var	T1	T2	IN	TA	NU	E	OA	PA	VA	IA	NG	S	R	IR	GS
T1	1	**.94**	**.39**	-.11	-.07	.21	.18	.01	.39	.19	.03	.20	-.12	.24	-.22
T2		1	**.34**	-.06	-.02	.18	.19	.03	.30	.20	.04	.17	-.06	.26	-.12
IN			1	-.19	-.11	.23	-.11	.03	.03	-.01	-.1\	-.1	-.24	.07	-.20
TA				1	**.71**	**-.37**	.29	.011	**.49**	.28	.27	**.38**	**.58**	.09	.26
NU					1	-.37	**.37**	.19	.15	**.38**	.20	**.36**	**.49**	.18	.26
E						1	**.40**	**.38**	**.42**	**.38**	**.42**	-.06	.01	**.38**	-.22
OA							1	**.71**	**.72**	**.78**	**.81**	.35	**.59**	**.79**	-.04
PA								1	**.38**	**.63**	**.50**	.03	.30	**.59**	-.13
VA									1	**.44**	**.64**	.16	.34	**.60**	-.23
IA										1	**.52**	.16	**.45**	**.53**	-.04
NG											1	.20	**.55**	**.59**	-.08
S												1	.26	-.00	.25
R													1	**.33**	.17
IR														1	-.26
GS															1

Table 3. Matrix of coefficients of correlations for less successful boxers (n=19)

Var	T1	T2	IN	TA	NU	E	OA	PA	VA	IA	NG	S	R	IR	GS
T1	1	**.95**	.25	-.14	-.10	.20	.05	-.00	.28	.11	.02	.33	-.04	-.11	.24
T2		1	.26	-.12	-.12	.10	-.06	-.09	.11	-.00	-.05	.29	-.01	-.11	.31
IN			1	-.42	-.29	.07	-.28	.10	-.04	-.30	-.23	-.15	-.30	-.12	-.19
TA				1	**.85**	**-.57**	.21	-.06	.07	.31	.04	**.52**	**.63**	-.10	**.51**
NU					1	**-.47**	.17	-.02	.11	.24	.05	.43	**.55**	-.06	.43
E						1	.38	.38	.38	.35	.42	-.22	-.18	0.31	**-.50**
OA							1	**.78**	**.79**	**.80**	**.83**	.39	**.51**	**.72**	.11
PA								1	**.59**	**.66**	**.61**	.18	.27	**.79**	-.08
VA									1	**.60**	**.66**	.23	.18	**.53**	.11
IA										1	**.58**	.28	**.63**	.44	.16
NG											1	.11	.31	**.54**	-.07
S												1	**.61**	.00	.31
R													1	.15	.44
IR														1	.05
GS															1

Table 4. Matrix of coefficients of correlations for more successful boxers (n=17)

Var	T1	T2	IN	TA	NU	E	OA	PA	VA	IA	NG	S	R	IR	GS
T1	1	**.95**	**.53**	-.05	-.02	.26	.23	.02	**.56**	.26	-.02	.04	-.17	**.59**	**-.57**
T2		1	.42	.05	.13	.22	.37	.12	**.56**	.39	.05	.10	-.13	**.62**	**-47**
IN			1	.42	.13	**.47**	.02	-.05	.15	.21	-.05	-.11	-.20	.27	-.17
TA				1	**.58**	-.00	**.48**	.20	.10	.35	**.62**	.13	**.52**	.31	-.06
NU					1	.29	**.68**	**.51**	.12	**.61**	.38	.18	.39	.40	.03
E						1	**.55**	.38	**.48**	**.49**	.46	.29	.27	.46	.11
OA							1	**.58**	**.61**	**.77**	**.72**	.27	**.55**	**.81**	-.28
PA								1	.11	**.63**	.26	-.00	.20	.26	-.16
VA									1	.31	**.53**	.15	.45	**.71**	**-62**
IA										1	.44	.05	.36	**.60**	-.22
NG											1	.28	**.70**	**.55**	-15
S												1	-.20	-.03	.17
R													1	.46	-.14
IR														1	**-.50**
GS															1

xes of Spearman correlation coefficients for the whole group (n=36) and for subgroups are given in Tables 2, 3 and 4. Significant ($p<0.05$) coefficients are printed in bold.

The results showed lack of significant differences between less- and more successful boxers with respect to any examined features. The group of more successful boxers demonstrated inconsiderable better (by 6%) mean result in Task 1 and (by 5%) result in Task 2 compared to those attained by less successful players. Considering the whole group of boxers and percentage of correct responses in Task 1 (77.1%) and Task 2 (36.3%) we see significant ($p<0.05$) lower level of Task 2, which was more difficult to perform. In both groups significant coefficients of correlations were found among some variables. In the whole group (n=36) the level of eye-hand coordination was significantly related to intelligence scores.

Discussion

As mentioned, in addition to the well anaerobic and aerobic capacity required in sport of boxing, there are also the other psycho-motor demands from the players, like quick and correct decision-making, short time reaction during a bout, and those mental features, which allow to realize previously established tactical schedule of a fight, and/or to modify on the fly during a contest. Boxers of lower mentioned skills are always more exposed to numerous blows to their head, which not only decrease chance of winning, but negatively influences on their mental health. Some professional and amateur boxers with longer sport career, who received numerous high-impact hits on their head demonstrate deterioration of cognitive function, neurological disorders and unpredictable social behavior [26-29]. Despite this, boxing is still promoted in the childhood years, however, scientists provided ethical, social and medical justifications for banning children under the age of 16 years from boxing [31].

Examined by us boxers were of relatively short-lasting sport career and with no history of knock-out or other boxing injury, Which could affect personality features [30]. Moreover, prior to the study their body mass was not reduced by restricted diet or dehydration, that might impair psycho-physical abilities [32-33]. I our study we may also excluded well known exercise-induced effect [34] on information processing, thus, both examined groups were not exposed on internal factors affecting the psychological profile and level of the tasks performance. Employed by us tasks named also eye-hand coordination provides knowledge about information processing speed with finger tapping speed. These examination is widely utilized in athletes [22-25].

Surprising that our study showed, that for all measured the psychological variables there were not differences in less- and more successful boxers. This finding seems to be unexpected in a light of the studies undertaken by other authors. For example, based on mood measures (Brunel Mood Scores) it is possible to classify correctly exercising subjects into less- or more successful performers [35,36]. Winning karate, taekwondo, and ice-hockey players whose psychological state were tested prior to competition showed higher vigor, anger, self-confidence, but lower tension, depression, fatigue and anxiety scores than those who lost [37-39]. Moreover, state anxiety, self-confidence and self-reported of performance among taekwondo contestants 1h prior to a contest also correctly indicated winners and losers, and the accuracy of that classification was of 89%. In addition, players, who won reported lower somatic and cognitive anxiety, but higher self-confidence than losers. Somewhat lower accuracy (57.8%) of classification to selected or non selected subjects to hockey team was found, when mood state was studied 45 min. before field trials [39].

We have to note, that contrary to protocol of our investigation, all the mentioned above psychological studies were

carried out directly before competition or trials. That would suggest, that psychological state correctly reflects temporary level of psycho-physical disposition influencing final outcome. Contrary to that, psychological traits which are examined usually in neutral condition should be considered rather as predictors of a sport carrier and trustworthy tools to distinguish athletic stars and non-stars in a future. Hence, some components of psychological profile (traits) may indicate more general predispositions to sport and does not allow to predict current victory or defeat. These assumptions has been partly confirmed by Litwiniuk [40] who found differences in personality structure among karate players of various skill levels. Other research has shown significantly lower (by 16%) pre- and post game scores in state anxiety in soccer and baseball player who were considered as "stars" comparing those results among "non-stars" [41]. Interestingly, lower (by 7.5%) and non significant difference was found between mentioned groups for trait anxiety [40].

Deliberation lack of psycho-motor differences between less and more successful boxers, it is worth to take into consider an inadequate key for classification players to less-and more successful groups. Probably, for young players, sport outcomes achieved in four tournaments played over 2 years, when athletes changed their body mass and consequently weight category, does not provided sufficient information about their general boxing skills.

To our knowledge the relations between psychological traits and psychomotor abilities have not been studied among athletes, hence, it is hard to compare our findings with other reports. These relationships were investigated by Biernacki in jet pilots [42].

Searching of simple and accurate predictors in a current boxing competition some researches

input the data of sport career, especially number of victories and defeats in tournament played by examined subjects and his opponents into mathematical model comprised chi-squared test and logistic regression analysis [43]. They found predictive age and number of winning and losing as main factors, making accurate predictions of the next fight result. This method of prediction, however, requires large amounts of data, so it is not be useful for use in novice athletes. There are interesting comparisons regarding left- handiness related success in sport Gursoy R found, that among 22 examined Turkish boxers (of national level), the left-handed players were significantly ($p<0.01$) more successful than those right-handed ones [44]. The same beneficial effect of being left-handed competitors was found in wrestlers [45] and tennis players [46]. Probably left-handed competitors force their right-handed opponents to use non preferable tactics. We did not analyzed that question in our study.

Study limitation

A longitudinal study carried out during 20 y. showed that psychological traits were relatively stable features in marathon runners who continued their sport activity up to their middle age (50 y.) [47]. Contrary to that we are not sure, whether single observation of psychological and visuo-motor features in male juvenile boxers (aged on average 16.6 y.) , whose psycho-biological development was not completed, may be considered as trustworthy predictor of athletic outcome, even in the short term period. Hence, some scientists are of the opinion that repeated bio-medical assessments considered as so-called aggregated data provide more reliable information, including those regarding personality [48], especially, when subjects are very young [49]. Unfortunately, these juvenile boxers were examined by us only once.

Conclusions

Summing up, our study do not support hypothesis that less- and more successful boxers are vary with respect to psychological profile and the level of eye-hand coordination, but because of single observations the obtained results should be interpreted with great care.

References

1. Lovell GP, Townrow J, Thatcher R. Mood state of soccer players in the English leagues: reflections of an increasing workload. Biol. Sport 2010; 27(2): 83-88.
2. Wong RSK, Thung JS, Pieter W. Mood and performance in young Malaysian karateka. J. Sports Sci. Med. 2006; CSSI: 54-59.
3. Stevens MJ, Lane AM, Terry PC. Mood profiling during Olympic qualifying judo competition: A case study testing transactional relationships. J. Sports Sci. Med. 2006; CSSI: 54-59.
4. Salvador A, Suay F, González-Bono E, Serrano MA. Anticipatory cortisol, testosterone and psychological responses to judo competition in young men. Psychoneuroendocrinology 2003; 2893: 364-375.
5. Obmiński Z, Mroczkowska H, Kownacka I. State anxiety and perception of fatigue following rowing regatta. Pol. J. Sports Med. 2010; 26: 260-266.
6. Coutts AJ, Reaburn P. Monitoring changes in rugby league players` perceived stress and recovery during intensified training. Pecept. Mot. Skills. 2008; 106(3): 904-916.
7. Jürimäe J, Mäestu J, Purge P. Changes in stress and recovery after heavy training in rowers. J. Sci. Med. Sports 2004; 7(3): 335-339.
8. Nicholls AR, Jones CR, Polman RC, Borkoles E, Acute sport-related stressors, coping, and emotion among professional rugby union players during training and matches. Scand. J. Sports Med. 2009; 19(1): 113-120.
9. Nicholls AR, Hemming SB, Clough PJ. Stress appraisals, emotions, and coping among international adolescents golfers. Scand. J. Med. Sci. Sports. 2010; 20(2): 346-355.
10. Bouget M, Rouveix M, Michaux O, Pequignot JM, Filaire E. Relationships among training stress, mood and dehydroepiandrostendione sulfate/cortisol ratio in female cyclists. J. Sport Sci. 2006; 24(12): 1297-1302.
11. Coutts AJ, Wallace LK, Slattery KM. Monitoring changes in performance, physiology, and psychology during overreaching and recovery in triathletes. Int. J. Sports Med. 2007; 28: 125-134.
12. Morales-Negron HR. Self-efficacy and state anxiety during mandatory combatives training. Arch Budo 2008; 4:26-3.
13. Chiodo S, Tessitore A, Cortis C et al. Stress-related hormonal and psychological changes to official youth Taekwondo competitions. Scand J Med Sci Sports 2011; 21: 111-119.

14. Reglin JS. Psychological factors in sport performance: The Mental Health Model revisited. Sports Med. 2001; 31(12): 875-890.
15. Raglin JS, Morgan WP, Luchsinger AE. Mood and self motivation in successful and unsuccessful female rowers. Med Sci Sports Exerc. 1990; 22(6): 849-853.
16. Cockerill IM, Nevill AM, Lyons N. Modeling mood states in athletic performance. J. Sports Sci. 1991; 9(2): 205-212.
17. Raglin JS, Morris MJ. Pre-competition anxiety in women volleyball players: a test of ZOF theory in a team sport. Br. J. Sports Med. 1994; 28(1): 47-51.
18. Iso-Akola SE. Intrapersonal and interpersonal factors in athletic performance. Scand. J. Med. Sports 1995; 5(4): 191-199.
19. Pedersen DM, Manning CL. A cross-sport athletic performance rating scale. Percept. Motor Skills 2003; 97(3): 1128-1132.
20. Weiss MR, Amorose AJ, Wilko AM. Coaching behaviors, motivational climate, and psychosocial outcomes among female adolescent athletes. Pediatric Exerc. Sci. 2009; 21(4): 475-492.
21. Jones MT, Mathews TD, Murray M, van Raalte J, Jensen EE. Psychological correlates of performance in female athletes during a 12-week of-season strength and conditional program. J. Strength Cond. Res. 2010; 24(3): 619-628.
22. Luft CD, Takase E, Darby D. Heart rate variability and cognitive function; effects of physical effort. Biol. Psychol. 2009; 82(2): 164-168.
23. Cojocarin A. Measurement of reaction time in qwan ki do. Biol Sport 2011; 28: 139-143.
24. Del Parcio C, Babiloni C, Bertollo M et al. Visuo-attentional and sensorimotor alfa rhythms are related to visuo-motor performance in athletes. Hum. Brain Mapp. 2009; 30(11): 3527-3540.
25. Le Runigo, Benguigi N, Bardy BG. Visuo-motor delay, information- movement coupling, and expertise in ball sports. J. Sports Sci. 2010; 28(3): 327-337.
26. Butler RJ. Neuropsychological investigation of amateur boxers. Br. J. Sport Med. 1994; 28: 187-190.
27. Di Russo F, Spinelli D. Sport is not always healthy: Executive brain dysfunction in professional boxers. Psychophysiology 2010; 47(3):425-434.
28. Echemendia RJ, Putukian M, Mckin RS, Julian L, Shoss N. Neropsychological test performance prior to and following sport-related mild traumatic brain injury. Clin. J. Sport Med. 2001: 11: 23-31.
29. Ravdin LD, Barr WB, Jordan B, Lathan WH, Relkin NR. Assessment of cognitive recovery following sports related head trauma in boxers. Clin. J. Sport Med. 2003; 13: 21-27.
30. Mercan S, Uzun M, Ertugrul A, Ozturk I, Demir B, Sulun T. Psychopathology and personality features in orthopedic patients with boxer`s Fractures. Gen. Hosp. Psychiatry 2005; 27(1): 13-17.
31. Pearn J. Boxing, youth and children. J. Pediatr. Child. Health 1998; 34(4): 311-313.
32. Hall CJ, Lane AM. Effects of rapid weight loss on mood and performance among amateur boxers Br. J. Sports Med. 2001; 35(6): 390-395.
33. Smith MS, Dyson R, Hale T, Harrison JH, McMann P. The effects in humans of rapid loss of body mass on a boxing-related task. Eur. J. Appl. Physiol. 2000; 83(1): 34-39.
34. Mouelhi Guizani S, Tenenbaum G, Bozaouach I, Ben Kheder A, Bouasiz M. Information –processing under incremental levels of physical loads: comparison racquet to combat sports. J. Sports Med. Phys. Fitness 2006; 46(2): 335-343.
35. Lane AM, Lane HJ. Predictive effectiveness of mood measures. Percept. Mot. Skills 2002; 94(3): 785-791.
36. Fazackerly R, Lane AM, Mahoney C. Confirmatory factor analysis of the Brunel Mood Scale for use with water-skiing competition. Percept. Mot. Skills 2003; 97(2): 657-661.
37. Terry PC, Slade A. Discriminant effectiveness of psychological state measures in predicting performance outcome in karate competition. Percept. Mot. Skills 1995; 81(1): 275-280.
38. Chapman C, Lane AM, Brierly JH, Terry PC. Anxiety, self confidence and performance in Taekwon-do. Percept. Mot. Skills 1997; 85(3): 1275-1278.
39. Terry PC, Yungs EL. Discriminant effectiveness of psychological state measures in predicting selection during field hockey trials. Percept. Mot. Skills 1996; 82(2): 371-377.
40. Litwiniuk A, Sadowski J, Wilczewski A, Szczuk J. Motoric and personality variables of karate competitors. Research Yearbook 2007; 13(1): 140-143.
41. Han DH, Park HW, Kee BS, Na C, Na DH, Zaichkowski L. Performance enhancment with low stress and anxiety modulated by cognitive flexibility. Psychiatry Investigations 2011; 8(3): 221-226.
42. Biernacki M, Tarnowski A. The relationships between temperamental traits and the level of performance of an eye-hand co-ordination task in jet pilots. Int. J. Occup. Saf. Ergon.(JOSE) 2008; 14(4): 423-432.
43. Warnick JE, Warnick K. Specification of variables predictive of victories in the sport of boxing: II. Further characterization of previous success. Percept. Mot. Skills 2009; 108(1): 137-138.
44. Gursoy R. Effects of left- or right-hand preference on the success of boxers in Turkey. Br. J. Sports Med. 2009; 43(2): 142-144.
45. Ziyagil MA, Gusoy R, Dane S, Yuksel R. Left-handed wrestlers are more successful. Percept. Mot. Skills 2010; 111(1): 65-70.
46. Loffing F, Hagemann N, Straus B, Automated processes in tennis: do left-handed players benefit from tactical preferences of their opponents? J. Sports Sci. 2010; 28(4): 435-443.
47. Morgan WP, Costill DL. Selected psychological characteristics and health behaviors of aging marathon runners: a longitudinal study. Int J. Sports Med. 1996; 17(4): 305-312.
48. Pruessner JC, Gaab J, Hellhammer DH, Lintz D, Schommer N, Kirschbaum C. Increasing correlations between personality traits and cortisol stress responses obtained by data aggregation. Psychoneuroendocrinology 1997; 22(8): 615-625.
49. Laurin R. The influence of the “big five” factors on the demands-abilities fit in soccer academies. Perceptual Mot. Skills. 2009; 109(1): 239-250.

Address for correspondence:
Zbigniew Obmiński
Department of Endocrinology, Institute of Sport
Trylogii 2/16, 01-982 Warsaw, Poland
phone: +48 (22) 834-95-07, e-mail: zbigniew.obminski@insp.waw.pl

Received: 17.04.2011
Accepted: 05.08.2011