Correlations between psychomotor abilities and selected personality variables in rowers

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Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

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abstract

Background   The purpose of this study was to present possibilities of using computer tests in the assessment of chosen cognitive skills and an analysis of correlations between the mentioned variables and the level of optimism, self-efficacy, coping strategies, anxiety and perceived stress in Polish national team rowers.

Material/Methods   The study involved 20 rowers. Cognitive abilities were measured with the following computer tests: the Reaction Test (RT) and the Determination Test (DT) taken from the Vienna Test System (VTS). The VTS has a wide range of psychometric tools to identify the level of athlete's cognitive abilities as well as personality-related strengths and weaknesses. The rowers also completed the following questionnaires: the Life Orientation Test (LOT-R), a measurement of the level of optimism, the Perceived Stress Scale (PSS 10), the Coping Orientations to Problem Experienced (Mini – COPE), the General Self – Efficacy Scale (GSES) and the State – Trait Anxiety Inventory (STAI). The study was conducted at the Physical and Exercise Laboratory of Gdansk University of Physical Education and Sport.

Results   Analysis of the results revealed a number of significant correlations between selected cognitive abilities, such as 1) the reaction time to individual stimuli to simultaneous or sequentially presented stimulus combinations 2) reactive stress tolerance, attention and reaction speed in situations requiring continuous, swift and varying responses to rapidly changing visual and acoustic stimuli and the level of optimism, self-efficacy, different coping strategies, anxiety and perceived stress.

Conclusions   The results of the study provide information on psychomotor abilities and characterize some aspects of rowers' personality. Further research should include a control group made of lower-level rowers and younger rowers. Future studies should also use selected tests from VTS as training tools.

Key words   psychomotor abilities, Vienna Test System, optimism, self-efficacy, coping strategies, anxiety, perceived stress, rowing

INTRODUCTION

Scientists and specialists whose research is carried out on top level athletes seek ways to objectively diagnose their abilities and monitor their developmental progress. Top level sport requires new training means which enable constant progress in competitors' psychomotor abilities. In this study the Vienna Test System was applied as such a mean for psychomotor training. The VTS is a computer tool supporting psychological diagnosis in many fields, including psychology. Apart from helping procedures on general abilities, it contains procedures to test special skills. The rowers participating in the study completed the Decision Test (DT) and the Reaction Test (RT S2 version) in the laboratory environment. The Decision Test, i.e. the test of general abilities, assesses stress tolerance and complex reactions to continuous, rapidly changing stimuli and detects a reduction in attention. The Reaction Test (RT S2 version), also a test of cognitive reactions, measures the reaction time to individual acoustic stimuli [1].

The purpose of this study was to present correlations between psychomotor variables diagnosed by the VTS, and mental and personality variables assessed by traditional questionnaires.

Competitors' personality can be determined in many ways with certain methods derived from theories of personality. Psychologists define personality in various ways, but almost in all definitions there are two concepts: uniqueness and characteristic patterns of behaviour. Pervin's [2] definitions is the most extensive: "Personality is the complex organization of cognitions [thoughts], affects [emotions], and behaviours that gives direction and patterns (cohesion)to the person's life. ["Personality the same as body consists of structures and processes and reflects the action as much of nature (genes) as the environment. The concept of personality covers the time aspect of human functioning as it contains memories of the past, mental present ideas, and ideas and expectations as to the future."].

In studying personality we concentrate not only on factors (optimism, neurotism, extraversion, etc.), which are in the sphere of interest of the type theory and the theory of factors, but also on mental aspects referring to efficacy (expectations and assurance about yourself), experience of reality and oneself- the issue of socio-cognitive and phenomenological theories (humanistic, positive and existential theory) [2].For the purpose of the study the following traits were assessed: personal variables, such as optimism, anxiety, general self-efficacy, and present state of well-being: state of anxiety, stress intensity and coping strategies.

Studies on athletes' personalities may cover many different issues, e.g. the psychological structure of a competitor, interactions between personality and sport achievements, identification of talent in a certain sport discipline, and the influence of sport on human personality [3].

Works on diagnosis of athletes' personality allow, to some extent, perceiving competitors' behaviour before, during and after competition. Moreover, they help to develop effective communication among a competitor, a coach and parents, and determine the strengths of character. Relationships between personality and sport achievements are observed in many publications on social

and physical culture sciences. Research results prove the correlation betwe-en personality traits in "Big Five", the five-factor model by Paul Costa and Robert McCrae, and sport results. The five factors in the model (neuroticism, extraversion, conscientiousness, opening to experience, and agreeableness) are considered to be examined as five bipolar dimensions [2, 4]. Numerous studies show strong positive relationships between conscientiousness and extraversion, and sport results irrespective of the sport discipline [5, 6, 7]. Top-level athletes are characterised by an average and a low level of neuro-ticism and trait anxiety [8, 9, 10, 11] and high optimism, particularly in failu-re-related situations [12, 13]. Differences between top and lower sport level athletes also concern the types of coping strategies, which are focused more on emotions or problems, or which are avoiding strategies. Research shows that, irrespective of discipline, successful athletes more often apply strate-gies concentrated on the problem, task, and focus on the way to the solution and the solution itself [14]. A psychological variable, self-efficacy, is essential on the way to reach sport mastery [15, 16, 17]. Many studies indicate signi-ficant inverse relationships between self-efficacy and cognitive and somatic anxiety in athletes, as well as positive relationship between self-efficacy and sport results and emotional control [18, 19].

In this study the emphasis is put on seeking relationships between the selected psychological variables, such as optimism, self-efficacy, coping strategies, the level of perceived stress and intensity of trait and state anxiety, and selected psychomotor variables, such as reaction speed to individual stimuli and deficit in attention assessed by a stress tolerance test in rowers in the preparatory period. There are not many examples of findings in scientific literature on the issue analysed in this research, i.e. correlations between personality variables and cognitive or psychomotor variables. The study has a diagnostic character.

MATERIAL AND METHODS

PARTICIPANTS

20 rowers (M = 23.9; SD = 2.6) participated in the study during the prepa-ratory period – March-April 2015. The test was carried out at the Physical Exercise Laboratory at Gdansk University of Physical Education and Sport.

STUDY PROCEDURE AND MEASURING TOOLS

The research had two stages. The first stage consisted of psychological tests. The following tools were used to assess mental variables:

LOT-R, Scheier, Carver, Bridges (1994), Polish version Poprawa, Juczyński,

GSES, Schwarzer and Jerusalem (1992), Polish version Schwarzer, Jerusalem,

PSS-10, Sheldon, Cohen et al. (1983), Polish version Juczyński, Ogińska – Bulik,

STAI–STAI, Spielberger, Gorsuch, Lushene (1970), Polish version Spielberger, Strelau, Tysarczyk, Wrześniewski (1987),

Mini-COPE, Carver (1989), Polish version Juczyński, Ogińska – Bulik, 7 factors were considered: active coping, helplessness, looking for support, avoiding

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bahaviour, turning to religion, acceptance and a sense of humour [20,21].

In the second stage the rowers were subjected to DT and RT tests from the Vienna Test System:

RT (S2) – enables measurement of the reaction time for individual visual and acoustic stimuli or stimulus combinations,

DT (S1) – measures stress tolerance by testing complex reactions to continuous, rapidly changing stimuli and detects reduction in attention [1].

Table 1 shows a list of abbreviations describing cognitive and psychomotor variables.

Table 1. Symbols and definitions of personality and psychomotor variables in research

Definition	Symbol
Level of optimism	LOT-R
Level of self-efficacy (general)	GSES
Level of perceived stress	PSS-10
Level of anxiety as state	STAI-X1
Level of anxiety as trait	STAI-X2
Active coping – 1st factor of (Mini-Cope) – measurement of coping; means undertaking actions to improve a situation, contemplating and planning what to do, considering a situation in a positive view	M-CI
Helplessness – 2nd factor of (Mini-Cope) – measurement of coping; means taking medicines to ease bad emotions, giving up any effort to achieve goals, criticizing and blaming oneself for what has happened	M-CII
Looking for support – 3rd factor of (Mini-Cope) – measurement of coping; means looking for comfort, understanding and support from others, and seeking and getting help/advice from others	M-CIII
Evasive behaviour – 4th factor of (Mini-Cope) – measurement of coping; means doing other things not to remember the situation, rejection of the fact, showing negative emotions (discharge of accumulated emotions)	M-CIV
Return to religion – 5th factor of (Mini-Cope) – measurement of coping; means praying, meditating to find comfort	M-CV
Acceptance – 6th factor of (Mini-Cope) – measurement of coping; means acceptance of a situation and learning how to live with it	M-CVI
Sense of humour – 7th factor of (Mini-Cope) – measurement of coping; means joking and treating the situation as a good game	M-CVII
Average time of motor reaction in RT to an acoustic stimulus	RT CM
Correct reactions in RT to an acoustic stimulus	RT RP
Incomplete reactions in RT to a stimulus	RT RN
Correct reactions in DT	DT RP
Incorrect reactions in DT	DT RB
Avoided stimuli in DT	DT PB
Median response time in DT	DT CRM
Total correct and incorrect reactions in DT – Total	DT RO

RESULTS

The research question is "Are there any correlations between psychomotor abilities and mental variables in rowers?".

Firstly, personality characteristics of the research group are presented. Table 2 shows results of general statistics.

Table 2. General statistics in the selected mental variables

Mental variables	Mean	Standard deviation	Interpretation
LOT-R	18.5	2.5	8 sten – high
GSES	33.58	4.03	8 sten – high
PSS 10	14.58	8.73	5 sten – average
M-C I	2.25	0.36	high
M-C II	0.52	0.42	low
M-C III	1.72	0.65	average
M-C IV	1.4	0.54	average
M-C V	0.75	0.89	low
M-C VI	2.04	0.45	high
M-C VII	1.12	0.48	average
STAI-X1	29.08	17.83	3 sten – low
STAI-X2	37.66	8.84	5 sten – average

Table 2 demonstrates high values with respect to optimism and general self-efficacy of rowers who use coping strategies and acceptance as ways to overcome difficult situations. The subjects obtained average scores in a sense of humour as a coping strategy and in other strategies, such as supporting and avoiding ones when attempting to separate from the source of emotions. Evaluating their life situation as slightly stressing and out of control, rather unpredictable and aggravating, they assess the anxiety trait level as average. The athletes are rarely helpless in difficult situations and rely on their own competence and possibilities. They seldom seek help in prayer or meditation, as strategies leading to calmness and emotional balance. Their state of anxiety is at a low level.

To determine interdependence between the selected personality and psychomotor variables r-Pearson method was applied. The results are shown in Table 3.

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Table 3.The Pearson correlation coefficient values (r-Pearson) between the level of optimism, self-efficacy, perceived stress, coping strategies / the level of anxiety as trait and state, and results in reaction time to an individual acoustic stimulus RT (S2), and stress tolerance test/ speed and stability of response time DT(S1) of the Vienna Test System

Variables	LOT-R	GSES	PSS 10	M-C I	M-C II	M-C III	M-C IV	M-C V	M-C VI	M-C VII	STAI-X1	STAI-X2
RT CM	0.183	-0.093	-0.276	0.166	-0.267	0.456	0.571	0.117	0.009	0.574	-0.784*	-0.196
RT RP	-0.279	-0.221	0.539	-0.106	-0.243	0.701*	0.417	-0.130	0.043	0.120	0.015	-0.149
RT RN	0.188	0.422	-0.309	0.071	-0.143	-0.713*	-0.523	0.088	-0.029	-0.407	0.104	0.118
DT RP	-0.321	-0.522	0.247	-0.362	0.126	-0.129	-0.279	-0.389	-0.570	0.385	0.342	0.174
DT RB	-0.171	0.251	0.439	0.104	0.036	0.348	0.562	0.447	0.390	-0.315	-0.062	0.002
DT PB	-0.296	-0.347	0.670*	-0.343	0.697*	-0.075	0.429	0.099	-0.343	-0.129	0.474	0.601*
DT CRM	0.281	-0.039	-0.576*	-0.008	0.142	-0.309	-0.069	-0.256	0.035	-0.063	-0.244	0.084
DT RO	-0.639*	-0.431	0.844*	-0.379	0.216	0.220	0.260	-0.023	-0.337	0.168	0.399	0.243

Statistical significance at $p < 0.05$*

The statistical analysis showed the strongest positive correlations between the number of responses in DT and the level of perceived stress (0.844), i.e. the higher the tension in connection with the present life situation, the higher the number of both correct and incorrect responses in DT. Also noteworthy is a high positive correlation between the number of correct responses in RT to an individual acoustic stimulus and coping strategies, i.e. seeking both instrumental and emotional support (0.701) – the higher number of correct responses to an acoustic stimulus, the more frequent a use of supporting strategies. Some moderate positive correlations appeared between avoiding stimuli in Decision Test and helplessness in a difficult situation (0.697), the level of perceived stress (0.670) and the intensity of anxiety trait (0.601); thus the more avoided stimuli in the Decision Test, probably the more abandon efforts to achieve goals; the more the athletes felt the situation as little predictable and stressing, the higher level of anxiety they had. The research pointed out a few high negative correlations between the state of anxiety and the average motor response time in the Reaction Test (-0.784). It means that the higher anxiety at that moment, the lower the average motor response time to an acoustic stimulus. The next high negative correlation occurred between seeking support as a coping strategy and the number of incomplete responses in the Reaction Test (-0.713) – the more frequent searching for emotional and instrumental support in a difficult situation, the fewer incomplete responses to an acoustic stimulus in the Reaction Test. Quite a high negative correlation (-0,639) was found between the total amount of responses in the Decision Test and the level of optimism. It shows that the greater the number of responses in the Decision Test, both correct and incorrect, the lower optimism of the subjects. The last moderately negative correlation was noted between the average response time values in the Decision Test obtained by the athletes and the perceived stress at the present life situation (-0.576); therefore, the higher the average value of time reaction to different stimuli in the Decision Test (a longer response time), the lower the tension and the lower stress arising from the interpretation of the present life situation.

The following step was an analysis of interdependence between mental variables. The results are presented in Table 4.

Table 4. The Pearson correlation coefficient values (r-Pearson) between personality varia-bles: the level of optimism, self-efficacy, perceived stress, coping strategies and the level of anxiety as trait and state

Variables	LOT-R	GSES	PSS 10	M-C I	M-C II	M-C III	M-C IV	M-C V	M-C VI	M-C VII	STAI-X1	STAI-X2
LOT-R	-	0.346	-0.741*	0.644*	-0.355	0.062	-0.205	0.020	0.382	-0.094	-0.444	-0.418
GSES	0.346	-	-0.340	0.580*	-0.487	0.013	-0.248	0.423	0.586*	-0.134	-0.122	-0.524
PSS 10	-0.741*	-0.340	-	-0.571	0.325	0.141	0.428	0.037	-0.214	-0.126	0.505	0.387
M-C I	0.644*	0.580*	-0.571	-	-0.502	0.293	-0.260	0.232	0.575	-0.021	-0.616*	-0.833*
M-C II	-0.355	-0.487	0.325	-0.502	-	-0.284	0.307	0.000	-0.481	0.092	0.512	0.771*
M-C III	0.062	0.013	0.141	0.293	-0.284	-	0.560	0.361	0.467	0.333	-0.343	-0.410
M-C IV	-0.205	-0.248	0.428	-0.260	0.307	0.560	-	0.351	0.018	0.339	-0.167	0.285
M-C V	0.020	0.423	0.037	0.232	0.000	0.361	0.351	-	0.537	0.237	-0.050	-0.051
M-C VI	0.382	0.586*	-0.214	0.575	-0.481	0.467	-0.018	0.537	-	-0.339	-0.311	-0.635*
M-C VII	-0.094	-0.134	-0.126	-0.021	0.092	0.333	0.339	0.237	-0.339	-	-0.196	0.074
STAI-X1	-0.444	-0.122	0.505	-0.616*	0.512	-0.343	-0.167	-0.050	-0.311	-0.196	-	0.635*
STAI-X2	-0.418	-0.524	0.387	-0.833*	0.771*	-0.410	0.285	-0.051	-0.635*	0.074	0.635*	-

Statistical significance at $p < 0.05$*

The table shows that the highest positive correlations occurred between the anxiety trait and helplessness in stressful situations (0.771), and next between the level of optimism and active coping (0.644). The latter positively corre-lated with self-efficacy (0.580), whereas general self-efficacy tended to be moderately positively correlated with coping acceptance (0.586). Thus the higher the anxiety trait in rowers, the more frequent helplessness, while the higher the athletes' optimism, the more practical ways of coping by taking actions to modify the situation for better. If the athletes had higher self-effi-cacy, they used active strategies more frequently in coping with a source of negative emotions, acceptance and adaptation to stressful situations. Reverse strongly negative relationships were found between: the anxiety trait and active coping with perceived stress (-0.83), acceptance of difficult situation (-0.635), and the state of anxiety and active coping with a source of negative emotions (-0.635), and the level of optimism and perceived stress (-0.741). The more frequently the subjects coped actively with negative emotions, the lower the level of state and trait anxiety occurred, which (the latter) when lower in rowers, caused higher acceptance of a difficult situation. The study revealed that the more optimistic the athletes were, the less they perceived their present life situation as unpredictable and negative.

The following steps in statistical analysis were addressed to correlations be-tween the results of the Reaction Test and the Decision Test of the Vienna Test System. Table 5 shows the scores.

Table 5. The Pearson correlation coefficient values (r-Pearson) between psychomotor variables in the Reaction Test to an individual acoustic stimulus RT(S2) and in tolerance to stress test, and the speed and stability of reaction time in DT (S1) of the Vienna Test System

Variables	RT RP
DT RO	0.646

Statistical significance at p < 0.05

Statistical analysis of the correlation between the selected psychomotor variables revealed one significant moderately positive correlation between the amount of correct responses in the Reaction Test to an individual acoustic stimulus, and the total number of responses in the Decision Test. The higher the number of correct responses to an acoustic stimulus was recorded, the more times the subjects responded, both correctly and incorrectly, to acoustic and visual stimuli in the Decision Test.

Summing up, the obtained results served to create a correlation model between mental and psychomotor variables in the tested group of rowers. Fig. 1 presents the model.
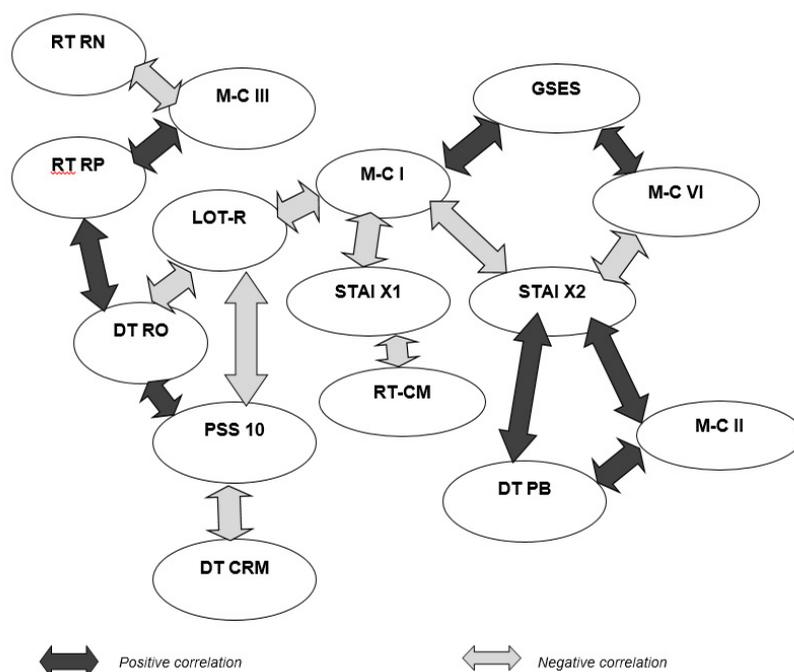

Fig 1. Correlation mode between mental and psychomotor variables

DISCUSSION

The purpose of the study was to determine a correlation between mental variables assessed by a questionnaire survey and psychomotor variables measured with computer tests taken from the Vienna Test System. The results showed many strong both positive and negative relationships between the tested variables in rowers during the preparatory period.

The study revealed that, from the personality viewpoint, athletes presented a high level of dispositional optimism (M = 18.5; SD = 2.5), i.e. dispositional

trait expressing general expectations of positive situations. Many research works confirm that dispositional optimism is an important personal resource, which not only increases well-being and affects a person's physical state, but it also increases a possibility of success; optimists in the face of difficulties continue their important goals and effectively self-regulate proceedings using suitable coping strategies, at the same time enhancing their resistance to stressful situations [21, 22, 23]. This study showed strong positive interactions between the subjects' dispositional optimism and active attempts in difficult situations consisting in finding ways to remedy, undertaking any steps to deal with negative emotions. Other studies also claim that optimists differ from pessimists in coping situations. The former concentrate on a problem, seek solutions and instrumental support and, in case of failure, they reach for more adaptive coping strategies concentrated on emotions such as acceptance and humour [21, 23]. The level of dispositional optimism correlates positively with self-esteem, self-efficacy, but negatively with depression, helplessness and anxiety [21]. The study found a strong inverse relationship with tension and the intensity of stress as a result of a life situation during the last months. It confirms earlier findings that if the athletes are more optimistic, the tension, anxiety and depression connected with the present situation are lower, especially when the situation is very emotional. Studies on athletes also show that optimistic athletes pay less emotional costs, e.g. for loss/failure, have a high sense of internal control and mental toughness [24, 25]. There is also scientific evidence for a strong positive correlation between optimism and sport experience which may prove that sport and achievements in it increase dispositional optimism [26]. Polish findings also confirm that special programs of mental training, in this case carried out on athletes, may increase dispositional optimism in comparison to competitors who were not subjected to such training [27]. It would be interesting from a scientific point of view to compare senior rowers with younger representatives and their achievements for future studies. Strong negative correlations were found between the level of optimism and the number of all responses in the stress tolerance test – the Decision Test of VTS. It shows that the more optimistic the athletes are, the lower the general number of responses in DT. Although statistical results were insignificant, they showed that more optimistic athletes tended to have fewer positive responses both in DT (-0.321) and RT (-0.279). But it must be emphasised that the data is statistically insignificant.

The rowers' general characteristics revealed high scores in general self-efficacy, active coping with problems and acceptance of difficult situations; these variables correlate positively with each other. Other studies also indicate significant correlations between general self-efficacy and coping strategies focused on a task – active coping [28]. It is emphasised that beliefs about one's own self-efficacy affect the assessment of personal resources particularly under stress. So the stronger the beliefs about self-efficacy, the more difficult the challenges and the stronger the engagement and determination to pursue aims despite the repeated failures [21]. The above analysed personality factors, namely self-efficacy and dispositional optimism, are treated as stress moderators which may favourably affect the encountered difficulties. Having life optimism and high self-efficacy, athletes can cope better in stressful situations and avoid or feel less negative effects of stress transactions (relations between a person and environment) [20].

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Attention should be also paid to the results determining the level of perceived stress in the past weeks. The rowers had average scores in this particular mental variable, which significantly negatively correlated with dispositional optimism and with the average score within time response in DT.A high positive correlation occurred between the described variable, total general responses and the number of avoided stimuli in the Decision Test. A lack of significant relationships between the perceived stress and coping strategies is highly surprising. Juczyński [20] in his studies demonstrated a negative correlation between stress intensity and focused on task-oriented strategies, such as: Active Coping and Planning (M-CI), while a positive relationship was shown with avoidance strategies (M-CIV). Our study showed a tendency towards a negative correlation with Active Coping (0.571) and a positive one with Avoidance Behaviour (0.428); however, correlations were not statistically significant. Research of other scientists on de-stress intensity indicates positive interactions with state and trait anxiety [29]. Anxiety as state had low intensity; however, anxiety as trait had an average level in the subjects. Both state and trait variables did not correlate significantly with stress intensity. The results tended to correlate positively with state anxiety (0.505) and trait anxiety (0.387). However, positive dependencies occurred between trait anxiety and helplessness in a difficult situation, as the second factor of the coping strategy. Opposite correlations were between state and trait anxiety, and active coping, i.e. a strategy concentrated on problem. Other findings show a similar direction of correlations between anxiety and types of responses to stress: high anxiety correlates positively with a strong tendency to cope by focusing on negative emotions, whereas low anxiety is typical of people who more often concentrate on task, trying to understand the situation and solve the problem [30].

Studies on athletes reveal that the intensity of anxiety depends on many factors, such as the training period, i.e. whether athletes are in the preparatory or the starting period, on a sports discipline, i.e. whether it is hazardous to life, a team game or individual competition. Besides it also depends on the athlete's career stage. Each athlete has an individual, typical of only this person, sphere of optimal functioning (IZOF). The intensity of emotions and adrenaline can also change due to the context, the time during competition – whether it is the beginning, the middle or end of the event [31–40].

Findings of this study determined correlations between stress intensity/anxiety variables, and psychomotor variables. The positive correlation referred to the level of negative emotions / anxiety trait, and the number of avoided stimuli and total responses to tolerance stress. The studies showed that the higher the level of anxiety in athletes, the quicker their motor reaction to an acoustic stimulus and other visual stimuli. Competitors who had negative emotions responded quicker, but happened to avoid stimuli. Works of Turosz et al. carried out on rowers showed similar positive correlations between the anxiety trait and the number of complex responses, which, in the author's opinion, increases the number of delayed, incorrect or avoided stimuli [41]. Trelak in his works also proved that the level of anxiety in junior boxers had a negative influence on athletes' psychomotor fitness [42].

Results of coping strategies show that their type and character depends, to a great extent, on athletes' age and experience and their emotional develop-

ment [43, 44, 45]. Top athletes more frequently apply strategies focused on a problem/task and try to put all their efforts to plan tactical solutions and all other actions which will change the situation, thinking positively and concentrating on those aspects which are under their control [46, 47, 48]. This study focused on 7 factors regarding styles of coping, which meant different strategies focused on emotions, problems or their avoidance. The results determined a few essential correlations both with described above personality aspects and psychomotor variables. The more often athletes felt helpless (focused on emotions), the more stimuli they avoided in the stress tolerance test. It can be said that when the athletes feel more overwhelmed by emotions, their selection of attention is worse. However, when the athletes seek more emotional support, as a result they have more correct responses to an individual acoustic stimulus, and fewer incomplete responses to the same stimulus.

The research was also focused on psychomotor correlations. The findings showed one correlation. The more frequently athletes responded correctly to an acoustic stimulus, the higher the number of responses to acoustic/ visual stimuli in the second test grew. Other authors present correlations between psychomotor variables in athletes as well. Mankowska et al. determined correlations between the number of correct responses to visual stimuli and anticipation of time and motion [49]. Other studies mention different correlations due to sport level [50] and the training period [41].

CONCLUSIONS

To sum up, the research on the Polish National Team rowers in the preparatory period showed many correlations. There is a need to continue work on seeking relationships between mental and psychomotor variables, as there is little material on that issue in scientific literature. It is advisable to extend research groups by different age categories and sport level athletes.

The presented research has a diagnostic character, so in future longitudinal studies extended by the preparatory, starting and 'tapering' period might be beneficial for scientific research. It seems interesting to include women rowers into studies and determine how this variable differentiates athletes during different stages of their sport career, both in their mental and psychomotor abilities.

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