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# Influence of neurodynamic properties on the choice of coping strategies in qualified athletes

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***Purpose:*** *evaluation of the influence of neurodynamic properties on the formation of coping strategies with stress in qualified athletes.*

***Material & Methods:*** *study involved 43 high-class athletes (MS, MSIG, HMS) at the age of 14–29 years (kind of sport – kayaking and canoeing). To determine the neurodynamic properties of athletes, the Diagnostic Complex "Diagnostic-1" was used to determine the strategies of stress-overcoming behavior-the "Questionnaire of Ways of Coping Questionnaire" by R. Lazarus and S. Folkman. The study used the final score of the test of competitive personal anxiety.*

***Results:*** *surveyed athletes identified the prevalence of such coping strategies as "Self-control", "Seeking social support", "Taking responsibility", "Problem solving planning" and "Positive revaluation". The interrelationships of coping strategies with indices of neurodynamic properties-the strength and dynamism of nervous processes, the rate of complex selection reaction.*

***Conclusions:*** *specific psychophysiological markers of such coping strategies as "Search for social support", "Taking responsibility" and "Escape-avoidance", one can consider indicators of the strength and dynamics of nervous processes, the speed of a complex selection reaction. The preference for non-constructive coping strategies for athletes was associated with an increase in the run-up time (the time for reaching the minimum exposure of the signals in the feedback mode).*

**Keywords:** *neurodynamic properties, coping strategies, qualified athletes, kayaking and canoeing.*

## Introduction

A special place in the formation of reliability and effectiveness in sports belongs to resistance to stress, the nonspecific reaction of the organism to various stress factors, the impact of which causes not only a corresponding protective reaction of the organism, but also a universal process – an adaptation syndrome, that is, the mobilization of the organism's capabilities [4; 19; 23]. The authors assume that it is the athletes with a high level of existing stress that can constitute a risk group for the development of occupational stress and mental burnout [1; 3; 16].

The issues of ensuring the optimal mental state of athletes in order to increase the effectiveness of training and competitive activities are devoted to a number of studies [2; 3; 4; 18]. As methods of optimizing the mental state, most authors consider mastering certain anti-stress technologies, as well as developing self-diagnosis and behavioral management skills in stressful situations, coping strategies (coping strategies) [6; 14; 15; 21]. A large number of works are devoted to overcoming (coping) the state or feelings of anxiety among athletes [2; 24].

There are three main types of coping strategies: 1) strategies for cognitive adaptation, 2) strategies for behavioral adaptation, and 3) emotionally-oriented strategies [2; 14]. In general, the adaptability of coping strategies is associated with a number of positive results, including a subjective assessment of their health, social support, psychosocial adaptation [27]. The use of constructive strategies to overcome stress determines the ability of an athlete to maintain the necessary performance for a long period of time with high efficiency, which helps achieve high results in sports [1; 2; 23]. Coping strategies play an important role in the processes of self-regulation, diagnosed by methods of game bio management [2; 9].

The most productive strategies to overcome difficulties include proactive coping (preparation for a possible stressful situation), strategies for actively overcoming problems, planning activities, seeking social support and a strategy of humor. To ineffective in the long term include the strategy of avoidance, avoiding problems [1; 14]. It should be noted that the effectiveness of coping strategies is not a stable characteristic, but depends on a number of factors. Thus, focusing on the problem may be a less effective strategy to overcome stress than avoiding, if accompanied by an emotional interpretation of a stressful situation [26]. In general, stress tolerance, tolerant attitude towards stress, is one of the main criteria of physical and mental health [6; 13; 15].

Thus, the problem of overcoming stressful situations, difficulties in training and competitive activities, interpersonal communication of athletes depending on their individual characteristics (personal, neurodynamic) remains one of the topical problems of the theory and methodology of sports training, psychology and psychophysiology of sports.

**Relationship of research with scientific programs, plans, themes.** In carrying out complex biological research with the participation of athletes in accordance with the principles of bioethics, the theory and methodology of athletic training and reserve capabilities of athletes of the Scientific Research Institute of NUPES "Programs of complex biological research of the features of athletes' functional capabilities", as well as the legislation of Ukraine on health protection and the Helsinki Declaration of 2000, the directive of the European

Society 86/609 on the participation of people in biomedical research [22].

The work was carried out in accordance with the state budget research theme "Technology prediction of economic development in the instants of the forced disinfection" (State Registration No. 0117U002385) of the Ministry of Education and Science of Ukraine.

**Purpose of the study:** assessment of the influence of neurodynamic properties on the formation of coping strategies with stress in qualified athletes who specialize in rowing and canoeing.

## Material and Methods of the research

The study involved 43 high-class athletes (MS, MSIG, HMS) at the age of 14–29 years (sport –rowing and canoeing), among them 27 men and 16 women. Diagnostic complex "Diagnost-1" was used to determine the neurodynamic properties of athletes [11]. Strength and functional mobility of nervous processes, efficiency of sensorimotor activity, dynamics of nervous processes, speed of complex sensorimotor reaction of two signals from three, indicators of sensorimotor asymmetry and asymmetry of dynamic muscular endurance of the right and left hand (teping test), and others were analyzed in this study.

To study the strategies of stress-overcoming behavior (coping strategies) and determine the preferred style of coping with a stressful situation or problems, the athletes used the "Question Ways of Coping Questionnaire" R. Lazarus and S. Folkman (adapted T. L. Kryukova, and others) [5; 25]. The test contains 50 statements that are combined into 8 scales: confrontational copying (CC), distancing (D), self-control (C), seeking social support (SSS), taking responsibility (TR), escape-avoidance (E), problem solving planning (PSP) and a positive reassessment (PR). The study used the final indicator of the competitive personal anxiety test (adapted by Yu. L. Khanin) [12; 20].

Statistical processing of data was carried out using nonparametric statistics. The results were processed by statistical analysis using STATISTICA 6.0.

## Results of the research and their discussion

Based on the results of previous studies, it was found that the effectiveness of mental self-regulation and adaptability in the surveyed athletes (complex co-ordination sports, jumping into water) was associated with the strength and functional mobility of nervous processes, the accuracy of reaction to a moving object and the ratio of lead/lag reactions. The intensity of the existing stress was associated with the indices of the strength of the nervous processes, the efficiency of the sensorimotor activity and the accuracy of the reaction to the moving object [17]. In addition, the higher psychophysiological status of athletes corresponded to a lower level of personal anxiety. A decrease in the level of situational anxiety was noted with an increase in the sensorimotor endurance of athletes [24]. Representatives of cyclic sports (cycling) as psychophysiological markers of mental self-regulation and adaptability have defined indicators of functional mobility of nervous processes in the feedback mode, and stress resistance – an indicator of the dynamics of nervous processes [18].
In this study, an attempt was made to identify the criteria for assessing the stress-resistance and stress-vulnerability of high-class athletes by analyzing the relationship between coping strategies and psychophysiological characteristics and the level of competitive personal anxiety. The surveyed athletes identified the prevalence of such coping strategies as "Self-control", "Seeking social support", "Taking responsibility", "Problem solving planning" and "Positive revaluation". The voltage level on these scales exceeded 50% (Table 1).

**Table 1**
**Types of coping strategies of athletes (n=43), Me [25%, 75%]**

| Coping strategies | Number of points | Level of stress, % |
|---|---|---|
| "Confrontational copying" | 9 [8; 12] | 50,0 [44,4; 66,7] |
| "Distancing" | 9 [7; 10] | 50,0 [38,9; 55,6] |
| "Self-control" | 13 [12; 16] | 61,9 [57,1; 76,2] |
| "Seeking social support" | 12 [9; 15] | 66,7 [50,0; 83,3] |
| "Taking responsibility" | 8 [6; 9] | 66,7 [50,0; 75,0] |
| "Escape-avoidance" | 11 [9; 12] | 45,8 [37,5; 50,0] |
| "Problem solving planning" | 15 [12; 16] | 83,3 [66,7; 88,9] |
| "Positive reassessment" | 14 [12: 16] | 66,7 [57,1: 76,2] |

**Table 2**
**Correlation relations of the indicator of competitive personal anxiety with the types of coping strategies of athletes (n=43), $r_s$**

| Indicators | Correlation relations, $r_s$ |
|---|---|
| The indicator of competitive personal anxiety is the indicator "Confrontational coping" | 0,34* |
| The indicator of competitive personal anxiety is the indicator "Search for social support" | 0,37* |
| The indicator of competitive personal anxiety is the indicator "Escape-Avoidance" | 0,43** |

***Remark.*** ** – p<0,05; ** – p<0,01.*

The correlation analysis of the obtained data showed that none of the indicators of coping strategies in the surveyed athletes was associated with age and sports experience. The final index of competitive personal anxiety (Table 2) reliably correlated according to the Spearman criterion with the indicators "Confrontational coping", "Search for social support" and the "Escape-avoidance" strategy (espectively: $r_s$=0,34, p<0,05; $r_s$=0,37, p<0,05 and $r_s$=0,43, p<0,01), which can indirectly testify to the influence of preferred coping strategies on the success of competitive activities of athletes.

Correlation analysis revealed the presence of Spearman correlation between the indicator on the "Search for social support" scale and the brain performance indicator for long sensorimotor loads, the strength of the nerve processes ($r_s$=0,34, p<0,05). The indicator of the dynamics of the nervous processes (the time of reaching the minimum exposure of the signals in the feedback mode, the test of 5 minutes) and the rate of the complex selection reaction by the same criterion correlated with the indicator on the scale "Search for social support" (respectively: $r_s$=0,38, p<0,05 и $r_s$=0,35, p<0,05). The score on the "Taking responsibility" scale was associated with the speed of the sensorimotor response when two signals were selected from three ($r_s$=0,37, p<0,05). In addition, a direct correlation was established between the indicator on the flight-avoidance scale and the indicator of the dynamics of nervous processes in the feedback mode, a test of 5 minutes ($r_s$=0,40, p<0,01) (Table 3). A higher level of stress on the

scale "Search for social support" was associated with a lower strength of the nervous processes and less dynamism of the nervous processes (feedback speed), large latent periods of a complex selection reaction (the choice of two signals out of three). Higher values of the indicator "Acceptance of responsibility" corresponded to large latent periods of a complex selection reaction (i.e., less speed of a complex selection reaction). A higher level of voltage on the scale "Flight-avoidance" was associated with a less dynamic nerve processes.

**Table 3**

**Correlation relations of the indices of neurodynamic properties (in feedback and imposed rhythm regimes) with the psychological characteristics of athletes (n=43), $r_s$**

| Indicators | Correlation relations, $r_s$ |
|---|---|
| Latent period of a complex choice reaction, ms - indicator "Search for social support" | 0,35* |
| Latent period of a complex selection reaction, ms - indicator "Taking responsibility" | 0,37* |
| The indicator of the strength of the nervous processes (in the regime of the imposed rhythm),% of the errors - the indicator "Search for social support" | 0,34* |
| The indicator of the dynamics of nervous processes (in the feedback mode, the test of 5 minutes), sec - indicator "Search for social support" | 0,38* |
| The index of the dynamics of nervous processes (in the feedback mode, the test of 5 minutes), sec - the indicator "Escape-Avoidance" | 0,40** |

***Remark.*** ** – p<0,05; ** – p<0,01.*

Thus, the strategies "Taking responsibility" and "Searching for social support" turned out to be associated with genetically conditioned basic properties of the nervous system that develop and improve both in ontogeny and in the process of sporting activity [8; 10]. It should be noted that the latent periods of a complex selection reaction are considered as additional indicators of strength and functional mobility of nervous processes [11]. At the same time, the strategy "Escape-avoidance" was associated precisely with the psycho-physiological characteristics that do not depend on the length of the sports training and the age of the athletes. Almost all the studied properties of the psychophysiological functions of the examined athletes were associated with age and sports experience, except for the dynamics of the nervous processes, which was determined by the time of reaching the minimum exposure of signals (run-in time) in feedback mode (test 5 minutes). The slower the athletes reached their highest result in the feedback mode, the greater the probability of preferring a flight strategy, on the one hand. On the other hand, the preference for non-constructive strategies to overcome difficulties by athletes contributed to a decrease in motivation during testing, which led to a "worsening" of psychophysiological indicators, in this case, to an increase in the feedback time in feedback mode.

It should be noted that it is the strategy of "Escape-avoidance" refers to the non-constructive coping strategies that promote mental burnout in elite sport [1]. Athletes prefer to choose defection strategy at high rates of mental burning out – figure "Impairment of achievements" and the integral index of mental burnout. Acceptance of responsibility, planning, problem solving and social support are constructive strategies to cope with stress in athletes. The higher the emotional intelligence (self-motivation, control their emotions), the lower the likelihood of athletes escape strategy [1].

Indicators of sensorimotor asymmetry and asymmetry dynamic muscular endurance of the right and left hand (tapping test) were not associated with test performance Copping strategies that in some way is not consistent with the published data on the adaptation of communication in the sphere of sports with the type of functional brain asymmetry [7]. Promising in this direction seems to conduct comprehensive studies of different types of sensory-motor and motor asymmetries in athletes, representatives of sports with different orientation of the training process, due to their level of stress, with the efficiency and adaptability of psychic self-regulation.

Thus, the specific psycho-physiological markers of certain coping strategies in the examined athletes (namely – the strategy of "Search of social support", "Taking responsibility" and "Escape-avoidance") can be regarded as indicators of the strength and dynamism of nervous processes, the speed of a complex choice reaction.

## Conclusions

1. At the surveyed athletes revealed the prevalence of such coping strategies as "Self-control", "Search for social support", "acceptance of responsibility", "Planning solution to the problem" and "positive reappraisal".

2. The interrelationships between coping strategies and indices of the neurodynamic properties of rowers have been revealed. Specific psycho-physiological markers of the strategies "Searching social support", "Taking responsibility" and "Escape-avoidance" can be considered indicators of strength and dynamism of the nervous processes, the speed of the complex reaction of choice.

3. A higher level of stress on the scale "Search for social support" was associated with a lower strength of the nervous processes and less dynamism of the nervous processes, greater latent periods of the complex reaction of choice. The higher values of the indicator "Taking responsibility" corresponded to the lower speed of a complex selection reaction. A higher level of voltage on the scale "Escape-avoidance " was associated with a less dynamic nerve processes.

4. Preference for non-constructive coping strategies for athletes was associated with an increase in the run-up time (the time for reaching the minimum exposure of the signals in the feedback mode).

5. Identified relationships of coping strategies with neurodynamic properties of athletes can have predictive value and be used to optimize sports development in this sport.

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