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CLINICAL STUDY

Diagnostics of psychophysiological states and motivation in elite athletes

Korobeynikov G[1], Mazmanian K[1], Korobeynikova L[1], Jagiello W[2]

Research Institute of Sport and Prevention Medicine, National University of Physical Culture and Sport of Ukraine, Kiev, Ukraine. **george.65@mail.ru**

Abstract: *Objectives:* Concepts explored in our study concerned identification of various types of motivation and their connection to psychophysiological states in elite judo and Greco-Roman wrestlers. We tried to figure out how do these different types of motivation interact to describe psychophysiological state in qualified wrestlers. *Methods:* Neuropsychological evaluation methods as simple (SRT) and choice reaction-time (CRT) tests, HRV measurements, psychological questionnaires. To explore obtained data methods of statistical analysis were used *Results and conclusion:* Obtained data show that different combinations of levels of motivation to achieve success and motivation to avoid failure provoke different psychophysiological states. Conducted experiment revealed that combination of high levels of both motivation to achievement of success and motivation to avoid failure provides better psychophysiological state in elite wrestlers compared to other groups with different combinations of motivational variables. Conducted experiment revealed that motivation to avoid failures had been formed as a personality formation, which compensates excessive tension, caused by high level of motivation to achieve and regulate the psychophysiological state. This can be viewed as an effect of training in athletes *(Tab. 3, Fig. 1, Ref. 38)*. Full Text in free PDF *www.bmj.sk.*
Key words: psychophysiological states, motivation, elite athletes, judo, wrestling.

Sport as a specific type of human activity combines different aspects of life and that is why it should be viewed in spiritual and corporal unity. Its primary purpose is human perfection through harmonization of physical, aesthetical and moral development.

Sport uniquity lies in the greatest motivation that allows athlete to yield to the long-term daily physical and psychological loading and to win. Due to this fact sport became the remarkable natural laboratory of human possibilities. The sports motivation basis constitutes comparison of own results with achievements of others, realization of own capabilities and self-affirmation as well as cognition of the world (McIntosh, 1982). Motivation in sport implies the presence of factors and processes which stimulate athlete to the action or inactivity in different situations. The key role of motivation lies in realization of abilities the «guided training» and forming athletes' behaviour by means of structural components of motivation (Biddle, 1993). The block of motivation executes such functions in the structure of sport activity (Dmitrienkova, 1980). It triggers the mechanism of activity and maintains its level during training and competitions. Also it regulates managing and application of various facilities of activity to achieve desirable results.

Human activities including sports are determined by different levels of regulation and complex mechanisms of psychophysiological functions organization. Various psychic phenomena can be characterized by their specific influence on inner processes. Such specificity can be represented by the changes of psychophysiological states. Intimate connection between psychic and physiological parameters (Iljin, 2000) forms a psychophysiological state of a person. Each psychic phenomenon appears to be related to physiological structures – it can influence physiological processes or be conditioned by them. According to our previous works (Korobeynikov et al, 2005), the structure of combats includes following components of the psychophysiological states: regulatory, cognitive and psychic.

Every state represents a certain need in its relevant form – motivation. Mobilizing force together with guiding motivational variables which reflect the subjects' emotional prediction of possible results (Atkłnson, 1958, 1964; Anokhin, 1968; Weiner, 1972) both constitute a neurodynamic structure of motivation. Concerning the probability of success, Atkinson and Feather (1966) state, "The person more motivated to achieve should prefer a moderate risk. His level of aspiration will fall at the point where his positive motivation is strongest, at the point where the odds seem to be 50 – 50" (p. 18). A person with a fear of failure does not want to take any risk, but when forced will choose either a task so easy it can not be failed, or a task so difficult it can not be expected to be accomplished.

[1]Research Institute of Sport and Prevention Medicine, National University of Physical Culture and Sport of Ukraine, Kiev, Ukraine, and [2]Gdansk Academy of Physical Culture, Gdansk, Poland

Address for correspondence: G. Korobeynikov, PhD, Dr of Biology Science, Laboratory of Research Institute of Sport and Prevention Medicine, National University of Physical Culture and Sport of Ukraine, 03680, Fizkultury St., 1, Ęiev-150, Ukraine.
Phone: +380.44.2876416, Fax: +330.44.2876191

This enables us to represent motivation as a source of certain influences on the athletes' behavioural reactions.

Obviously there are different forms motivation can take (Halisch and Kuhl, 1987). Motivational variables viewed here include the need for achievement and the fear of failure. That is a predominant force that directs our behaviour toward positive and negative outcomes. These motives are considered as working together to regulate achievement behaviour and they are treated as predictors for performance outcomes.

The need for achievement was conceptualized by Murray (1938) as an enduring characteristic of personality, a striving for success in any situation in which performance can be evaluated according to some standard of excellence. As pointed out by Atkinson (1964; Atkinson and Feather, 1966), achievement motivation is a combination of motivational strength and situational variables. Achievement goals can affect the way a person performs a task and represent a desire to show competence (Harackiewicz, Barron, Carter, Lehto, and Elliot, 1997).

Since William James' initial work, a great deal of research has been conducted on need to achieve. Substantial contributions were made by Murray in the 1930s, and his work was followed by McClelland and Atkinson in the 1950's, and continued in the recent work of Hekhausen and Spence (1995). There are well over 3,000 published articles investigating individual personality characteristics and motivational levels, illustrating the importance of the work begun by William James (Madsen, 1959). Achievement motivation is the term that has been most frequently used to describe personal striving of individuals to attain goals within their social environment. As a psychological concept, it has wide implications for the behaviour of the individual (Cassidy and Lynn, 1989). Existing classical achievement motivation theorists claimed that activities are emphasized and oriented toward attaining success or avoiding failure (Elliot and Church, 1997; Brunstein and Maier, 2005). Motivational researchers share the view that achievement behaviour is an interaction between situational variables and the individual subject's motivation to achieve. Achievement motivation theorists focus their research attention on behaviours involving competence. Individuals aspire to attain competence or may strive to avoid incompetence, based on the earlier approach-avoidance research and theories. The desire for success and the desire to avoid failure were identified as critical determinants of aspiration and behaviour by Lewin (1935). In his achievement motivation theory, McClelland was the first who proposed that there are two kinds of achievement motivation, one oriented around avoiding failure and the other around the more positive goal of attaining success. Atkinson, another motivational theorist, drew from the work of Lewin and McClelland in forming his need-achievement theory, a mathematical framework that assigned the desire to succeed and the desire to avoid failure as important determinants in achievement behaviour (Elliot and Harackiewicz, 1996).

In this study we tried to explore existing gaps concerning various combinations of opposing motivational variables to achieve and to avoid so called motivational conflict. A motivational conflict is determined as a psychic tension which arises up under the action of the opposite directed motivational variables.

Understanding of motivational conflict was formed in psychology within the framework of theory of the field of K. Lewin. According to this theory various objects, that surround us possess certain valency – force which "attracts" a person. Such behaviour Lewin (1935) names the "field behaviour", because person is being under the influence of objects valencies.

Valency can be positive (directed towards achievement) and negative (directed towards avoidance) (Feather, 1968). Lewin explains motivational conflict as the situation of simultaneously actualized objects of opposite valency.

Existing contradictions lie in the fact that some researchers (Atkinson 1964, MacClelland, 1971; Murrey, 1938; Weiner and Kukla, 1970) stand on the idea that motivational variables have a dichotomic nature: the presence of one excludes the other variable. Others prove (Feather, 1968; Heckhausen, 1973, 1977; Weiner, 1972; White, 1959; Brunstein and Maier, 2005) that highly expressed need to achieve success fully can be combined with strong fear of failure, especially if the situation is associated with some heavy consequences for a subject, as sport activity, especially combats . Therefore probably we should talk about advantage of need to achieve success or avoidance of failure in the presence of both motivational variables.

Accepting that different motivational variables do not exclude one another it was hypothesized that subjects showing combination of both high levels of motivation to achieve and to avoid should experience motivational conflict, which in its turn should provoke the state of psychophysiological tension. And it was further hypothesized that favourable psychophysiological state would be associated with lower level of motivation to avoid and higher level of motivation to achieve.

It is possible to consider motivation as a specific excitation of physiological structures, which has regulative influence on human activity. Motivation sets conditions for the psychophysiological states of person, and can be mediated through these states. So we can assume that motivation variables to achieve and to avoid are the psychophysiological components of purposeful activity (McClelland, 1971, Iljin 2000). Concepts explored in this paper concerned the identification of motivation types and their relation with psychophysiological states in qualified judo and Greco-Roman wrestlers. Here we tried to figure out how these different types of motivation interact to describe psychophysiological state.

The presented study examined the effects of different level combination of motivation to achieve success and motivation to avoid failure on psychophysiological states in elite wrestlers.

Subjects

27 healthy qualified wrestlers (19 male and 8 female), members of national judo, Greco-Roman and free-style wrestling teams of Ukraine, participated in this study after giving their informed consent. Their mean age was 22.7±2.6 (SD) years. Each subject was tested individually. Each subject completed all test blocks in one day.

Researches were conducted as a part of a stage control on the basis of the State scientific research institute of physical culture and sport (Kyiv) and directly during training camps.

Methods

Questionnaires by T. Elers have been used to study motivation (Raygorodskiy, 1998). This block consisted of 2 sub-tests of motivation to achieve and to avoid, containing 41 and 30 units, respectively. Each test belongs to the monoscale methods. An overall level of expressed motivation to achieve and motivation to avoid has been calculated by the sum of points, consilient with the key. Obtained levels of expression can be divided as:

1 to 10 points: low level;

11 to 16 points: middle level;

17 to 20 points: moderately high level

More than 21 points: extremely high level

In the first sub-test subjects were asked to answer 41 "yes or no" questions. In the second sub-test subjects had to choose one of the three given adjectives that described their person in the most appropriate way.

Neurodynamic measurements

Neurodynamic component was tested with a computer-based method „Diagnost-1" (Makarenko and Lizogub, 1999) and included visual-motor reaction time tests, which assessed an individual response time to presentation of visual targets on a computer screen. After practice, subjects were given simple (SRT) and choice reaction-time (CRT) tests of 30 trials each. The subjects responded with the dominant hand to target stimuli. Visual stimuli have been presented on a computer 19-inch display with a 1024 X 768 resolution at a refresh rate of 100 Hz positioned in front of the subject. For registering subject responses double-handed handlebars connected to the computer running the experiment through the LPT port have been used.

In all experiments, stimuli were presented against a black background. For each sub-test we used randomly displayed stationary red geometric figures (square, triangle, circle). The consequence of stimuli has been repeated randomly per trial without changes equally for each subject. Stimulus presentation was prefaced by a 2s red fixation block. Pause between signals displaying was drawn randomly from 500 to 1900 ms.

For simple reaction time test (SRT) subjects were asked to press the button as quickly as possible on each appearing stimulus (square, circle, triangle) using his/her preferred hand. Time of fixation per each displayed stimulus is 700 ms. Amount of stimuli was 30.

The choice reaction-time test (CRT) included positive signals (square or circle) and negative (triangle) stimuli applied in random order. Time of stimulus fixation for the CRT constituted 900 ms per displayed unit. The subjects were instructed to press and then to release, as quickly as possible, the button on the right handlebar in response to the square, the button the left handlebar in response to the circle and do not react to the negative stimuli.

The following parameters for SR and CR tests were automatically registered: mean response latency, ms; variation coefficient (CV), %; errors; mean motor reaction time, ms; mean information processing time, ms

Regulatory measurements

Heart rate variability (HRV) provides non-invasive data about the autonomic regulation of heart rate in real-life conditions. HRV, reflecting cardiovascular control exerted by both parasympathetic and sympathetic nervous system, has been used to evaluate modifications of autonomic functions due to acute exercise or training (Task Force, 1996).

All data acquisitions were performed in the morning. The subjects were given enough time to relax before the test. HRV profile of athlete was characterized, with statistical and frequency analysis, during supine rest and 90ş upright positions for 5 min. RR intervals were recorded and analyzed before completing the rest experimental tasks. No instruction was given regarding respiration.

An ECG signal was recorded with computer-based method „Cardio+"© (Metekol, Nizhin, Ukraine) by a bipolar electrode pair placed at right and left wrists and ankles. R-R intervals were instantaneously determined by software (Cardio+ v.1.0.45.0, Nizhin, Ukraine) and were simultaneously transformed into heart period time series on-line.

To asses regulatory component we used following indices: Mean RR, ms; SDNN, ms; CV RR-intervals, %; and LF/HF ratio; Stress index (SI), n.u.; (Baevskiy, 2001).

$$SI = \frac{AMo}{2\,Mo \cdot \Delta RR}$$

All the R-R intervals were edited by visual inspection to exclude all the undesirable beats.

Statistical analyses

Because of a marked skewness in the distribution of some variables, descriptive statistics are given as median (lower quartile, upper quartile), Normality of data distribution was assessed by the Shapiro-Wilk test. Paired comparisons between groups were performed by the Wilcoxon signed-rank test. The strength of linear association between pairs of variables was assessed by the Pearson coefficient of correlation. Statistical significance was assumed for $p<0.05$.

Statistical analyses were performed with STATISTICA 6.0 software (StatSoft Inc., USA).

Results and discussion

According to obtained results none of the 27 participants in this study showed low level of motivation to achieve, while more than a half (67 %) from the general group of subjects expressed high level of such motivational variable forms. Our findings agree

Tab. 1. Neurodynamic indexes in groups of athletes with different levels of motivation.

Indexes	Group 1	Group 2	Group 3
Simple reaction time latency (SRT), ms	239.4 230.34; 255.29	270.37* 260.86; 280.8	276.86* 252.96; 280.3
Motor response latency (SRT), ms	118.17 105.9; 173.3	115.37 99.96; 143.42	121.56 114.3; 141.56
Choice reaction time latency (CRT), ms	405.8 404.09; 421.29	429.02* 395.08; 436.66	463.59* 435.57; 485.99
CV (CRT), %	17.85 15.2; 19.12	17.52 14.36; 21.47	19.45 16.96; 22.25
Errors	0 0; 1	1* 0; 2	2* 1; 3
Motor response latency (CRT), ms	144.56 120.61; 178.7	131.23 114.55; 140.05	137.36 130.11; 140.68
Information processing latency (CRT), ms	180.03 148.21; 196.87	159.8 124.35; 232.43	189.91 156.73; 197.66

* p<0.05, values are median (lower quartile, upper quartile)

Tab. 2. Parameters of the heart rate regulation in groups with the different levels of motivation (supine position).

Indexes	Group 1	Group 2	Group 3
Mean RR, s	1,05 0,95; 1,1	0,95* 0,8; 1	0,95* 0,8; 0,95
SDNN, s	0,052 0,04; 0,07	0,048 0,039; 0,062	0,049 0,029; 0,067
CV RR, %	4,66 4,39; 6,19	5,93 4,4; 6,39	4,97 4,02; 5,22
SI, n.u.	64,71 38,25; 123,63	71,74 48,13; 109,32	93,82 50,32; 193,42
LF/HF ratio n.u.	1,21 0,26; 1,9	0,63 0,51; 1,33	1,19 0,4; 2,03

* p<0.05, values are median (lower quartile, upper quartile)

with researches of Dmitrienkova (1980), who claimed that high level of motivation to achieve success is inherent to qualified athletes.

For motivation to avoid failures in the general group the following distribution was obtained: high, medium and low level of motivation to avoid was expressed by 9 athletes per level (33 %).

A cross-correlation analysis was used to explore associations between studied parameters of psychological, neurodynamic and regulatory indexes.

Motivation to avoid failures was revealed to be negatively associated with simple (SRT) and choice reaction time (CRT) (r = –0.55 and –0.45 respectively; đ<0.05) and with the amount of errors in a choice reaction-time test (r = –0.51; đ<0.05);

Also interconnection between motivation to avoid failure with indexes that characterize tension of the systems of heart rate regulation - mean value and variation coefficient of RR intervals in

Tab. 3. Parameters of the heart rate regulation in groups with the different levels of motivation (upright position).

Indexes	Group 1	Group 2	Group 3
Mean, s	0.75 0.7; 0.85	0.70 0.65; 0.7	0.65 0.6; 0.7
SDNN. s	0.069 0.05; 0.07	0.054 0.037; 0.07	0.052 0.043; 0.073
CV, %	8.82 7.11; 13.12	7.47 5.49; 11.04	6.3* 4.24; 7.59
SI, n.u	61.88 56.93; 95.87	109.33 76.76; 182.89	164.57* 97.49; 256.71
LF/HF ratio n.u.	5.05 4.79; 5.56	4.06 3.6; 4.7	5.26 3.58; 5.81

* p<0.05, values are median (lower quartile, upper quartile)

upright position (r = 0,43 and 0,59 respectively; p<0,05) has been shown. A negative association was obtained between motivation to avoid failure and stress index SI (Baevskiy, 2001) in upright position. Findings specify that high index of motivation to avoid failure meets better parameters of heart rate regulation together with speed and quality characteristics of information processing.

As a change of heart rate variability reflects the dynamics of the emotional states of person (Nuissier et al, 2007; Danilova, 1995), it is possible to imply that motivation to avoid failures is the regulator of functional systems tension of cognitive (neurodynamic indexes) and regulator (vegetative heart rate regulation indexes) processes.

We carried out further analysis in sub-groups of participants with different combinations of motivational variables levels using the Wilcoxon signed-rank test.

After studying motivational questionnaires, three groups were formed 9 subjects in each:

1. Subjects with the combination of both extreme high levels of motivation to achieve and to avoid;

2. Subjects with combination of both medium levels of motivation to achieve and to avoid (with insignificant predominance of motivation to avoid failures);

3. Subjects with low level of motivation to avoid overwhelmed by extreme high level of motivation to achieve.

Table 1 shows neurodynamic indexes in sub-groups of subjects.

Data analysis revealed significantly lower indexes of latent periods of simple (SRT) and choice reaction times (CRT) in the first group of athletes comparing to the second and third groups, indicating the best possibilities of visual motor functions for athletes with combination of high levels of both motivational variables. Also first group shows significantly (Table 1.) lower errors levels compared to groups 2 and 3. So we can speculate that first group subjects differ from others with greater information processing speed and accuracy.

Latent reaction time periods are related to functional brain systems activity (Vladimirov and Timofeeva, 1986) By the error

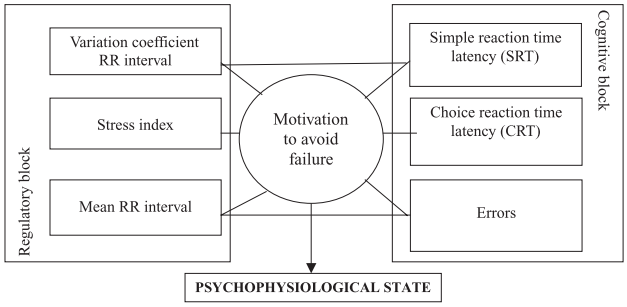

Fig. 1. Cognitive-regulatory functional system model.

reactions it is possible to assess activity of the attention and short-term memory systems (Kucenko and Filimonova, 2007).

It should be noted that statistical results showed no significant differences between the second and the third groups. But it is possible to mark lower mean central information processing time in the second group of athletes. Not significantly greater variation coefficient of choice reaction time (CRT) in the third group can indicate instability of the system which provides this type of activity (Kucenko and Filimonova, 2007).

We expected that subjects classified in the first group would have a different orthostatic response than those in the second and third group. In fact, the percentage of changes for CV and SI when subjects moved from the supine to the upright position differed between these groups. This suggests that groups 2 and 3 have a greater decrease in global autonomic regulation of the heart during orthostatic stimulation than group of subjects with extremely high levels of both motivational variables.

Tables 2 and 3 represent parameters of vegetative regulation of heart rate estimated for the groups with different levels of motivation in supine and upright positions, respectively.

Analysis of HRV data shows significantly greater tension of the vegetative regulation in a group with extremely high level of motivation to achieve and low level of motivation to avoid. It has been indicated by statistically higher stress index SI (Baevskiy, 2001) in athletes of third group. Growth of heart rate regulatory mechanisms tension in subjects of third and second group is accompanied by decline in nervous system functional state level, due to substantial activation of sympathetic and attenuation of vagal influence on the sinus node (Tab. 3) during upright 90° test. This is specified by significantly higher indexes of mean RR in supine and CV of RR-intervals in upright positions (for the third group).

According to obtained results it is possible to assume that motivation to achieve success is responsible for activation of sympathetic, and motivation to avoid failures – parasympathetic nervous system (it can be explained by positive correlation of motivation to avoid and index of mean RR indicating the effect of vegetative influence on a sinus node).

Parasympathetic and sympathetic nervous system activity can be estimated by LF/HF ratio as an index of sympathovagal balance (PNS and SNS, respectively) (Task Force, 1996). Our results show statistically not significant reduction of LF/HF, in the second group with insignificant predominance of motivation to avoid failures and increase in the third group in which motivation to achieve prevails.

Success appears to have a price. Motivation to achieve causes tension and mobilization of energy resources of organism – thus excessive motivation can exhaust these resources. Thurstone (1937) claimed, that overmotivation can worsen the quality of achievement. Probably for every task there is an optimum strength quantity of motivation to maintain concrete task executiong efficiency at maximal rate.

At first, growth of energy mobilization can appear to be such immense, that it will exceed a level, necessary for the performance of task: it is possible to try abundantly, that will result in violation of delicate co-ordination of efforts. Secondly, excessive tension can result in cognitive limitation: a person fully focuses the attention on blocked ways to achieve the purpose or on an unattainable result so that he/she does not see the possibility of alternative ways or other suitable purpose. And at last, growth of tension is often accompanied by emotional excitation, which obstructs the rational processes of reasoning and choice: a person worries, panics and ruins control of a situation. We can assume that there is a certain threshold of tension exceeding of which leads to qualitatively different influences on the behaviour.

Tension is necessary, as it leads to mobilization of forces and power resources of organism. Regarding this fact we can say that there is a certain optimum for the state of tension of the systems involved in vegetative regulation when maximal efficiency of activity is reached.

In this case motivation to avoid is a factor, which regulates the psychophysiological state of an athlete. In the presence of extremely high level of motivation to achieve high level of motivation to avoid secures the decrease of regulator systems tension and maintains high-rate psychomotor performance retaining purpose achievement setting. An aim as an expected and desirable result of activity needs permanent tension of strength. Person who aspires to achievements, experiences permanent desire and volitional tension which affects his psychophysiological state. It is possible to draw an inference that motivation to avoid failures was formed as psychic structure, which compensates excessive tension, caused by the excessive level of motivation to achieve and regulates the psychophysiological state. This phenomenon can be considered as a training effect in elite athlete.

We can say that motivation to avoid failures is the forming factor for the cognitive-regulatory functional system of individuals' activity. And the psychophysiological state of an athlete is a result of this activity (Fig. 1).

The individual's perception of probability to accomplish the task would cause a need to achieve and a fear of failure. Both are strong emotions that influence the individual's decision on whether or not to attempt the task (Bar-Tal et al, 1974). If a task simultaneously arouses an individual's motivation to approach the task and motivation to avoid the task, then the sum of the two motivations will be the result. If the result is more positive to approach the task, then the individual will be motivated toward the task. If the result is more positive to avoid the task, then the

individual will be motivated to avoid the task. The strength of motivation is also important. Different variables are taken into account for each task and often this is done subconsciously. These variables factor into how much the individual is motivated to approach or avoid the task (Atkinson and Feather, 1966). In a person motivated to achieve, his behaviour is directed by a positive possibility. In a person motivated to avoid failure, behaviour is directed by an undesirable possibility. The same person may experience both motives at the same time depending on the situation. Which motive the person selects depends on the relative strength of the achievement motives, either to achieve success, or to avoid failure. An individual will find a task easy if he has a high probability of successfully completing the task. An individual will find a task hard if he has a low probability of successfully completing the task.

No matter how much enjoyment athletes receive from their work, people engaged in sport must perform tasks in the pain threats and competition framework. They most definitely face some anxiety and fear about not meeting their trainer standards and perform tasks based on avoidance motivation in order to prevent from losing. They may also aim to perform tasks better both for an ego-boost and for avoiding social incompetence.

It seems idealistic to have one's motivation completely based on receiving positive reinforcement and self-improvement in order to achieve personal success, perhaps it is not realistic. Motivation based on avoidance characteristics may be detrimental to one's self in excess, but it may be a necessary tool in some regards towards the development of long-term approach and mastery goals.

In contrast too much motivation through means of avoidance would completely „undermine intrinsic motivation." With a deprivation of approach and mastery type goals an athlete may lack the inner-drive needed to succeed in sports. An individual chooses the easiest route and removes most or all task-related effort in order to avoid failure and low self-esteem.

A delicate balance of both approach and avoidance motivation may lead to a more well-rounded and successful individual.

Research conducted by Baturin (1984), revealed that subjects directed on avoidance of failures possess higher frustrational endurance. Particularly, due to this Stepanskiy (1981) considers relatively equal combination of motivations to achieve success and avoid failure to be optimal. Results of his works (Stepanskiy, 1981) show that overall effectiveness of individuals' activity depends on combination of motivational variables to achieve and to avoid under high level of activity regulation i.e. the psychophysiological states of subjects. Subjects experiencing medium level of motivation to avoid and reduced level of motivation to achieve attain the best results in executing test task at the initial decreased activity regulation level. Such combination of motivational variables results in weakening of subjective criterion strictness of success and allows person to regard unsuccessful results more easily.

As proposed by Shilenkov (1996) in his works with sport game players he demonstrates that motivation to achieve success and motivation to avoid failures can be compared to attacking and protective strategy. According to this information we can assume that wrestlers with combination of high levels of both motivational variables are more flexible due to using both strategies during a fight. It is consistent with our data that athletes of the first group perform high speed and quality of information processing comparatively with other groups. Obtained results indicate large possibilities for subjects with combination of high levels of both motivational variables to adequate assessment of situation and rapid decision-making without considerable tension of regulatory systems, saving psychophysiological state which maintains high level of efficient activity during trainings and competitions.

To resume the results of our study we can conclude that efficiency of psychomotor performance and optimality of the psychophysiological state is determined not only by the high level of motivation to achieve or avoid, but also by their combination.

Conclusions

Consideration of motivation as a complex multilevel functional system with integrated affective and cognitive processes allows considering this psychic process to regulate activity of a person in actual situation.

Obtained data show that different combinations of levels of motivation to achieve success and motivation to avoid failure provoke different psychophysiological states. Conducted experiment revealed that combination of high levels of both motivation to achieve and motivation to avoid provides the high level of the psychophysiological state in elite athletes (psychophysiological state which maintains high level of efficient activity during trainings and competitions). The process of forming of the psychophysiological states in subjects is characterized by the cognitive-regulatory functional system.

The analyses carried out in this study suggest that overwhelming of only one of these motivational variables leads to arising in regulator systems tension and decreased psychomotor performance. Combination of high levels of both motivational variables ensures flexibility in the athletes' activity.

The presence of activity regulating system tension is predetermined by the decline of level of the psychophysiological state and worsens psychomotor performance with the simultaneous increase of amount of errors during choice reaction test (CRT).

Lastly, research of individual characteristics of motivational sphere in elite athletes discovered that motivation to avoid failures composes a personality formation, which compensates excessive tension, caused by high level of motivation to achieve and thus regulating actual psychophysiological state. This might be considered as an effect of training in athletes.

Further research needs to be conducted to examine the effects of different combinations of motivational variables upon athletes' performance e.g. competitive activity. Thus, illustrating that motivation has a significant effect on performance outcomes may increase attention and research examining some of the same issues sport psychology is focusing upon. This further research would clearly link laboratory experimental findings with settings and tasks relevant to the target population.

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