

Original Article

Psycho-physiological features of sportsmen in impact and throwing martial arts

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Published online: June 25, 2016

(Accepted for publication May 15, 2016)

DOI:10.7752/jpes.2016.02067

Abstract:

Studying of sportsmen's functional state is important aspect of their training. Analysis and assessment of workability permit to prognosticate success and give basis for determination of sportsmanship's factors. *The purpose of the work:* study and comparative analysis of elite martial arts sportsmen's psycho-physiological features for prognostication of their successfulness and optimization of training. *Material and methods:* in the research 50 martial arts sportsmen participated. First group (n=28, age – 22.86±0.95 years) consisted of impact martial arts representatives (karate, thae-quan do, Mixed Martial Arts). Second group (n=22, age – 22.27±1.09 years) consisted of sportsmen, practicing throwing kinds of wrestling (free style wrestling, Greco-Rome wrestling, Judo). All participants were elite sportsmen. We used battery of tests: assessment of simple motor abilities, chrono- reflex metering, tapping test, responses of choice and distinguishing, and reproduction of geometric figures. *Results:* we confirmed similarity of sportsmen's functional state owing to likeness of most tests' results. First group's sportsmen had confidently more touches in tests for simple motor qualities. They chose one from five colors quicker, as well as required half of screen. They had substantially less deviations from pre-set patterns (reproduction of line and shape of geometric figure). The most important qualities for success in fight were determined. For impact kinds they were: responses of choice, coincidence of shape and mean quantity of touches in motor tests. For sportsmen of throwing kinds of wrestling they were: response to audio signal, response of choice of required half of screen, reproduction of temp and line, speed of line drawing and quantity of touches in tapping test. *Conclusions:* we have proved importance of wrestlers' psycho-physiological features as factors of success. Results of impact kinds' sportsmen illustrate better mobilization, more optimal readiness for action and more developed differentiation; better space characteristics, more optimal regulation of muscles' tonus.

Key words: martial arts, functional state, psycho-physiological features, correlations, impact, throwing.

Introduction

Monitoring of sportsmen's functional state is an important aspect of their training. Analysis and assessment of sportsmen's workability permit to prognosticate successfulness and give basis for determination of sportsmanship factors. Among them sportsmen's psycho-physiological features, assessed with the help of functional tests, are rather important. Blazeovich and Jenkins (1998) note that peculiarities of training influence on sportsmen's efficiency and workability. They also proved interconnection of different indicators. For example speed orientation of training influences on strength, power and amplitude of movements in joints.

Influence of psycho-physiological qualities on successfulness of golf players was studied by Cotterill, Sanders, and Collins (2010). As leading factors of fitness, they marked out attention, high level of functional potentials and ability to assess situation. Among other researches of sportsmen's psycho-physiological qualities we can point at several works (Kozina, Ryepko, Prusik, & Cieslicka, 2013; Korobeynikov, Aksutin, & Smoliar, 2015). The authors found higher indicators of nervous processes' mobility and strength in rock-climbers, comparing with mountaineers. This fact is connected with specificity of rock-climbers' training and competition functioning, which requires total concentration in conditions of maximal or sub-maximal strength tension (Kozina et al., 2013). Concerning martial arts, it was found that attacking fighting style is accompanied by high workability, reduction of fatigue and anxiety; by presence of psychological comfort. (Korobeynikov et al., 2015).

Validity of functional tests' usage for assessment of motor and functional abilities in game and power kinds of sports was confirmed by Chernenko (2014). Appropriateness of their application for assessment of dynamic of power, quickness and coordination of movements, cardio-vascular and respiratory systems' indicators was proved. Balamutova and Shyryaeva (2014) found peculiar features of swimmers' training, facilitating increase of its effectiveness with the help of motor tests for special workability and functional tests. Researches of special workability in other kinds of sports (Gaskov, Kuzmin, Kudryavtsev, & Iermakov, 2016) permitted to find that in distribution of training loads and means it is necessary to equally dose correlation of these means with all marked out factors. Berezka (2014) offered to use variant of test PWC₁₇₀ for determination

of football players' physical workability. To increase information value of the results additional criteria for assessment of football players' functional fitness were worked out in the form of indices. Other authors (Abdula & Lebedev, 2014) note that there is a wide range in loads parameters for elite sportsmen. It dictates demand in assessment of football exercises' intensity. The carried out analysis witnesses that there are significant distinctions in heart beats rate indicators when using game and interval methods.

Besides analysis of functional state dynamic, for prognosis of successfulness assessment of dependences and connections between separate indicators is of great importance. El Ashker (2012) studied dependences between development of complex and simple motor skills and level of technical and physical skills. It was found that development of complex motor skills increase sportsmen's successfulness. In such approaches great attention is paid to pedagogic control and choice of adequate tests (Khudolii, Iermakov, & Prusik, 2015; Zaporozhanov, Borachinski, & Nosko, 2015); to simulation of training process (Khudolii, Iermakov, & Ananchenko, 2015). It permitted for the authors to detect the most informative indicators of schoolchildren's motor fitness. Brown et al. (2011) analyzed characteristics of golf players' movements. Their researches confirmed presence of correlations between indicators, determining motor techniques. Significance of correlation and discriminant analysis is stressed also in other researches (Ivashchenko et al., 2015; Ivashchenko, Yermakova, Cieslicka, & Muszkieta, 2015; Ivashchenko, Yermakova, Cieslicka, & Zukowska, 2015; Kozina, Iermakov, Kuzmin, Kudryavtsev, & Galimov, 2016). Results of the researches point at demand in structural and functional analysis of youth's motor fitness. Szabo, Bangert, Reuter-Lorenz, and Seidler (2012) showed that higher level of physical activity is connected with better accuracy of synchronization. Expressiveness of this effect depended on duration of fulfillment of dosed works.

Analysis of dependences permits to outline the most significant indicators and detect those, which do not make sufficient contribution. For example, when studying interconnections of self-assessment with efficiency it was proved that self-assessment was not an important predictor of successfulness. (LaForge-MacKenzie & Sullivan, 2014). Alongside with it self-assessment can increase the feeling of own value. It substantially influences on setting targets, perception of different tasks (Romanowska-Tolloczko & Piwowarczyk, 2015). It is especially important to help young people in creation of adequate self-assessment and own positive image. Zahra, Maesoumeh, and Afkham (2014) analyzed interconnections between sports form and sports functioning in rowers of national team during the whole season. Results showed that there is positive correlation by Pearson between sports form and efficiency ($p < 0.05$). However, the strength of the correlation can be different in different periods. Basing on sports form at the end of season it is possible to predict sportsman's efficiency. Rovnaya, Podrigalo, Iermakov, Prusik, and Cieślicka (2014) studied morphological functional features of synchronous swimming sportswomen. They found correlations between respiratory system's indicators, which illustrated increase of functional reserves. These correlations reflect orientation of adaptation process in specific conditions of synchronous swimming.

In wrestling, successfulness is determined by a number of factors. Among them psycho-physiological factors take an important place. Their studying and analysis are rather important for growth of sportsmanship. This conclusion was proved in work by Rata, Dobrescu, Rata, Rata, and Mares (2013). Basing on questioning of wrestling coaches the authors found high significance of psycho-physiological training for rising of sportsmanship and predicting of successfulness. Korobeynikov and Radchenko (2012) analyzed intuitive thinking depending on elite wrestlers' psycho-physiological state in conditions of competition functioning. It was found that manifestations of intuitive thinking are connected with weight category of wrestlers. It was proved that effectiveness of intuitive thinking in competition functioning is connected with status of psycho-physiological and neuro-dynamic functions.

Starosta and Fostiak (2013) note, that modern wrestling sets very high requirements to motor coordination. In their research 227 classic and free style wrestlers from Polish combined team participated. They found dependence of results on period of training as well as expressed asymmetry of coordination abilities. Weigelt, Ahlmeyer, Lex, and Schack (2011) studied motor abilities of Judo wrestlers with the help of original test. They offered to use it as diagnostic tool for registration of individual sportsmanship. In Judo training important place is taken by optimizing of quantity of exercises' repetitions (Iermakov, Arziutov, & Jagiełło, 2016). Such approach permits to reduce physical loads on sportsmen's organism.

Kiprych (2014) used variability of heart rate and studying of spontaneous breathing for assessment of boxers' functional state. Results permit to differentiate the state of sportsmen's organism before load, in process of load and in post-training period. Liu (2015) determined factorial structure of functional fitness in every profile of sportsmen. As well as supplemented Judo wrestlers' model characteristics with the most important sides of functional fitness. Analysis of recreation effectiveness indicators in two groups of Judo wrestlers showed high level of organism's reaction to training load of special and power orientation, comparing with speed-power load.

Korobeynikov, Korobeinikova, and Shatskiha (2013) studied neuro-dynamic functions of nervous system and heart rate regulation parameters of Greco-Rome style wrestlers. They found, that rates of rising of wrestlers' sensor motor reaction are accompanied by psycho-motor tension. Quickness of sensor-motor reaction was connected with tension of heart rate regulation in sportsmen with high quickness of sensor-motor reaction. Studying of motor coordination of Greco-Rome style wrestlers was carried out by Gierczuk and Ljach (2012). They proved that significant physical loads cause fatigue and weaken coordination. It worsens sportsmen's

successfulness and is a risk factor of sports traumas. It is also proved in other researches. They also determined that principles, which are most often used by coaches and sportsmen, permit to maximally reduce level of traumatism with preservation of efficiency. (Slavityak, 2014). In the researches by Abdulrahman (2015) the types of functional state of sportsmen's organism with chronic fatigue were determined. Appearing of sportsmen's unstable state can be connected with reduction of organism's resistance to loads and with high risk of chronic fatigue syndrome's formation

In our previous researches we presented ways of perfection of junior sportsmen's technical-tactic training. We worked out complexes of tasks for perfection of the sportsmen's technical-tactic skillfulness. We also offered percentage distribution of technically oriented combinations' application in compliance with fighting style (Iermakov, & Boychenko, 2010). In other research methodic features of perfection of wrestlers' technical-tactic skillfulness with the help of special technical means were regarded. Main methodic principles of perfection of sportsman's serial and combination technique with the help of traditional equipment were formulated (Boychenko, 2010a). In compliance with it there were worked out complexes of tasks and formulated directions of sportsmen's technical-tactic training's perfection (Boychenko, 2010b). It was found, that in assessment of wrestlers' technical-tactic potentials the final part of competitions was the most informative. It was found that wrestlers would fight at high temp. Sportsmen are recommended to fulfill 1-2 actual attempts to realize techniques during every period of fighting (Tropin, 2013). It was also found that final part of competitions, which is determined by efficiency and technical arsenal, is the most informative in assessment of wrestlers' technical-tactic potentials (Tropin, & Pashkov, 2015).

Thus, studying of functional characteristics with the help of psycho-physiological tests can be used for analysis of martial arts sportsmen's condition and permit to predict their successfulness. Basing on the above rendered, *the purpose of the present work* is studying and analysis of elite wrestlers' psycho-physiological features for prediction of their successfulness and optimizing of their training.

Material & methods

Participants: in the research 50 wrestlers participated. First group (n=28, age – 22.86±0.95 years) consisted of impart martial arts representatives (karate, thae-quan do, Mixed Martial Arts). Second group (n=22, age – 22.27±1.09 years) consisted of sportsmen, practicing throwing kinds of wrestling (free style wrestling, Greco-Rome wrestling, Judo). All participants were elite sportsmen. There were not registered any distinctions by age (p>0.05).

The research was conducted in compliance with WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects, 2013. The study protocol was approved by the Ethical Committee of Kharkov State Academy of Physical Culture.

The design of the research implied carrying out of psycho-physiological reactions' complex, directed on assessment of organism's sensor systems. The test battery consisted of 10 functional tests. By the tests' results 13 indicators were calculated. Assessment of simple motor abilities was realized by pressing on geometric figure (circle). Circles appeared on screen in random order during 10 seconds. As differentiated irritator circles of other color appeared. Pressing on such circle was a mistake. Results were assessed by mean quantity of touches and reliability – percentage of correct answers. Chrono-reflex metering included determination of simple visual-motor and hearing-motor responses. In contrast to commonly accepted we registered time of finger release. Tapping test was conducted according to common methodic. Total quantity of touches in 6 squares was registered. 5 seconds were assigned for every square. Time of choice response was assessed by time of pre-set color object's choice from five possible. Response to moving object implied: it was necessary to stop object in pre-set place with pre-set velocity of movement. As a result we used time differences, comparing with correct fulfillment. Reaction of distinguishing: it was necessary to fix the moment, when values of immobile and expanding circles coincide. Results are assessed like in previous test. Reaction of choice of half of screen implied choice of those half-screen, in which signal appears. We fixed time after signal's appearing. Reproduction of temp meant repetition of pre-set frequency of 80 strikes per minute. Time of not-coincidence was registered. Reproduction of line implied drawing of line by pattern. Linear deviation and velocity of fulfillment were registered. Coincidence of shape required to register the moment, when size of square started to change. The time of reaction was registered.

Statistical analysis

Statistical analysis of the received data was fulfilled with the help of licensed electronic tables Excel (2010). We determined indicators of descriptive statistics (mean arithmetic value), mean deviation and error of mean value) (Antomonov, 2006). Confidence of values' differences was determined by Student's and sign criteria. Difference was considered confident with p<0.05. For determination of correlations between indicators we calculated correlation coefficients by Pirson ad built correlation structures (Antomonov, 2006). Their comparative analysis was carried out with the following indicators: specific weight of significant and confident correlations, labialization/synchronization coefficient (LC) and mean correlation coefficient (MCC). The latter two indicators were found by special formulas (Zosimov, 2000):

$$CL = [n/N(N-1)] \cdot 100\%, (1),$$

Where n – is the sum of all significant correlations, formed by every parameter of correlation structure; N – total quantity of structure’s parameters.

$$MCC = \sum r_j / n, (2),$$

Where $\sum r_j$ – is the sum of all confident correlation coefficients of structure; n –number of significant correlations.

For determination of correlation structure’s component, making the highest contribution in creation of correlations we found indicator of system formation. Calculation was carried out by formula:

$$PS = \sum r_j \cdot n (3),$$

Where $\sum r_j$ – is the sum of all confident correlation coefficients, formed by the given indicator; n – number of this structure indicator’s significant correlations.

Results

The received results are given in table 1.

Table 1. Results of psycho-physiological testing of martial arts sportsmen

Indicators	1 group	2group
Mean quantity of touches (absolute)	27.39±0.36 ¹	25.57±0.37
Reliability (%)	81.60±7.32	81.55±8.27
Simple visual/motor response (m.sec.)	227.40±3.21	231.06±3.79
Simple hearing/motor response (m.sec.)	214.00±2.80	213.25±3.40
Quantity of touches in tapping test (absolute)	211.52±5.32	205.39±4.09
Time of choice reaction (m.sec)	596.23±13.96 ¹	642.37±15.27
Reaction to moving object (m.sec.)	18.34±1.12	19.45±1.27
Reaction of distinguishing (m.sec.)	275.81±4.76	286.31±4.17
Reaction of half-screen choice (m.sec.)	339.00±4.95 ¹	369.54±9.68
Reproduction of temp (m.sec.)	34.67±2.72	35.78±3.30
Reproduction of line (mm)	0.38±0.02 ¹	0.49±0.03
Speed of line drawing (mm/sec)	70.22±4.55	80.59±4.23
Coincidence of shape (m.sec.)	808.59±22.02 ¹	911.58±25.71

Note1 – differences with group 2 are confident (p<0.05)

Analysis of the received data permits to conclude, that functional status of both groups’ sportsmen was rather close. It is confirmed by absence of significant differences in 8 from 13 of indicators. Specific weight of errors in assessment of simple motor abilities also did not differ substantially. Results of chrono-reflex metering were close in both kinds of reactions. Total quantity of touches in tapping test also had not significant differences as well as parameters of reactions to moving object and reaction of distinguishing. Sportsmen fulfilled reproduction of temp practically equally and drew pre-set line with equal velocity.

At the same time substantial differences were also found. For example, first group sportsmen had confidently higher quantity of touches in simple motor abilities’ test (p<0.05). They quicker chose required color from five offered and required half of screen. When reproducing line, sportsmen of first group made much less deviation from pattern. The same results were registered in test for coincidence of shape. These data permit to speak about better psycho-physiological condition of impact martial arts sportsmen.

For clarification of correlations between the studied criteria we determined correlation coefficients by Pirson and built appropriate correlation structures. It gives additional information about sportsmen’s functional condition. Main indicators of correlation structures are give in table 2.

Table 2. Indicators of correlation matrixes of martial arts sportsmen’s psycho-physiological testing

Group	Specific weight of significant correlations (%)	Specific weight of confident correlations (%)	Indicator of labialization/synchronization (absolute)	Mean correlation coefficient (absolute)
1	37.36±5.07	27.47±4.68	20.53	0.36
2	45.05±5.22	31.87±4.88	24.76	0.38

The data of table 2 permit to consider condition of both groups’ sportsmen rather close. It again proves previously made assumptions. It is confirmed by absence of significant differences between specific weight of confident and significant correlations. Labialization indicators were not high and differ by 17%. It can be interpreted as illustration of adaptation mechanisms’ little tension in process of tests’ fulfillment. MCC indicator in both groups relates to average interval and it also can be assessed as little tension of adaptation mechanisms.

For analysis of the tested indicators’ potential contribution in sportsmen’s functional state we calculated indicator of psycho-physiological indicators’ system formation. The received values are shown in fig. 1.

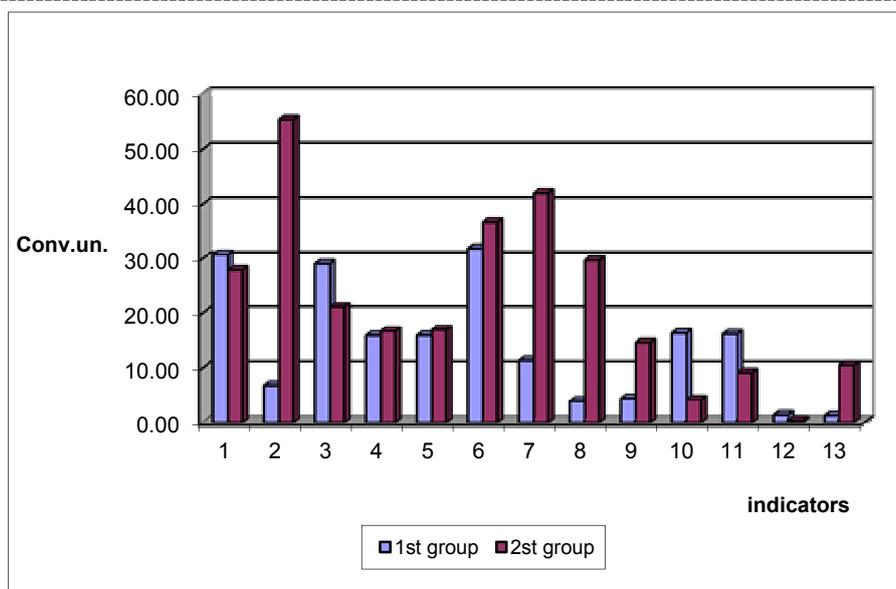


Fig.1. System formation indicators of sportsmen's psycho-physiological tests: 1- simple visual-motor reaction; 2 – simple hearing-motor reaction; 3 – Time of choice reaction; 4 – Reaction to moving object; 5 – Reaction of distinguishing; 6 – Reaction of half-screen choice; 7 – Reproduction of temp; 8 – Reproduction of line; 9 – Speed of line drawing; 10 – Shape coincidence; 11 – Mean quantity of touches; 12 –Reliability; 13 – Quantity of touches in tapping test.

Analysis of fig.1 data permits to speak about closeness of participants' functional condition. Application of sign criteria in analysis permitted to absence of confident distinctions in system formation indicators in the tested groups ($p>0.05$). Close values of system formation indicator of simple visual motor reaction, reaction to moving object, reaction of distinguishing were found. In first group their values were 30,73, 15,93 and 15,96. In second group their values were accordingly 27.96, 16.76 and 16.98.

At the same time first group sportsmen had noticeably higher system formation indicator in time of choice reaction (29.07), shape coincidence (16.37) and mean quantity of touches in simple motor abilities (16.20). In second group they were accordingly: 1.13, 4.18 and 9.17. In throwing martial arts sportsmen we found significantly higher contribution in system of the following indicators: simple hearing-motor reaction (55.41), reaction of half screen choice (36.66), reproduction of temp (41.95) and line (29.69), speed of line drawing (14.66) and quantity of touches in tapping test (10.52). In first group these indicators were accordingly 6.74, 31.85, 11.31, 3.93, 4.40 and 1.31. Contribution of such indicator as reliability was insignificant in both groups. It was 1.44 in first group and 0.39 in second group.

Discussion

The received data illustrate importance of sportsmen's psycho-physiological condition as factor of successfulness in sports. High level of sportsmanship conditions of participants' optimal functional state, underlines perfectness of required skills and abilities. It is witnessed by absence of significant distinctions in results of most of the used indicators. The data about influence of sportsmanship on psycho-physiological state were received by Seifert et al. (2011). When analyzing coordination of different sportsmanship swimmers it was found that in health related swimming there is high variability of indicators. The best coordination indicators, demonstrated by sportsmen of high skillfulness, are interpreted from the point of successfulness in competition functioning.

Analysis of psycho-physiological testing results permits to mark out the most significant for successfulness in wrestling qualities. For example, closeness of chrono reflex metering data confirms importance of quick reaction to visual and hearing irritators of both groups' sportsmen. Testing of reaction to moving object assesses dynamic parameters of moving object and ability to maximally quickly take necessary decision. That is why this methodic illustrates high level of fitness, without significant differences between sportsmen's groups. The same conclusion can be made in analysis reaction of distinguishing. This test permits to realize control of own space, distance and prediction of movement. It is an important factor in impact and throwing kinds of martial arts. Closeness of tapping test results underlines their similarity of sportsmen's main nervous system indicators. Its lability and mobility are important factors for efficiency in sports. For example, Omelyanenko (2014) studied influence of trainings on junior skiers' physical workability depending on nervous system's characteristics. It was found that with weak nervous system substantial progress of physical workability does not take place. The registered differences between groups witness about psycho-physiological characteristics of sportsmen of different wrestling kinds. Results of simple motor abilities' testing reflect impact martial arts representatives' better mobilization ability. Besides, these results say about more optimal readiness for action.

Less time losses for choice reaction in first group sportsmen can be assessed as evidence of more developed differentiation functions. This indicator influences on motion tactic and reflects possible asymmetry.

Results of tests for reproduction of line and shape coincidence also illustrate differences between sportsmen of impact and throwing martial arts. The received data can be assessed as evidence of better space characteristics, more optimal coordination and regulation of muscular tonus of first group sportsmen. Though in this case we can not but consider peculiarities of visual sensor potentials, its condition, characteristics of visual fatigue. These methodic are especially important for prediction and assessment of sportsmen's tactic. For example, Brétigny, Leroy, Button, Chollet, and Seifert (2011) studied coordination abilities of field hockey players. Application of cluster analysis permitted to build two profiles of players. By the received data and depending on their roles, the players were divided into two groups: group with prevailing of strength and group with better coordination in time.

Better indicators of temp reproduction in first group show that impact martial arts sportsmen have better sense of rhythm and are successful in maintaining of pre-set frequency. It reflects specificities of their training, oriented on achievement of higher frequency of punches and kicks. In this connection it was interesting to compare correlation of this test with tapping test. In both groups correlation of reverse character was registered. In first group it belonged to average range and was significant ($r=-0.312$). In second group it was weak ($r=-0.221$). Thus, analysis of correlation dependences proves one more the assumption about higher significance of this temp reproduction test for impact martial arts representatives.

Application of modern statistic methods in analysis of psycho-physiological indicators permits to build mathematical models. They help to more accurately understand changes, which take place in sportsmen's organism. Robertson, Woods, and Gastin, P. (2015) studied morphological functional characteristics of Australian football league sportsmen. The authors confirmed appropriateness of regression models' application for selection and prediction of sportsmanship in football. Unevik, Wickford, and Melander (2012) used correlation regression and factorial analysis for assessment of physical education means' influence on students' functional state and physical fitness improvement. The received results permitted to build mathematical models as well as to determine strength, orientation and form of the tested indicators. Podrigalo, Iermakov, Nosko, Galashko, and Galashko (2015) applied method of correlation structures for assessment of arm-wrestlers' condition. They proved that elite sportsmen's condition was more stable. Besides, they noted their lower functional tension, comparing with sportsmen-amateurs. The same data are rendered by Keiner, Yaghabi, Sander, Wirth, and Hartmann (2015). When studying correlations by Pirson between morphological functional indicators of elite swimmers they proved dependences between power and speed indicators. Results were interpreted from the point of prediction of sport functioning efficiency. Telles, Barbosa, Campos, and Júnior (2011), studying bio-mechanical characteristics of swimmers' movements, confirmed the presence of dependences between movement phases and movements' coordination. It was found that strength of correlation increases under durable loads for fitness improvement.

Application of statistical methods is rather promising for prediction of sportsmen's successfulness. For example, quantity of confident and significant correlations in structure is considered to be an important predictor. Logan, Robinson, Rudisill, Wadsworth, and Morera (2014) assessed motor skills of pupils and dependences between them. They proved the presence of great quantity of correlations by Pirson between ability to control movements, dexterity, and balance of movements. Jarraya, Jarraya, Chtourou, and Souissi (2014) studied structural-functional correlations of physical and technical-tactic fitness of handball players. Statistically significant were nearly half of correlations. These correlations permit to assess effectiveness of handball players' training process. Characteristics of correlation structures (see table 2) reflect absence of substantial distinctions in all tested indicators. In our opinion it is a confirmation of sportsmanship and stable fitness high level in all participants of the researches. Results of Podrigalo, Iermakov, Alekseev, and Rovnaya (2016) proved presence of correlations between morphological functional indicators of students-wrestlers. The highest contribution in system was made by anthropometrical indicators. At the same time, rather sufficient contribution in system formation was made by results of functional tests. It permits to consider analysis of correlations' quantity and strength to be also important predictors. The received data (see fig.1) permit to mark out the most significant for successfulness in martial arts psycho-physiological qualities. For impact kinds of martial arts they are: time of choice response, shape coincidence and mean quantity of touches in simple motor abilities' test. For throwing kinds of martial arts they are: simple hearing-motor reaction, reaction of half screen choice, reproduction of temp and line, speed of line drawing and quantity of touches in tapping test.

Conclusions

The conducted research proved importance of wrestlers' psycho-physiological qualities as factors of successfulness. High level of participants' fitness conditioned closeness many used methodic results. Results of impact martial arts sportsmen illustrate better ability to mobilization, more optimal readiness for action and more developed functions of differentiation. The received data permitted to assess first group sportsmen as having better space characteristics and more optimal regulation of muscular tonus. Analysis of correlation structures confirms closeness of sportsmen's condition. Assessment of separate qualities' contribution into system

permitted to mark out main features depending on kind of martial arts. Increasing of the most significant psycho-physiological qualities of sportsmen seems to be a promising direction in martial arts training.

Conflict of interests

The authors declare that there is no conflict of interests.

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