

Features of the psychophysiological state of qualified handball players

Особенности психофизиологического состояния квалифицированных гандболисток

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Abstract

Background and purpose

Over the past decade, women's handball has evolved towards increasing speed and rapid development of technical skills during competitions. Female players demonstrated a new technical and tactical approach and reduced execution time through the use of running and jumping exercises. Handball preparation requires an integrated approach to training, including the following components: physical performance, technical abilities and mental readiness. In this regard, psychophysiological functions play a key role in efficient movement and the implementation of special skills.

Material and Methods

A total of 24 female handball players (age 22.54; SD=2.54) and 17 male handball players (age 21.83; SD=2.69) were examined. We used a set of test batteries that assess the level of psycho-emotional state and neurodynamic functions. All tests are part of the computer diagnostic complex "Multipsychometer-05".

Results

The results revealed differences in some variables between male and female handball players. Male handball players had a high level of psychoemotional stress. This is due to the predominance of sympathetic activation. Female handball players had a balance of sympathetic and parasympathetic activation with optimization of the emotional state. According to the balance of nervous processes, male handball players had a balance of excitation and inhibition. But female handball players had a predominance of excitation. The decision-making ability of male handball players was faster than that of female handball players. This fact indicates a faster ability to process information in male handball players. The conducted correlation analysis revealed gender features of information processing strategies. In male handball players, the balance of nervous processes contributes to the optimization of the emotional state. In female handball players, independent decisions were revealed in female compared to male.

Conclusions

The results obtained showed that the peculiarities of the psychophysiological state of handball players manifest themselves in different information processing strategies. In male, this manifests itself in emotional tension, balance of nervous processes, and faster decision-making. In female, an optimal emotional state, predominance of nervous system excitation, and slower decision-making are observed.

Keywords: gender features, psychophysiological state, handball players, information processing

Аннотация

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Обоснование и цель

За последнее десятилетие женский гандбол развивался в сторону увеличения скорости и быстрого развития технических навыков во время соревнований. Игроки-женщины продемонстрировали новый технико-тактический подход и сократили время выполнения за счет использования беговых и прыжковых упражнений. Подготовка гандболисток требует комплексного подхода к тренировкам, включающего следующие компоненты: физическую работоспособность, технические способности и психическую готовность. В связи с этим психофизиологические функции играют ключевую роль в эффективном движении и реализации специальных навыков.

Материал и методы

Всего было обследовано 24 гандболистки (возраст 22,54; SD=2,54) и 17 гандболистов-мужчин (возраст 21,83; SD=2,69). Мы использовали набор тестовых батарей, оценивающих уровень психоэмоционального состояния и нейродинамических функций. Все тесты входят в состав компьютерного диагностического комплекса «Мультитсихометр-05».

Результаты

Результаты выявили различия по некоторым переменным между гандболистами-мужчинами и гандболистками. У гандболистов-мужчин наблюдался высокий уровень психоэмоционального напряжения. Это обусловлено преобладанием симпатической активации. У гандболисток наблюдается баланс симпатической и парасимпатической активации с оптимизацией эмоционального состояния. По балансу нервных процессов у гандболистов-мужчин наблюдается баланс возбуждения и торможения. А вот у гандболисток преобладает возбуждение. Способность принятия решений у гандболистов-мужчин быстрее, чем у гандболисток. Этот факт свидетельствует о более быстрой способности к обработке информации у гандболистов-мужчин. Проведенный корреляционный анализ выявил гендерные особенности стратегий обработки информации. У гандболистов-мужчин сбалансированность нервных процессов способствует оптимизации эмоционального состояния. У гандболисток выявлены самостоятельные решения у женщин по сравнению с мужчинами.

Выводы

Полученные результаты показали, что особенности психофизиологического состояния гандболисток проявляются в разных стратегиях обработки информации. У мужчин это проявляется в эмоциональной напряженности, сбалансированности нервных процессов и более быстром принятии решений. У женщин наблюдается оптимальное эмоциональное состояние, преобладание возбуждения нервной системы и более медленное принятие решений.

Ключевые слова: гендерные особенности, психофизиологическое состояние, гандболисты, обработка информации.

Introduction

Handball is a very popular sport among players [1, 2]. Handball as a team sport develops friendship, team spirit and emotional control among athletes [3]. Modern handball is characterized by high intensity, power and spectacularity [4]. But some authors believe that modern handball has elements of chaos [5].

Handball is a sport that involves competition between male and female participants. Over the past decade, women's handball has evolved towards increasing speed and rapid development of technical skills during competitions. Female players demonstrated a new technical and tactical approach and reduced execution time through the use of running and jumping exercises [6, 7]. Moreover, men's handball has shifted towards strength and speed with the implementation of complex technical skills on the court [8]. Handball preparation requires an integrated approach to training, including the following components: physical performance, technical abilities and mental readiness [9, 10].

Handball is a complex game, characterized by the complexity of combinations and tactical algorithms in real game situations [11, 12]. To implement specific skills during a match, a handball player must implement all the abilities that correspond to the perception of external information about the situation on the field, solving tactical problems and performing actions [13, 14]. In this regard, psychophysiological functions play a key role in efficient movement and the implementation of special skills [15, 16].

Psychophysiological functions in game sports ensure optimal implementation of technical skills, are the main link in the formation of a set of skills and reflect the state of the nervous system and fatigue processes [17]. Therefore, the study of psychophysiological functions provides additional information about the level of training of an athlete and his ability to perform game work [18].

Among the numerous studies related to handball, the scientific substantiation of the characteristics of the psychophysiological state of the studied qualified handball players is not sufficient. There are only isolated data on the study of psychophysiological properties in handball players of different levels of training [19, 20].

In connection with the above, the development of a new approach to determining the gender characteristics of the psychophysiological state of handball players is relevant.

Purpose to study of gender features of psychophysiological state in handball players.

Material and Methods

Participates

A total of 24 female handball players (age 22.54; SD=2.54) and 17 male handball players (age 21.83; SD=2.69) were examined. All participants gave their consent to participate in the study and use its results in scientific analysis. The study procedure was approved by the Bioethics Commission of the Uzbek State University of Physical Education and Sport.

Design and methods of the study

The study procedure lasted about 10-15 minutes. All participants received instructions and completed all their tests.

We used a set of test batteries that assess the level of psycho-emotional state and neurodynamic

unctions. All tests are part of the computer diagnostic complex "Multipsychometer-05". The psycho-emotional state was assessed using the Luscher color test. This test provides information about the mental state, mental comfort and the characteristics of emotional stress [21]. Neurodynamic functions were assessed by two tests: an assessment of the balance and mobility of nervous processes.

Statistical analysis

Due to the fact that our sample does not correspond to the normal distribution, we used nonparametric methods (median, quartile range) and correlation analysis (according to Spearman). For this, the Statistica 12 program was used. We also used G-Power 3.1.96 software (Germany) to determine the minimum sample size for our study.

Results

The study of the mental state of handball players showed the presence of significant changes between male and female in the magnitude of deviation from the autogenic norm (Table 1).

This fact indicates that male have a high level of psycho-emotional stress and expenditure of internal mental resources to ensure activity. Female had an optimal psycho-emotional state. This corresponded with the value of the vegetative coefficient, which was higher in male. The result revealed indicates the predominance of sympathetic activation and depletion of adaptation mechanisms in male. The female group is characterized by a tendency to balance between sympathetic and parasympathetic tone.

The study of the balance of nervous processes in both gender groups of handball players revealed a significant difference in the indices of excitation (Table 2). According to the data obtained, the balance between excitation and inhibition of nervous processes prevails in male, while the excitation process prevails in female. This fact indicates a gender-specific feature of the nervous system organization and is consistent with the data of some authors [22, 23].

The functional mobility analysis showed that the decision-making time of male handball players was shorter than that of female handball players (Table 3). According to these results, male handball players made decisions faster on individual test parameters. In contrast, female handball players made decisions more slowly.

Thus, high rates of psycho-emotional stress and activation of sympathetic regulation were established in male handball players. In addition, a balance between excitation and inhibition of nervous processes in men was revealed. This contributes to faster decision-making in male handball players.

Thus, in male handball players were observed high rates of psycho-emotional stress and activation of sympathetic regulation. In addition, a balance between excitation and inhibition of nervous processes in men has been revealed. This contributes to faster decision-making in male handball players.

Female handball players have an optimal psycho-emotional state with a balance between sympathetic and parasympathetic regulation. At the same time, women show a predominance of excitation of nervous processes. As a result, female handball players demonstrate slower decision-making than male players.

Thus, gender features of the psychophysiological state in handball players are characterized by different strategies for processing information and making decisions.

The obtained correlation of the connection of the mental state with the variables of neurodynamics in handball players is presented in Table 4. According to these data, the correlation between accuracy (according to the test of balance of nervous processes) and autonomy reflects the

ability to make independent decisions in male players. The analysis of correlations revealed the connections between the variable stability (according to the test of balance of nervous processes) and the variables of the mental state (six significant correlation coefficients). This fact indicates that the balance of the ratio of excitation and inhibition of the nervous system forms the optimal mental state in male handball players. The correlation between impulsivity (according to the test of mobility of nervous processes) and the vegetative coefficient reflects the compensatory mechanism at a high level of psycho-emotional stress and sympathetic regulation in male handball players. Impulsivity helps to reduce psycho-emotional stress in male handball players.

Correlation analysis between the variables of the nervous process balance test and the nervous process mobility test showed the presence of two significant correlation coefficients: between accuracy with the capacity of the visual analyzer and the time of decision-making (Table 5). According to the obtained result, it can be stated that accuracy has an opposite vector relative to the time of decision-making in male handball players. In female handball players, there are no significant correlation coefficients between the variables of mental state and neurodynamics.

The exception is the correlation between autonomy and the time of decision-making ($r_s = 0.44$, $p < 0.05$). Probably, the obtained result reflects the features of the decision-making strategy in female handball players, which characterize the independence of decision-making in female players.

The analysis of the correlation of the balance test indicators and the mobility of the nervous process in female handball players is presented in Table 6. This result revealed opposite correlations between the capacity of the visual analyzer with accuracy and stability. This indicates a balance between two properties of information processing: faster and better quality. With the prevalence of faster processing, the quality of processing decreases, with the prevalence of quality processing, a decrease in the speed of processing is observed.

Table 1

Mental state according to the Luscher color test in elite handball players of different gender groups (median, quartile range)

Variables	Male	Female
Psycho-social capabilities, conditional unit	8.00; 8.00	9.00; 6.00
Fatigue, conditional unit	4.00; 3.50	3.00; 4.00
Anxiety, conditional unit	3.50; 5.50	3.50; 5.00
Deviation from autogenously norm, conditional unit	18.00; 16.00	16.00; 14.00*
Eccentricity, secret unit	8.00; 10.50	8.00; 5.00
Concentricity, conditional unit	7.00; 2.50	7.00; 4.00
Vegetative coefficient, conditional unit	17.00; 6.00	16.00; 5.00*
Heteronomy, conditional unit	7.00; 4.00	6.50; 3.00
Autonomy, conditional unit	7.00; 3.50	8.00; 6.00

Legend: * $p = .05$, points out the differences between male and female handball players

Table 2

Balance of neural processes in elite handball players of different gender groups (median, quartile range)

Variables	Male	Female
Accuracy, conditional unit	2.31; 0.80	2.73; 0.99
Stability, conditional unit	3.29; 2.40	3.50; 1.84
Excitation, conditional unit	0.001; 0.73	0.01; 0.19*

Legend: * $p = .05$, points out the differences between male and female handball players

Table 3

Functional mobility of neural processes in elite handball players of different gender groups (median, quartile range)

Variables	Male	Female
Capacity of visual analyzer, conventional units	1.42; 0.23	1.39; 0.41
Decision making time, ms	325.00; 35.00	425.00; 210.00*
Impulsiveness, conditional unit	-0.27; 0.17	-0.23; 0.27
Dynamism, conditional unit	60.85; 16.62	60.49; 10.33

Legend: * $p = .05$, points out the differences between male and female handball players

Table 4

Results of the correlation analysis (according to Spearman) between mental state and neurodynamic characteristics in male handball players

Variables	Accuracy	Stability	Impulsiveness
Psycho-social capabilities	0,29	0,63	-0,15
Anxiety	-0,44	-0,46	0,32
Deviation from autogenously norm	-0,42	-0,59	0,30
Eccentricity	0,41	0,62	-0,08
Concentricity	-0,10	-0,47	-0,43
Vegetative coefficient	-0,32	-0,26	0,68
Heteronomy	0,03	0,57	-0,12
Autonomy	0,60	0,28	-0,28

Legend: * $p = .05$, highlighted numbers

Table 5

Results of the correlation analysis (according to Spearman) between balance and mobility of nervous process properties in male handball players

Variables	Accuracy	Stability
Capacity of visual analyzer, conventional units	-0,61	-0,24
Decision making time, ms	0,64	0,251

Legend: * $p = .05$, highlighted numbers

Table 6

Results of the correlation analysis (according to Spearman) between balance and mobility of nervous process properties in female handball players

Variables	Accuracy	Stability
Capacity of visual analyzer, conventional units	-0,55	-0,56
Decision making time, ms	0,62	0,38
Impulsiveness, conditional unit	-0,40	-0,50

Legend: * $p = .05$, highlighted numbers

This confirmed the obtained correlation between decision-making time and accuracy. An increase in decision-making time leads to an increase in accuracy, but a decrease in rapid information processing in female handball players. Impulsiveness has an inverse correlation with stability. This means that a decrease in impulsiveness balances the processes of excitation and inhibition of the nervous system.

Discussion

The idea of our work was to study the gender features of the psychophysiological state of handball players. This topic reflects the need to find a new approach to the training process taking into account gender specifics. Modern handball is characterized by the use of new technologies in training [24, 25]. Knowing the mechanisms of manifestation of psychophysiological functions, they can be used in developing the optimal training of handball players.

To solve this problem, complex methods for assessing the mental state and neurodynamic properties were used.

Significant differences in a number of variables were found between male and female handball players. Male handball players showed a high level of psycho-emotional stress.

At the same time, male handball players showed a predominance of sympathetic activation.

This fact indicates the mobilization of additional resources to ensure activity [26]. In female handball players, a balance is observed between sympathetic and parasympathetic activation. This leads to optimization of emotions [27].

Gender characteristics show a difference in the ratio of excitation and inhibition of the nervous system. Male handball players have a balance between excitation and inhibition, while females have a predominance of excitation. Thus, male handball players have a better expression of the property of anticipation [21].

Decision-making is the main property and limitation of the manifestation of special skills in a game situation. In our study, it was found that male handball players make decisions faster than female handball players. This corresponded to the activation of the autonomic nervous system and the balance of excitation and inhibition. On the contrary, female handball players have an optimal emotional state with a balance of autonomic regulation and a predominance of excitation of the nervous system. According to the decision-making data, this variable is faster in male.

Correlation analysis revealed that the presented balance of nervous processes contributes to the optimization of the emotional state of male handball players. At the same time, an increase in the impulsivity of the nervous process as a compensatory mechanism affects the reduction of mental stress in male handball players. Correlation analysis of female handball players shows a different information processing system than male. The main difference is in the ability to make independent decisions in female n compared to male.

Conclusion

The results obtained showed that the peculiarities of the psychophysiological state of handball players manifest themselves in different information processing strategies. In male, this manifests itself in emotional tension, balance of nervous processes, and faster decision-making. In female, an optimal emotional state, predominance of nervous system excitation, and slower decision-making are observed.

Conflicts of Interest

The authors declare no conflicts of interest.

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