

CORRELATION BETWEEN INDICATORS OF BALANCE OF NERVOUS PROCESSES WITH LOCALIZATION OF CONTROL IN HIGH SKILLED WOMEN HANDBALL PLAYERS

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Summary

Introduction. The problem of finding the psychological resource of the athlete remains relevant. Success in sports largely depends on the athlete's individual psychological characteristics. Many authors, based on research, conclude that the internal locus of control has a positive effect on performance in team and non-team sports. It seems to be an interesting scientific problem to study the gender aspect of this problem.

The purpose of the study: to establish a relation between the locus of control and the characteristics of the response to the moving object of elite women handball players.

Materials and Methods: Athletes of the Ukrainian National women handball team (21 players aged 17 to 28, experience in this sport from 5 to 19 years) took part in the research. To study the locus of athletes' control over significant events, the method for the research of the level of subjective control (LSC) by J. Rotter was used. Software and hardware complex «BOS-test-Professional» for psychological and psychophysiological diagnostics was used to determine the characteristics of the athlete's response to the moving object.

Results: A study of internality found that the majority of skilled handball players (61.9%) have a general internal type of locus of control. The vast majority of athletes tend to take responsibility in the field of productive (sports) relations (81%), areas of achievement (71.4%) and failures (52.4%). However, in areas such as family relationships, health and illness, most athletes share responsibility with the social environment and feel unable to control external circumstances. A correlation has been identified between the internality of locus of control and the ratio of nervous processes (inhibition and excitation) in elite women handball players. Higher stability of athletes' responses to a moving object is associated with a more pronounced internal locus of control, but only in the field of family relations. The obtained data indicate a more optimal functional state of the athlete's central nervous system with internal locus of control.

Conclusions: Family relationships and health & illness are the most sensitive areas for female athletes. This fact provides a basis for gender mainstreaming in psychological support activities.

Key Words: locus of control, internality, response to a moving object, balance of nervous processes.

INTRODUCTION

Success and results in sports largely depend on the athlete's ability to regulate their behavior [28], to restrain their feelings [27], to control spirits and maintain self-esteem [29], confidence and self-efficacy [31], to predict the development of events on the sports field [1]. Working at the limit of athlete's capabilities constantly creates situations in which the athlete needs to regulate and control his mental state [1, 6, 15, 12, 30].

If physical activity is heavy, and the athlete does not manage his condition well, there is excessive mental stress, which reduces the effectiveness of activities, leads to its disorganization, and as a result leads to loss. This can lead to loss of self-confidence, mental stress, depression and psychosomatic shifts [2, 14, 32].

Thus, success in sports largely depends on the individual psychological characteristics of the athlete, and specific sports have certain requirements for him and at the

same time form the personality qualities necessary for the successful implementation of competitive activities [30, 34].

One of the important qualities of an athlete is the ability to control and self-control. One of the personal characteristics of athletes that deserves the attention of researchers and undoubtedly affects the professional success and success of representatives of the sports industry is the locus of athletes' control over significant events in particular [16, 25].

The locus of control determines how effectively a person can control or manage external circumstances [4, 8, 17, 21]. An athlete with an internal locus of control behaves in accordance with his inner intentions and perceives his results as the result of his own actions and abilities. On the contrary, an athlete with an external locus of control behaves according to external circumstances and perceives his results as the consequences of circumstances that are not controlled [25, 33].

The results of the study of the locus of control in athletes of non-team sports give grounds to conclude that the authors on the beneficial effect of the internal locus of control on the professional success of athletes aged 18-22 years [16]. Interns, in contrast to externals, work more productively not in a team, but alone. They are more active in finding information. In addition, intern athletes do a better job that requires initiative.

Team sports and handball in particular, refers to situational team sports. Athletes need the ability of variable actions, quick decision-making according to the game situation, team play, where the success of the player depends on the diligence and consistency of the whole team. Therefore, in team sports, high skilled athletes may differ in personal characteristics of locus of control from athletes in non-team sports. However, studies conducted with the Nigerian National Football League also confirm that there is a significant impact of the locus of control on the self-efficacy of elite footballers [31]. It was interesting for us to research the peculiarities of locus of control in the gender aspect on the example of elite women athletes.

Research objective is to establish a relation between the locus of control and the characteristics of the response to the moving object (RMO) of elite women handball players.

MATERIALS AND METHODS

Participants and Procedures

Athletes of the Ukrainian National women handball team (21 players aged 17 to 28 years, experienced from 5 to 19 years in this sport) participated in the study. The research was conducted in preparation period for the play-off qualifiers for the World Handball Championship. The research was conformed to «Program of complex biological research of functional capabilities of athletes» that was developed by laboratory of theory and methods

of sports training and reserve capabilities of athletes on the basis of the Scientific Research Institute of National University of Ukraine on Physical Education and Sports. The researchers followed all protocols and procedures required by the Biomedical research Ethics Committee and conform to the directive of the Ukrainian Legislation on health care, Helsinki Declaration 2000 and European Society Directive 86/609 on human participation in biomedical research to ensure adherence to all standards for adequate protection and well-being of participants. To study the athlete's locus of control over significant events, the method for research of the level of subjective control (LSC) by J. Rotter (adaptation by E. F. Bazhin, E. A. Golyukina & A. M. Etkind) was used [3]. «BOS-test-Professional» software and hardware complex of psychological and psychophysiological diagnostics was used to determine the characteristics of the athlete's response to the moving object [5].

The response to a moving object (RMO) is to perform a movement in answer to a specific signal a visible spatial combination of two or more moving objects. The indicators of RMO show the athlete's ability to anticipate (predict) the time of change of the spatial position of the stimulus and to correlate with it the sensory processes of regulation of their movement.

Data collection and analysis

The following methods of mathematical statistics were used: nonparametric descriptive statistics, Shapiro-Wilk test of normality, correlation analysis. The Shapiro-Wilk test confirmed the normality of the following indicators of handball player's psychological diagnosis: general scale of internality, family relations. Because 7 of the 9 indicators of psychological diagnosis of women handball players were not normally distributed, we used non-parametric statistics. The following statistical parameters were determined: mean \bar{x} , standard deviation SD, median, lower and upper quartiles Me (25%, 75%).

Correlation analysis was used to determine the relationship between the indicators of psychological diagnosis of women handball players. The Pearson correlation coefficient was used for the normally distributed parameters; otherwise the relationship was determined by the nonparametric Spearman correlation coefficient. The significance of the correlation coefficients relative to zero was determined by two-tails criterion at the level of $p = 0.05$. Statistical data analysis was performed using «Statistica» (StatSoft, version 10.0).

RESULTS

The following parameters of the Ukrainian National women handball team: the general scale of internality, internality in areas of achievements and failures, health and illness, family, industrial and interpersonal relationships and response to a moving object were determined (Table 1).

Table 1

Parameters of psychological diagnosis of elite women handball players (n = 21)

	Parameter	\bar{x}	S	Me	25%	75%
1.	General scale of internality	6.0	1.7	6	5	7
2.	Area of achievements	7.0	2.3	7	6	8
3.	Area of failures	6.3	2.8	7	3	8
4.	Family relationships	5.7	3.0	6	3	8
5.	Industrial relations	6.0	1.7	6	6	7
6.	Interpersonal relationships	5.2	2.6	5	2	7
7.	Health and illness	4.6	2.9	4	4	7
8.	Coefficient of balance of nervous processes	1.16	0.88	0.80	0.50	1.71
9.	Scatter of time response to moving object	46.53	18.37	41.61	37.72	50.62

A study of internality found that the majority of high skilled women handball players (61.9%) have a general internal type of locus of control. The vast majority of athletes tend to take responsibility in the field of industrial (sports) relations (81%), areas of

achievement (71.4%) and failures (52.4%). However, in areas such as family relationships, health and illness, most athletes share responsibility with the social environment and feel unable to control external circumstances (Figure 1).

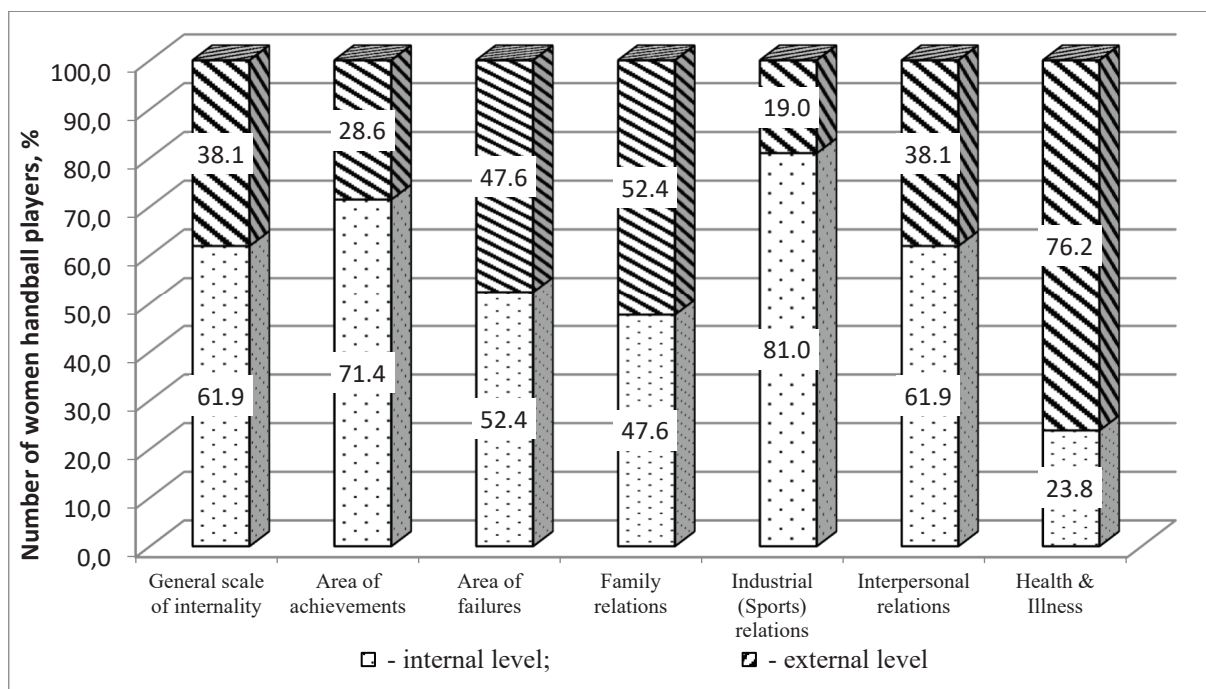


Figure 1. Distribution of women handball players according to the obtained score in the research method of the level of subjective control (LSC) by J. Rotter, n = 21

Athletes demonstrate internality in those areas that can be directly related to the specifics of sports and team activities: achievements, industrial and interpersonal relationships. Externality is manifested when women handball player believes that what happens to her does not depend on her, but is the result of external causes (for example, accident or other person’s intervention), namely: the field of family relations, health and illness.

The RMO test allows assessing the sensitivity of the athlete to time constraints. Stability indicators and directions of errors are used together with accuracy

indicators. Directions of errors indicate the tendency to be late or in a hurry and characterize the degree of sensory excitation. The response to a moving object reveals individual features of the organization of the human nervous system: with the predominance of the excitatory process there is an increase in the number of premature responses, with the predominance of the inhibitory process an increase in the number of delayed responses. The test results allow counting the number of accurate responses, delayed responses and anticipation. The coefficient of balance (CB) was defined as the ratio of the total delay

time to the total modulus lead time. The stability of the responses was assessed by the standard deviation (SD) of the difference between the real responses from the ideal: high variation of the response time at $SD > 60$; the average variation of the response time at $30 \leq SD \leq 60$; low variation of response time at $SD < 30$ [5].

In our studies, elite women handball players showed a high variation in response time and a predominant shift in the balance of nervous processes towards excitation (Table 1), which may be a sign of existing stress [11]. The ratio of advancing and delay responses in RMO is usually associated with the typological properties of the nervous

system and is considered as a sign of balance or imbalance of nervous processes [9, 22]. Other authors believe that the RMO method allows determining only individual differences in the accuracy of sensorimotor response and the predominance of excitation or inhibition processes [9, 24]. According to the results of previous studies, the prevalence of anticipatory responses in students over delayed responses in the RMO corresponded to a higher level of existing stress [11].

As a result of the study, the correlation matrix of parameters of psychological diagnosis of elite women handball players was determined (Table 2).

Table 2

Correlation matrix of parameters of psychological diagnosis of elite women handball players (n = 21)

Parameter	General scale of internality	Area of achievements	Area of failures	Family relationships	Industrial relations	Interpersonal relationships	Health and illness	Coefficient of balance of nervous processes	Scatter of time response to moving object
General scale of internality	1.00	0.68	0.73	0.70	0.25	0.56	0.39	-0.57	-0.26
Area of achievements	0.68	1.00	0.17	0.41	0.18	0.40	0.27	-0.52	-0.15
Area of failures	0.73	0.17	1.00	0.81	-0.11	0.45	0.20	-0.45	-0.35
Family relationships	0.70	0.41	0.81	1.00	-0.14	0.19	0.07	-0.57	-0.49
Industrial relations	0.25	0.18	-0.11	-0.14	1.00	0.17	-0.03	0.05	0.08
Interpersonal relationships	0.56	0.40	0.45	0.19	0.17	1.00	0.23	-0.15	-0.30
Health and illness	0.39	0.27	0.20	0.07	-0.03	0.23	1.00	-0.45	0.39
Coefficient of balance of nervous processes	-0.57	-0.52	-0.45	-0.57	0.05	-0.15	-0.45	1.00	0.00
Scatter of time response to moving object	-0.26	-0.15	-0.35	-0.49	0.08	-0.30	0.39	0.00	1.00

The coefficient of balance of nervous processes in the high skilled women handball players has negative correlation with the general internality ($r = -0.57$; $p < 0.05$), internality in the field of achievements ($r = -0.52$; $p < 0.05$), failures ($r = -0.45$; $p < 0.05$), and family relationships ($r = -0.57$; $p < 0.05$), health and illness ($r = -0.45$; $p < 0.05$). The variation of the response time to a moving object, which was demonstrated by women handball players, has negative correlation with the locus of control in the field of family relations ($r = -0.49$; $p < 0.05$).

Thus, the more pronounced the internal locus of control, the smaller the coefficient of balance of nervous processes that is smaller shift of the balance of nervous processes towards inhibition and greater shift of the balance of nervous processes towards excitation. Higher stability of responses of athletes in the RMO is also associated with a more pronounced internal locus of control, but only in the field of family relations.

DISCUSSION

Elite-level sport requires greater responsibility not only from athletes but also from coaches, scientists, and sports psychologists [31]. Elite players have to overcome more problems, as they are aimed at maximum athletic performance, which depends, among other things, on optimal well-being, stress resistance and other personal characteristics [1]. Of particular importance is a comprehensive study of psychological and psychophysiological characteristics of women handball players, the use of a comprehensive approach to assessing general and special physical and psychological preparedness, taking into account the state of psychophysiological functions of athletes to develop practical recommendations for improving their competitive activity [13]. For handball players, taking into account psychological and psychophysiological

characteristics is certainly important to ensure the quality of technical and tactical interaction in the play situation [18].

Handball is a situational sport with a pronounced risk of injury, which requires a high level of strength and mobility of nervous processes, the resistance of the central nervous system to interference in conditions of significant nervous and emotional tension, control and self-control [20, 18, 19].

Our research indicators of the inverse correlation between internality and the characteristics of the response to the moving object of elite women handball players is confirmed by studies of other authors on the beneficial effect of internal locus of control on professional performance of athletes [31, 25, 16].

In general, from the point of view that the RMO indicators are indicators of the functional state of the central nervous system (CNS) [9], our result data indicate a more optimal functional state of the CNS of women handball players with internal locus control.

Locus of control can act as a coping resource [7, 10]. It was found that the internal locus of control is associated with a low level of anxiety, and the external one with a high one; in addition, an inverse relationship between locus of control and neuroticism was found [17]. This indicates that respondents with an internal locus of control are more stable in their behavior in situations that provoke anxiety and actualize personal anxiety. Internality allows a person to maintain a sense of control over the situation and his condition. It has been proven that the relationship between locus of control and anxiety depends on volitional self-control [7]. According to S. R. Maddi, control (as a component of vitality) acts as a buffer between stress and personal response to it [23]. However, along with this, the phenomenon of «heaviness of responsibility» is known in the scientific literature, which manifests itself in a sharp increase in anxiety with an internal locus of control. This may indicate that internality «loses» its resourcefulness under certain conditions: relationships between internality and anxiety are evident only at a low level of self-control. In the case when a person has developed self-control, such a connection is broken. Therefore, the locus of control can act as a coping resource only under certain conditions, precisely in the structure of self-regulation of the individual [7].

It can be assumed that the obtained results regarding the relationship between the indicators of the balance of the nervous processes of elite handball women players and the localization of control can be explained to some extent by the phenomenon of «heaviness of responsibility» under the internal locus of control. A shift in the balance of nervous processes towards excitement with an increase in internality in the examined female athletes may be associated with an increase in anxiety and stress levels,

which in turn may be mediated by a reduced level of self-control in some female athletes. However, these assumptions require further research.

At the same time, there is a question of psychological correction of athlete's personal qualities, which affect the athlete's ability to demonstrate a high sports result. Scientific publications show the positive impact of psychological training to increase the self-esteem of athletes [29, 26], confidence, motivation of athletes, emotional intelligence [27]. In particular, the positive impact of mindfulness training and locus of control on self-efficacy for elite football players has been reported [31].

Thus, experience in sports psychology gives grounds to argue about the feasibility of using techniques to correct individual psychological qualities in the practice of training elite women handball players, which will improve their sportsmanship [31].

The development of the adapted psychological profile of the athlete is achieved with the help of techniques: self-regulation, self-training, meditation (coach ability), positive attitude and attitude to success; maintaining a sense of general psychological well-being; the ability to learn, as the ability to perceive the content of new information without emotional evaluation or feelings about the form of its presentation (for example, criticism of the coach); positive adaptation to the stress; general welfare (a set of socio-economic, cultural, living conditions of an individual) [1].

CONCLUSIONS

1. A correlation has been established between the internal nature of control locus and the ratio of nervous processes (inhibition and excitation) in elite women handball players.
2. Higher stability of women handball player's responses to a moving object is associated with a more pronounced internal locus of control, but only in the field of family relations.
3. The results indicate a more optimal functional state of the central nervous system of women handball players with internal locus control.
4. Family relationships and health and illness are the most sensitive areas for women athletes, this provides a basis for gender mainstreaming in psychological support activities.

CONFLICTS OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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Резюме

ВЗАЄМОЗВ'ЯЗОК ПОКАЗНИКІВ БАЛАНСУ НЕРВОВИХ ПРОЦЕСІВ З ЛОКАЛІЗАЦІЄЮ КОНТРОЛЮ У ЕЛІТНИХ ГАНДБОЛІСТОК

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Вступ. Проблема пошуку психологічного ресурсу спортсмена залишається актуальною. Успіх у спорті багато в чому залежить від індивідуально-психологічних особливостей спортсмена. Багато авторів на основі досліджень роблять висновок, що внутрішній локус контролю позитивно впливає на результативність у командних і некомандних видах спорту. Цікавою науковою проблемою видається вивчення гендерного аспекту цієї проблеми.

Мета дослідження: встановити зв'язок між локусом контролю та особливостями реакції на рухомий об'єкт елітних гандболісток.

Матеріали та методи. У дослідженні взяли участь спортсменки жіночої збірної України з гандболу (21 гравець віком від 17 до 28 років, стаж у цьому виді спорту від 5 до 19 років). Для вивчення локусу контролю спортсменів над значущими подіями була використана методика дослідження рівня суб'єктивного контролю (РСК) Дж. Роттера. Для визначення особливостей реакції спортсмена на рухомий об'єкт використовувався програмно-технічний комплекс психолого-психофізіологічної діагностики «БОС-тест-Професіонал».

Результати: Дослідження інтернальності виявило, що більшість кваліфікованих гандболістів (61,9%) мають загальний внутрішній тип локусу контролю. Переважна більшість спортсменів схильні брати на себе відповідальність у сфері продуктивних (спортивних) стосунків (81%), сфер досягнень (71,4%) і невдач (52,4%). Однак у таких сферах, як сімейні стосунки, здоров'я та хвороба, більшість спортсменів поділяють відповідальність із соціальним оточенням і відчують нездатність контролювати зовнішні обставини. Виявлено кореляцію між інтернальністю локусу контролю та співвідношенням нервових процесів (гальмування та збудження) у гандболісток елітного рівня. Більш висока стійкість реакцій спортсменів на рухомий об'єкт пов'язана з більш вираженим внутрішнім локусом контролю, але тільки в сфері сімейних відносин. Отримані дані свідчать про більш оптимальний функціональний стан центральної нервової системи спортсмена з внутрішнім локусом контролю.

Висновки: сімейні відносини, здоров'я та хвороба є найбільш чутливими сферами для жінок-спортсменок. Цей факт є основою для впровадження гендерного мейнстрімінгу в діяльність психологічної підтримки.

Ключові слова: локус контролю, інтернальність, реакція на рухомий об'єкт, баланс нервових процесів.