

Construction and comparison of mental resource complexes of male and female sports teams

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Abstract:

The purpose of the study is to justify the methodology for developing complexes of mental resources (CMR) for sports representatives by comparing CMR male and female sports teams. The male sample included football (n=108) and volleyball (n=58) teams, meanwhile, the female sample included handball (n=38) and volleyball (n=55) teams. **Research Methods:** valid test methods with standard survey forms; factor analysis; criterion and reliability coefficients of the empirical data array. **Results.** The methodology for developing complexes of mental resources in athletes is substantiated, and an algorithm for operations is proposed. ANOVA factor analysis was used to discover the most loaded parameters of all CMR. The CMR of male and female sports samples is represented graphically. F1 “Value-Meaningful” (DG1=24.01%; DG2=10.67%) and F2 “Pragmatically-Moderate” (DG2=24.25%; DG1=13.12%) are the most loaded CMR factors. Significant differences in the samples were found between the “Value-Meaningful” (t=3.2; p<.01); “Pragmatically-Moderate” (t=-2.9; p<.01) and “Procedural” (t=2.1; p<.05) factors. The factors that comprise the value-meaningful core are proven as the basis of the CMR of the male sample. It should be mentioned that the purpose of sports activities for male athletes is physical energy and “inner strength”, which allow them to overcome challenges, recover, and not break down. It was established that the CMR of the female sample is founded on pragmatism and moderation. The predominance of the pragmatic component in female sample representatives is assumed because the multifaceted nature of women consists in a female’s ability to create a family, give birth to children, and be in competitive sports shape in a relatively short period of time, which requires more time and psycho-emotional resources than men. **Conclusions.** The development of mental resource complexes enables the identification of major differences, the identification of athlete growth indicators, and serves as the basis for the development of work programs aimed at strengthening mental resources.

Key words: mental health, mental resource, coping strategy, defense mechanism, tactical and technical training, mental state.

Introduction

Today’s world is characterized by an unstable, politically crisis-ridden, and complex socioeconomic situation. As a result, as subjects of sports life who are responsible for their own choices and effectiveness, sports representatives face unique challenges. As reality shows, some athletes remain at the forefront of sports fighting despite difficulties and traumatic situations, whereas others who are not even close to enduring such challenges appear to give up, break down, and lose their sports zeal and desire to fight. As a result, such athletes have no joy in life and make life difficult for other sports subjects.

The answer to the described problem is found in the athlete’s “inner strength”. This directs the author’s team to continue looking for the problem of the athlete’s mental resources, which allow them to consistently achieve high results. Individual sports representatives clearly need mental resources to achieve a winning result, successfully overcome life’s difficulties, stresses, and injuries, endure extreme and chronic trials, feel satisfaction from life, and be the master of their own life. Such articulation of the outlined issues motivates us to study mental resource complexes to develop an algorithm for establishing dominant CMR in specific situations.

The essence of the concept of “psychological resource” has been revealed in scientific literature, which is a tool for ensuring the realization of life-creating functions, allowing you to solve current and global issues of your own existence (Datsenko, 2020). Positive psychology has traditionally studied the issue of mental resources as “positive personality traits” (Csikszentmihalyi & Nakamura, 2011). Internal strengths, according to research, increase a person’s value in the eyes of others, making them more successful, productive, and sustainable. E. Fromm (1993) investigated the mental resource in the context of personal striving for the pinnacles of existence

and overcoming adversity. According to the scientist, the mental resource encompasses three fundamental personal values: hope, rational faith, and mental strength (courage). Hope looks to the future and helps to determine prospects for self-development and life growth. Rational faith is the awareness of the existence of numerous opportunities and the need to seize these opportunities as soon as possible, whereas mental strength is the ability to face challenges that threaten the realization of fundamental values (Fromm, 1993). What is hope, according to E. Fromm (1993), is defined as social expectations of an athlete, which are their regulatory capacity and prediction of the likely course of events and behavior of all involved subjects of sports activity in a number of sports studies by I. Popovych et al. (2020b; 2020c; 2021b). Without a doubt, the athlete's mental resources will be influenced by their awareness of the likely course of events, the expected attitude toward other competitors, and the expected outcome of sports activities (Popovych, 2014; 2015).

There is also the concept of "psychological resource" in addition to "mental resource". L. Kulikov (2004) defines a psychological resource as "individual properties and abilities that allow an athlete to maintain and develop their own activity while ensuring psychological well-being through the conceptualization of conditions, needs, and their own mental capabilities". Resources are mechanisms that influence how people perceive, evaluate, and interpret external and internal space. Under certain conditions, particularly unfavorable or uncertain ones, the importance of dominant individual properties and abilities becomes crucial (Kulikov, 2004). We come to the conclusion that the complex of mental resources under consideration is an integral formation based on internal and external factors that enable an individual to be effective and aware of their existence.

A number of modern sports studies have addressed the issue of mental resources and the interdependence of the factors that influence these resources. It is worth noting research on the mental health and identity of young athletes (Miller & Hoffman, 2009). Participation in sports and athlete identity improve mental and social development, lowering the risk of depression and suicidality. This study confirms the findings of M. Grasdalsmoen et al. (2022) who investigated the mental health of elite student-athletes. Despite excessive workloads, female athletes who trained more than fourteen hours per week reported lower mental health, although elite male and female athletes had better mental health than the average population on most criteria (Grasdalsmoen et al., 2022). Pluhar et al. (2019) discovered that athletes who participate in team sports are less likely to experience anxiety or depression than individual athletes. It is evident that team sports have a particular mental resource regarding anxiety and depression due to interpersonal connection, communication, mutual help, and mutual support. Purcell et al. (2019) draw attention to the development of literacy, regarding mental health or awareness of the signs of mental disorder among athletes. The authors consider that raising awareness is insufficient, therefore they propose a new intervention model and define a new complete system to support athletes' mental health and well-being. As a result of this complicated structure, a culture of sporting activities will emerge. The new culture must understand that the mental health requirements of athletes are equally as essential as their physical health demands. According to studies, such a combination will help the optimization of overall well-being in conjunction with excellent sports performance (Purcell et al., 2019). Admittedly, a lot of sports studies deal with resilience list attributes and abilities that are key to competitive performance (Bonanno & Burton, 2013; Southwick et al., 2014). The athlete's mental resources are constantly linked to his or her energy. S. Maddi (1994) established that resilience, as measured by aspects such as perception of problems, engagement, and control, enables a person to overcome tough, unpredictable, and stressful situations. The athlete has a range of behavioral scenarios under tough conditions, which R. Lazarus and S. Folkman (1984) defined as coping strategies. Dominant coping strategies are the result and consequence of the latter's developed properties and abilities. S. Hobfoll (1998), in particular, attempted to completely explain the function of mental resources as a mechanism of coping behavior in the resource concept of stress. When people believe they are losing resources to oppose the situation that has evolved, or that they have already been lost and are impossible to recover, they are suffering stress. As a result, surviving a stressful circumstance is feasible through the restoration of lost resources (Hobfoll, 1998). So, the problem of mental resources, namely the development of an algorithm for optimally integrating them into a complex of mental resources, is of great relevance.

The authors conducted a variety of empirical studies that are directly relevant to the mental resource complex. In a study of athletes' mental states (Popovych et al., 2019b; 2021e; 2022e), dominating mental states were identified and characterized, and a factor structure was constructed. Important scientific facts have been revealed in research on vitality and emotional stability content characteristics (Popovych et al., 2021a; 2022b). Several research have revealed the essence of the adaptation resource, which is identical to the mental resource during the phases of sports activity accommodation and assimilation (Blynova et al., 2019; 2022). Psychological well-being and mental health were also the subjects of the author's search (Popovych et al., 2021d; 2022c).

The retrospective analysis, as well as previous empirical and experimental investigations of mental states, emotional stability, content dimensions of psychological well-being, and mental health, give grounds for establishing the key category of research. Under the complexes of mental resources of an athlete, we understand the optimal integration of mental states, processes, and properties of their efficiency and awareness of life.

Hypotheses. We assume that the development of complexes of mental resources for sports teams will contribute to the quality of training of coaching staff and athletes in the context of tactical and technical training;

a comparison of mental resource complexes for male and female sports teams reveals significant differences in the level of load and factor structure.

The purpose is to justify the methodology for developing complexes of mental resources for athletes; to compare the complexes of mental resources of male and female sports teams.

Material and methods

The following conceptual beginning points comprised the methodology of the research of complexes of mental resources (CMR): 1) The athlete's own aspiration to the pinnacles of existence and conquering adversity in life is their mental resource (Fromm, 1993); 2) The athlete's expected regulatory capacity is the ability to build a model of the expected future, which influences the efficiency and quality of their action (Popovych, 2017); 3) Athlete stress, which is an awareness of the impact of extreme indicators, happens when they believe they are running out of resources for countermeasures (Hobfoll, 1998); 4) Mental resources, such as resilience, acceptance of challenges, inclusion, and control, enable athletes to overcome extreme situations (Maddi, 1994).

The experience of experimental studies of sports (Popovych et al., 2021c; 2022d), competitive (Popovych et al., 2021f), educational and professional (Hudimova, 2021; Huias, 2020; Huias & Hoian, 2022; Huias & Karpenko, 2022; Kobets et al., 2021a; 2021b; Popovych et al., 2021g) and similar activities in terms of content and organization (Nosov et al., 2021a; 2021b; Plokhikh, 2021; Zinchenko et al., 2021; 2022a; 2022b) is taken into account while developing the research ascertaining strategy. The organization of research relevant to the establishment of a safe place has received special attention (Mamenko et al., 2022; Popovych et al., 2020a; Zinchenko et al., 2020). The algorithm developed for the analysis of mental resource complexes qualitatively represented the subject of the study, with the purpose of taking into consideration the optimal list of significant parameters.

Participants. Football (n=108) and volleyball (n=58) teams represented the male sample. The teams presented range from the Championship of Ukraine's premier league to regional championship teams. The male sample ranged in age from 15 to 38 years old (M=21.73). Teams playing handball (n=38) and volleyball (n=55) were both represented in the female sample. The teams presented range from the Ukrainian Handball Championship's Super League to the regional championship. The female sample ranged in age from 14 to 35 years old (M=20.15).

Organization of research. The declarative research strategy was implemented from August to November 2021. Priority was given to principled matches since here is where the athletes' mental resources were shown to be most important, according to the specifics of our research. All participants' results are processed, including winners, losers, and those who played in a draw. Empirical data was collected before the games. Permission was acquired from coaching staff, club administrations, event organizers, and ethical committees of professional sports federations.

Procedures and instruments. The "Hardiness Survey" ("HS") (Maddi, 1994) was defined as the basic method of the research of complexes of mental resources in the research methodology. D. Leontiev and E. Rasskazova (2006) adapted a version of the method that was used. The method's four scales were all relevant. The "Level of Social Expectations of a Sportsman" ("LSES") (Popovych, 2017) questionnaire was the next method. The method's three main scales were also relevant. The "Way of Coping Questionnaire" ("WCQ") coping test was used. An adapted version of the questionnaire edited by T. Kriukova and Ye. Kuftiak (2007) was used. The method's eight scales were relevant. The "Level of subjective control" ("LSC") (Rotter, 1966) questionnaire was used. The adapted version of the questionnaire edited by E. Bazhin, E. Golyukin, and A. Etkind (1984) was taken into consideration. General Internality (GI) was the only integral scale used. The "Purpose in Life Test" ("PIL") (Leontiev, 2006) was the next psychodiagnostic method in our research. The method's main scales were relevant. Three scales based on the 16 PF Cattell test (2014) were used. We consider that the selection of scales: Emotional Stability (C), Sensitivity (I), and Liveliness (F) significantly supplements the list of relevant mental resource parameters. The "Motivation to Succeed" ("MS") (Elers, 2002) questionnaire was the next method. One scale was used. "The Scales of Psychological Well-being" ("SPW") were the final method (Ryff, 1989). An adapted version of the method edited by T. Shevelenkova and P. Fesenko (2005) was used. The method's integral scale – "Psychological Well-being" (PW) – was relevant. The coefficient of reliability of empirical data α -Cronbach of all implemented psychodiagnostic methods was between .805 and .945, corresponding to medium and high levels and matching the requirements for a massive proportion of empirical data.

Statistical analysis. The empirical array of data was processed using the software "SPSS" v. 23.0. The strength of associations with the fundamental parameters of mental resource complexes was determined using Spearman's coefficient (rs). The proportionality of the list of selected parameters was reduced using ANOVA factor analysis. In accordance with the requirements for this level of research, the relevant criteria and reliability coefficients were applied. Differences of $p \leq .05$ and $p \leq .01$ were considered reliable.

Results

The empirical data array was analyzed, and standard descriptive frequency characteristics were determined. The obtained arithmetic mean (M) and mean square deviation (SD) indicators were within the norms provided by the methods' authors (Kriukova & Kuftiak, 2007; Leontiev, 2006; Leontiev & Rasskazova, 2006; Popovych, 2017) and showed no significant differences from actual data acquired by the authors in previous sports research (Hudimova et al., 2021; Popovych et al., 2019a; 2022a).

Using the Spearman coefficient (rs) as well as the methodology of constructing complexes of mental resources (CMR), a correlation matrix of the fundamental parameters "Hardiness" (HR), "Commitment" (CM), "Control" (CN) and "Challenge" (ChL) (Maddi, 1994) was established with all other parameters that were factors of mental resources (Tabl. 1).

Table 1. Correlation matrix of fundamental parameters with mental resources' factors

Scale	Hardiness		Commitment		Control		Challenge	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
AEESA	.086*	-	.186*	.196*	.106*	.096*	-	-
EATPSA	.096*	.101*	-	-	.086*	.109*	.085*	.091*
ERSA	.085*	.087*	.093*	.098*	.185*	.157*	.099*	.101*
CNF	-	-	-.087*	-.091*	-	-	.097*	.090*
D	-.216**	-.236**	-	-	-	-	-	-
SC	.133*	.123*	.143*	.113*	.337**	.321**	-	-
SSS	.211**	.204**	.111*	.156*	.110*	.106*	.141*	.125*
AR	.138*	.086*	.188*	.189*	.189*	.166*	.098*	.089*
A	-	-	-	-	-.089*	-.093*	-	-
PSP	.186*	.145*	.186*	.145*	.196*	.185*	.096*	.095*
PO	-	-	-	-	.087*	.092*	.121*	.132*
GI	.143*	.183*	.097*	.089*	.271**	.234**	.094*	-
LG	.233**	.183*	.133*	.123*	.283**	.223*	.101*	.093*
P	.103*	.113*	.143*	.193*	-	-	-	-
R	.185*	.165*	.085*	.095*	.145*	.115*	.084*	.085*
LSC	.095*	-	-	-	-	-	.193*	.141*
LLC	.113*	.143*	.093*	.148*	-	-	-	-
C	.133*	.093*	.103*	.091*	.123*	.113*	-.087*	-.092*
I	-	.085*	-	-	-	-	-	-
F	.098*	.093*	-	-	-	-	.133*	.133*
MS	.231**	.189*	.130*	.088*	.238**	.219**	.230**	.188*
PW	.171*	.198*	-	-	.097*	.093*	-	-

Note: Group 1 – male sample; Group 2 – female sample; * – $p \leq .05$; ** – $p \leq .01$; AEESA – Awareness of the Expected Events of Sports Activity; EATPSA – Expected Attitude Towards the Participants of Sports Activity; ERSAs – Expected Result of Sports Activity; CN – Confrontation; D – Distantiating; SC – Self-Control; SSS – Seeking Social Support; AR – Accepting Responsibility; A – Avoidance; PSP – Planning to Solve a Problem; PO – Positive Overestimation; GI – General Internality; LG – Life Goals; P – Process; R – Result; LSC – Locus of Self-Control; LLC – Locus of Life-Control; C – Emotional Stability; I – Sensitivity; F – Liveliness; MS – Motivation to Succeed; PW – Psychological Well-being.

The next step involved ranking (R) of the data, and the strongest correlations between ten parameters – factors of mental resources for each of the studied groups – were determined (Tabl. 2).

Table 2. Ranking of factors of Group 1 and Group 2 mental resources

R	Group 1	Group 2
1	SC (.337**)	SC (.321**)
2	LG (.283**)	GI (.234**)
3	GI (.271**)	LG (.223**)
4	MS (.238**)	D (-.236**)
5	D (-.216**)	MS (.219**)
6	SSS (.211**)	SSS (.204**)
7	LSC (.193*)	AEESA (.196*)
8	AR (.189*)	P (.193*)
9	PSP (.186*)	AR (.189*)
10	AEESA (.186*)	PSP (.185*)

Note: R – ranking (ten ranks of the strongest correlations); * – $p < .05$; ** – $p < .01$; Group 1 – male sample; Group 2 – female sample.

It was found that nine mental resources factors were identical between Group 1 and Group 2. They differed by the presence in Group 1 – LSC (.193*), and in Group 2 – P (.193*). It was established that the placement of parameters by ranks had minor differences. Factorial ANOVA analysis was conducted on a set of fundamental and rank-selected examined parameters to determine the factors of the mental resources complex of Group 1 and Group 2 (Tabl. 3).

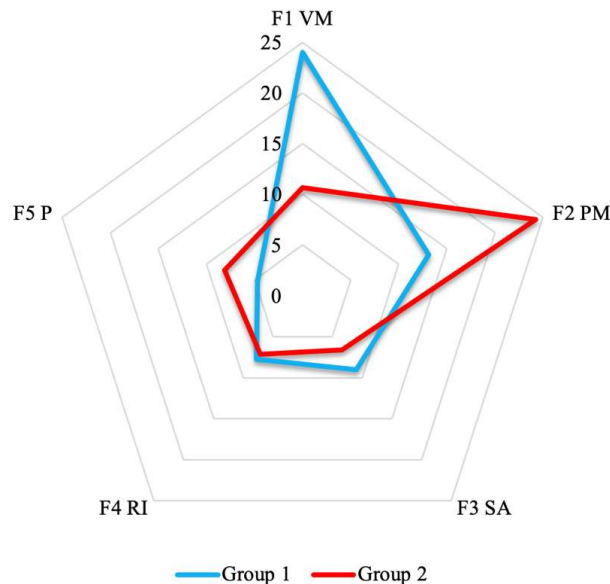
Table 3. The results of determining the factors of the mental resources complex of Group 1 and Group 2

Group 1 (n=166)				Group 2 (n=193)			
Factors	V	D	ΣD	Factors	V	D	ΣD
F1 “Value-Meaningful”	7.342	24.01	24.01	F1 “Pragmatically-Moderate”	8.790	24.25	24.25
F2 “Pragmatically-Moderate”	4.034	13.12	37.12	F2 “Value-Meaningful”	4.374	10.67	34.92
F3 “Socially Acceptable”	2.923	9.01	46.14	F3 “Procedural”	3.231	8.12	43.04
F4 “Remotely-Isolated”	2.199	7.76	53.90	F4 “Remotely-Isolated”	2.941	7.14	50.18
F5 “Procedural”	1.081	4.67	58.57	F5 “Socially Acceptable”	2.367	6.59	56.77

Note: Group 1 – male sample; Group 2 – female sample; V – value; D – dispersion; ΣD – sum dispersion.

According to the loadings of essential parameters, the same number of factors were generated in Group 1 and Group 2. The sum dispersion in Group 1 was made up of five factors with eigenvalues greater than one ($\Sigma D = 58.57\%$). Group 2 likewise had five components with values greater than one, which made up the sum dispersion ($\Sigma D = 56.77\%$). We consider that the psychodiagnostic complex of fourteen components (four fundamental and ten ranked) was methodologically justified and relevantly reflected the subject of the research.

The mental resource complexes of Groups 1 and 2 are shown graphically in Figure 1.



Note: Scale D (Dispersion) – 0-25; Group 1 – male sample; Group 2 – female sample; F1 VM – Value-Meaningful; F2 PM – Pragmatically-Moderate; F3 SA – Socially-Acceptable; F4 RI – Remotely-Isolated; F5 P – Procedural.

Figure 1. Mental resources complexes of Group 1 and Group 2

The differences between Group 1 and Group 2 mental resource complexes were clarified. It was determined that there was a significant difference between the data in F1 VM ($t=3.2$; $p\leq.01$); F2 PM ($t=-2.9$; $p\leq.01$); F5 P ($t=2.1$; $p\leq.05$) using the Student's t-test. In the comparison of F3 SA and F4 RI, no significant differences were found. The established differences we explained by the fact that the factors that composed the value-meaningful core were the foundation of the male sample's complex of mental resources (Group 1). Obviously, the meaning attached by the male sample representatives was physical energy and "inner strength" that helped to overcome obstacles, recover, and not break down. Accordingly, the female sample's complex of mental resources (Group 2) was founded on pragmatism and moderation. We explained this by the multidimensional aspect of female nature since a woman must be able to form a family, give birth to children, and be in competitive sports shape in a relatively short period of time, which demands more time and psycho-emotional resources than males. As a result, we assume that the pragmatic component might predominate among female sample representatives. The fact that the procedural component dominated the result component in female sports explained the F5 P ($t=2.1$; $p\leq.05$) factor's dominance. We did not consider this as a disadvantage, but rather an advantage, because, as experience has shown, the result comes from high-quality process execution. We recommend that the analyst, sports psychologist, and team coaching staff consider the documented facts. The construction of the CMR in one team will be especially valuable for comparing data between the main team, backup team, and juniors. This will allow the identification of significant differences, the identification of growth markers in athletes, and the development of a work program aimed at strengthening mental resources.

Discussions

There were no experimental sports studies that comprehensively examined mental resources that we could find. There are theoretical works that analyze mental resource paradigms (Datsenko, 2020), substantiate the nature of mental resource values (Fromm, 1993), and present the resource concept of coping with stress (Hobfoll, 1998). There is also a substantial body of empirical research that establishes the interrelationships of mental resource factors. The interrelationship of the parameters on which the improvement of student youth mental health is dependent is specifically investigated (Popovych et al., 2022c). The researchers found positive changes ($p<.01$) in the experimental groups in the parameters "Self-Acceptance", "Psychological Well-being", "Integral Level of Self-regulation", "Life Satisfaction Index", and "Evaluation of Activity Results", which are broadly similar to the results obtained by us from the correlation matrix of fundamental parameters and factors of mental resources (see Tabl. 1). Popovych et al. (2021a) found a strong relationship between "Control" ($p < .05$) of parachuting sports representatives and yoga representatives and dispositional vitality parameters in another study. In the current study, we identified "Control as one of the relevant CMR parameters. A study of mental well-being and relevant parameters influencing athlete performance (Miller & Hoffman, 2009) has tangential results to those established in our study (see Tabl. 2). The list of works describing specific factors and revealing their roles can be expanded. They all confirm the validity of our research's parameters selection.

Without a doubt, the study's findings may be influenced by the initial list of relevant factors identified by the researchers. The level of qualification of those organizing the research is important in this context. Sports teams that compete in international tournaments, as well as world championships and national championships, should have a strong analytical department. The following operations must be performed by the specialists in this department for the empirical processing of the algorithm outlined by us: 1) a retrospective analysis of sports literature with the objective of determining relevant parameters; 2) selection of basic CMR parameters; 3) selection of valid psychodiagnostic methods that will allow objective measurement of the selected parameters; 4) construction of a correlation matrix; 5) ranking by the level of significance of correlations; 6) factor analysis of fundamental and ranked parameters; 7) construction of a mental resource complex. Another point to consider is comparing the resulting CMR to similar, simulated, pre-built CMR.

At the same time, we state that the factors we discovered: "Value-Meaningful", "Pragmatically-Moderate", "Socially Acceptable", "Remotely-Isolated" and "Procedural" are supported by our previous works (Popovych et al., 2019a; 2019b) and the works of other researchers (Marcora et al., 2009; Prokhorov et al., 2015). Furthermore, the content characteristics of the factors obtained by us are consistent with the findings of a study on the regulatory function of human mental states (Silvia et al., 2009; Thoman et al., 2011).

The obtained empirical results support the hypothesis that the construction of complexes of mental resources for sports teams will enhance the quality of the coaching staff's and athletes' tactical and technical training. It has been empirically established and substantiated that the CMR of male and female sports teams differs significantly in terms of workload and factors' structure.

Conclusions

1. An athlete's complex of mental resources (CMR) is the optimal integration of mental states, processes, and properties of effectiveness and life awareness.
2. The methodology for constructing CMR for athletes is supported. An algorithm that combined the following operations was proposed: 1) retrospective analysis of sports literature with the objective of determining relevant parameters; 2) the selection of basic parameters; 3) the selection of valid psychodiagnostic

methods that will allow objective measurement of the selected parameters; 4) the construction of a correlation matrix; 5) ranking by the level of significance of correlations; 6) factor analysis of fundamental and ranked parameters; 7) the construction of a complex of mental resources. Another point to consider is comparing the resulting CMR to similar, simulated, pre-built CMR.

3. CMR Groups 1 and 2 were graphically represented. F1 VS ($t=3.2$; $p \leq .01$); F2 PM ($t=-2.9$; $p \leq .01$) and F5 P ($t=2.1$; $p \leq .05$) showed significant differences. It is substantiated that the factors that comprise the value-meaningful core form the foundation of the CMR of the male sample. For male athletes, sports activities mean physical energy and “inner strength” that allows them to overcome obstacles, recover, and not break down. The CMR of the female sample is based on pragmatism and moderation. The versatility of female nature is a woman’s ability to start a family, have children, and be in competitive sports shape in a relatively short period of time, whereas men require more time and psycho-emotional resources. An assumption was made as to why the pragmatic component might prevail among female sample representatives, which needs to be proven or disproven further.

4. In general, CMR construction allows for the establishment of significant differences, the determination of growth indicators of athletes, and the creation of a program of work on strengthening mental resources.

5. The research purpose was achieved, and both hypotheses were proven.

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