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Original Article

Work Capacity and Individual Differences of Elite Gymnasts In The Pre-Competitive Period

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Abstract

In this study, the issue of the dependence of work capacity on the individual differences of gymnasts during the pre-competitive training period was investigated. These characteristics aimed to determine their impact, dependence, and interaction on the work capacity of gymnasts, who are characterized by complex individual and personal properties. The personal and individual properties of 17 elite gymnasts were tested according to a unified psychodiagnostic methodology during a two-month pre-competitive period. Work capacity was assessed by absolute values (total number of elements, number of elements with increased difficulty, artistic compositions and number of executions for one minute). Based on the psycho-diagnostic examinations, indicators that characterize the personal differences of the gymnasts and that can directly affect the work capacity were obtained. In the complex, they had a positive impact on the volume and intensity indicators of the training efforts, which directly characterized the working capacity of the athletes.

1. Introduction

The issue of work capacity in modern artistic gymnastics is one of the most significant study subjects for the preparation of high-performance athletes. Addressing this issue can only be achieved by considering a series of complex information about the individual differences in athletes' bodies, as well as other specific differences in their activity. Therefore, there is a clear and significant interest from specialists in the field who study and research the work and effort capacity of

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athletes from individualized and personalized perspectives. Since the discipline of "Artistic Gymnastics" intersects multiple fields (Buftea, 2022; Grigore, 2001), specialists from areas such as physiology, medicine, psychology, genetics, and others are actively involved in studying athletes' work capacity with efficiency.

At present, numerous studies in gymnastics, as well as in other Olympic sports, have highlighted the meaning of the concept of "work capacity" (Cretu, 2012; Dorgan, 2008). Researchers are focused on identifying the factors that signify the level of development and increase of work capacity, and they are interested in elucidating relevant methods for diagnosing athletes' conditions, as well as all possible versions of training, developing, and establishing an optimal work capacity (Rozin Yu. 2004); (Buftea, 2017; Buftea, 2019). Recent research (using genetic methods) has demonstrated the genetic impact on the indicators of athletes' work capacity, specifically on the activity of the cardiovascular and respiratory systems (Grimalschi, 2011; Pașcan, 2003). These factual results have prompted specialists in the field to review certain conceptual positions in the theory and methodology of sports training, which has led to changes in the methodology of athlete selection and orientation, aiming to improve the training system (Platonov, 2015). Largely, these changes have proven useful in cyclic sports events, where achieving high performance results is only possible by attaining a superior level of functionality in the cardiovascular and respiratory systems.

Deciphering the issue of work capacity in women's artistic gymnastics becomes very difficult and complex, as it is determined by many factors. It is worth mentioning that, up to this point, the concept of "work capacity" has not been fully defined, where it is stated that it implies the ability to work long and intensively, overcoming various forms of fatigue (physical, sensory, mental, etc.) (Driss, Serrau, & Behm, 2014, Bučar, Čuk, Pajek, Karacsony, & Leskošek, 2014).

At the same time, in the theory and practice of artistic gymnastics, athletes' work capacity is understood as the ability to perform a certain volume of work (the number of elements, element combinations, sequences, and others) within a determined period of time.

In the same context, in women's artistic gymnastics, five key factors can be highlighted that determine athletes' work capacity (Potop, 2013; Chen et al., 2009) morphological differences, the state of the neuromuscular system, the state of energy systems, the condition of individual-psychological differences, and the external conditions in which the activity takes place.

Clearly, all these factors interact and depend on one another, despite the superiority of some (referring to their essential content). For now, it is complicated to determine the nature of the interdependence of both these key factors and other secondary factors that contribute to the real determination of athletes' work capacity (Reaboi, 2014; Chengliang, Weiya, Wei, Xiaofei, & Xuhong, 2019). Therefore, a standard model of "work capacity" at the highest level of qualification has not been outlined, and this suggests that the progression of the increase and development of the body's work capacity cannot be consistently determined. It is difficult to assess to what extent athletes' deficiencies in certain segments of the body are compensated

and offset, to what extent they can be regulated and perfected, and where the boundary set by the athlete's genotype lies, along with many other factors.

Currently, according to specialists in the field, psychological approaches that determine the work capacity of gymnasts, particularly their personal and individual characteristics, are also less studied (Potop, 2010; Cîmpeanu, 2012; Burt, Naughton, Higham, & Landeo, 2014).

The aim of the study is to investigate the possibilities of determining the dependency and influence of the work capacity of performance gymnasts on the factors characteristic of their individual and personal properties during the pre-competition period.

The study objectives are:

1. To analyze the theoretical-scientific and methodological approaches to sports training in women's artistic gymnastics through the lens of synthesizing and generalizing data provided by specialists in the field regarding effort, performance, and work capacity.
2. To identify the individual and personal characteristics of athletes that have a direct influence on their work capacity in relation to preparing gymnasts for competition.
3. To determine and substantiate the conditioning factors of work capacity based on the individual and personal characteristics of athletes.

In the context of the aforementioned points, it is also necessary to:

- state the value of the interdependence between individual characteristics and the work capacity of athletes during the pre-competition phase;
- clarify the essential possibilities regarding the interaction between these two components and establish analytical approaches concerning methodological aspects based on principles in structuring and content of training activities;
- synthesize the materials into a recommended informational spectrum regarding the directed essence of the training process, which can form the basis for aligning individual characteristics with the work capacity of athletes in order to achieve maximum preparation efficiency.

2. Material and methods

This study involved researching aspects that characterize the interaction between the individual differences of regular performance gymnasts and the training efforts, which collectively define work capacity. It should be noted that most psychological studies, for example, are focused on the impact of athletes' individual characteristics on the differences in functional and physiological states during gymnasts' activity in so-called "critical conditions," which typically occur during sports competitions. Such research is undoubtedly crucial for a technical sport like artistic gymnastics.

However, a much more particular interest is the study of the athletes' individual and personal aspects within the training process. The current level of development in women's artistic gymnastics demands from athletes not only physical abilities but also significantly increased neuropsychological efforts. The role of psychological

factors is conditioned by the growing complexity and difficulty of executing gymnastic elements, as well as the need to master techniques directly related to high-risk executions, where the athlete must completely overcome fear and lack of confidence. Additionally, the numerous repetitions of the same exercises during training can eventually lead to monotony.

In this context, the hypothesis arises that gymnasts' work capacity depends on complex individual and personal traits. The interaction of these two components prompted the current study, in which the personal and individual characteristics of 17 performance gymnasts (12 masters of sport and 5 Olympic candidates, with an average age of 16) were tested using unified psychodiagnostic methodology. Moreover, the athletes' work capacity was studied over two months of the pre-competition period. Work capacity was assessed based on absolute measures (total number of elements, number of high-difficulty elements, artistic compositions, etc.), as well as relative indicators (the ratio of the quantity/volume of elements and combinations during the training process).

3. Results and Discussions

As a result of the psychodiagnostic examinations of the gymnasts, over 80 indicators were obtained, which characterize various personal differences among the athletes. The gymnasts demonstrated emotional agitation properties that, ultimately, were compatible with balanced nervous processes. It was observed that the inhibitory forces increased, ensuring exceptional self-control in movement activities. One of the remarkable differences among the gymnasts proved to be the development of a sense of responsibility, self-organization, and self-discipline. Additionally, a tendency was observed for the athletes to stand out as leaders, which could dominate other athletes and activated a general life attitude, including a tendency to overcome difficulties and adverse conditions.

The gymnasts' self-evaluation abilities also became significant. Most of them were able to improve their execution quality, demonstrating a tendency to learn something new and a desire to experiment independently. Along with these findings, various components of the gymnasts' mental state and activity were influenced by motivational differences regarding goal achievement. The following motivational differences were highlighted: the level or degree of motivation, which represents the tendency to activate and intensify efforts to achieve goals with the highest degree of efficiency; and the nature of the motivation, which is determined by the priority given to successfully accomplishing training activities, while also manifesting a tendency to disregard failure.

The motivational differences exceeded the average level of manifestation in athletes, aiming for the successful achievement of their objectives. In terms of assessing the increased degree of motivation (quantified as 15 conventional units), this motivation demonstrated more than double the dominance over the tendency to ignore failure (correspondingly 10 and 5 conventional units). Along with the high level of positive emotions experienced by the gymnasts, there was also an increase in dissatisfaction with themselves and their accomplishments. This dissatisfaction

served as a catalyst, stimulating the athletes to continually strive for the intensified improvement of their sports mastery.

These are some of the most significant personal and individual differences among the gymnasts. However, collectively, these differences had a positive impact on the volume and intensity indicators of training efforts, which directly characterized work capacity.

Table 1 presents the volume and intensity indicators of the training efforts for the gymnasts studied during the pre-competition phase of the training period. Attention is drawn to the variability coefficient characteristics, which highlight significant individual differences in the volume and intensity indicators of the training loads. In this regard, correlations between work capacity indicators and individual qualities were analyzed through correlation analysis. The analysis demonstrated that gymnasts with higher work capacity are those who manifested stronger motivational components for achieving their objectives and who experienced a continuous increase in dissatisfaction with their results, driving them to elevate their performance further.

These athletes are also characterized by a high degree of mental activation, which predominated in motor actions, alongside the intensification of intellectual efforts, emotional-volitional sphere, and relationships within the social environment. These gymnasts exhibited elevated general psychomotor tone, faster thinking processes, emotional excitement, quicker decision-making, improved mood, socialization, and initiative in mastering new and complex techniques. Additionally, a more pronounced level of differences in the central nervous system was observed, which facilitated the mobility of nervous processes, contributing significantly to the realization of these abilities.

Table 1. *Indicators of the volume and intensity of training efforts for performance gymnasts during the pre-competition phase of sports preparation (n=17)*

Work capacity indicators	**For 1 month**		**For 1 week**		**For 1 day**	
	x	***C %***	***x***	***C %***	***x***	***C %***
The quantity (number) of technical elements	6474	22	1113	62	253	17
Number of artistic compositions	180	10	33	32	10	23
Number of elements with increased difficulty level	1116	44	193	60	43	37
Number of elements performed within one minute	1,1	6	1,04	11	-	-

It can be assumed that such an association of individual-psychological characteristics and the differences and similarities between them has contributed to the acceptance of increased training efforts. This has become an essential factor that proves to be contradictory to the initial state and during the process of overcoming

neuropsychological and physical fatigue.

A particular interest is also shown in other results of this study. These refer to the impact or influence of the personal qualities of gymnasts on their ability to accept training efforts with a higher degree of emotional tension. Here, the interactions between physical-technical qualities and neuropsychological qualities are considered, which led to an increase in the volume of difficult elements performed and complicated exercises associated with risk, belonging to the higher difficulty level group.

Discussions

Applying a correlational analysis, it was demonstrated that greater neuropsychological resilience is observed in athletes with moderate tendencies toward achieving their goals, where both these qualities and the quality of maximum logical attention are pronounced in the environment. As a result, these gymnasts exhibited a lower state of alertness, which significantly activated all functions to overcome difficulties, specifically through this optimistic attitude.

They are characterized by an individual attitude of control and self-control, regardless of the opinions of others, and they also demonstrate a high level of self-organization and self-discipline. In these subjects, differences in a balanced nervous system were highlighted, constituting a particularly strong factor in the equilibrium of nervous processes. However, gymnasts who exhibit high alertness, insufficient work organization, and who struggle to overcome training efforts tend to learn new and complicated elements more slowly and less prominently (Cuk et al, 2007). In this context, it is evident that the results of the conducted study demonstrate the significant influence of individual qualities on the work capacity of gymnasts. At the same time, these results allow for the enhancement of the development and cultivation of other qualities that collectively enable the athlete to accept and maintain a high level of work capacity, even under significant emotional tension, as is the case during the pre-competition and competition periods. At the same time, the research on the work capacity of performance gymnasts raises the question of the causes of these issues and their dynamics. Additionally, in the interest of the study, an attempt was made to interact some dynamic characteristics of work capacity with the individual and personal differences of the gymnasts. The obtained data characterize a series of changes and modifications in the athletes' work capacity throughout the entire examination period. This data allows for the highlighting of various types of dynamics in work capacity that differ, primarily, in terms of deviations from the range of action. If the question arises as to whether personal, individual, and psychological differences can constitute the factor determining the dynamics of work capacity, the answer is that the correlational analysis of the results fully supports the idea of the dependence of the completed workload on the individual and personal qualities of the gymnast (Dallas, Tsopani, Smirniotoy, & Di Cango, 2014). Additionally, a more pronounced and uneven dynamic of training efforts is observed in athletes with a lower motivational level, where goal achievement is influenced by insufficient results. In these athletes, personal characteristics are conditioned by impulsivity, sudden drops in work mood,

emotional imbalance, and increased psychological distress, all leading to a decrease in overall and specific mental resilience. Contradictory aspects are also noted, indicating a pronounced tendency toward self-sufficient and independent behavior, unaffected by those around them, and a lack of desire to dominate or lead over others. Distrust of surrounding individuals is combined with certain naive characteristics, which may lead to a decrease in mental activity and engagement, where depressive states can emerge. These, in turn, can influence psychological states that condition the inadequacy of the execution technique quality of elements, including the overall work capacity.

4. Conclusions

Considering work capacity from these perspectives, it is acknowledged that such questions in the practice of training can only be raised under created critical conditions. Typically, the training process is not focused on the centralized study of these interactions. However, given the current conditions of athletes' preparation, which may push them to the limits of their bio-psycho-motor potential, such questions become regulatory mechanisms in achieving all training objectives: specifically, the influence of psychological, individual, and personal factors on work capacity.

Certainly, the significance of this subject is continually increasing, driven by the growing complexity and difficulty of exercises and the rising and synthesizing demands for intensified athlete training, which pose significant challenges to work capacity.

Based on the aforementioned, it can be concluded that the work capacity of performance gymnasts is governed by the significant influence of individual and personal capabilities. These beliefs can add value to addressing many practical questions regarding the training of high-qualification gymnasts. For example, this can lead to research on the individualization of the training process, accurately distributing the volume and intensity of efforts during various training periods.

Another argument of this study lies in the fact that the organic functionality of an interdependence between these components will enhance the training activities of gymnasts across other training stages (intensive, competitive, post-competitive, etc.), addressing additional interests such as:

- Accurately determining the work output, volume, and intensity of efforts for various instructional tasks.
- Organizing and conducting the training process based on conditioning elements and effective influence of expressive logical and tactical arrangements.
- Understanding energy expenditures with a direct interdependence of all actions and forms of athletes' manifestations.
- Synthesizing accessible actions based on a specific methodology for forecasting applied efforts through the effective connection of thought types and reproduction of specific actions, as well as other technological and methodological specifics of training.

Ultimately, the reclamation of these concepts and ideas can be widely utilized by coaches and athletes in the vast practice of training activities at all stages of preparation in modern artistic gymnastics.

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