

UDC 796.28.76–055.2 (045)

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QUALIMETRY AS A TOOL FOR PROCESSING SCIENTIFIC DATA IN PHYSICAL EDUCATION AND SPORTS: A MODERN DIMENSION

Relevance of the problem. *Qualimetry remains a powerful and promising tool in modern scientific research, opening up new horizons for objective and systematic analysis of quality in different areas, including physical culture and sports. Its further development and integration with other scientific disciplines and technologies make it possible to overcome existing difficulties and increase the effectiveness of research.*

The purpose of the study is to substantiate the data of expert assessment of the significance of motor qualities that are inherent in biathlon.

Research methods: analysis of literary sources, qualimetry, methods of mathematical statistics.

Research results. *The analysis of the results of expert assessment of physical qualities of female biathletes indicates the dominant role of speed-strength endurance ($R=9$) as a key factor of competitive efficiency. Its priority directly correlates with the nature of motor activity in biathlon. The second most important quality, according to expert data, is strength endurance ($R=12$). This is due to the direct influence on the speed of movement on difficult terrain, as well as on the technical preparedness of athletes due to the formation of the power of push-offs. Speed endurance ranks third ($R=15$) in the priority list, highlighting its importance for the dynamic start of the race and maintaining optimal speed throughout the entire distance (e.g. in a mass start or a chase). The importance of coordination endurance ($R=28$) was also highly rated, reflecting its role in ensuring the continuous effectiveness of complex locomotor coordination acts throughout the competition.*

Conclusions. *Qualimetry allows transforming subjective assessments and qualitative data into objective numerical indicators. This increases the scientific reliability and reproducibility of research results, making them less dependent on individual opinions or interpretations. It should be noted that qualimetry transforms approaches to assessing scientific research in the field of physical education and sports, offering new opportunities to increase the objectivity and reliability of results. During the study of the physical qualities of female athletes, certain components were identified, such as: speed-strength endurance, strength endurance, speed endurance, coordination endurance, dynamic endurance, static endurance, agility and flexibility. The expert assessment method identified the weight of motor qualities specific to biathlon.*

Key words: management, qualimetry, expert assessment, monitoring, control, physical qualities, modeling, training process.

Introduction. Transformation of approaches to the assessment of scientific research in physical culture and sports is impossible without qualimetry [4]. It offers new opportunities to ensure objectivity and increase the reliability of results. Challenges of using qualimetry in modern scientific research:

one of the main challenges is the objective and correct definition of the nomenclature of individual and complex quality indicators for a specific object of study [5; 6; 8]. Quality is often a multifactorial concept and its measurement can be complex [9; 10].

Although qualimetry is aimed at objectification, many qualimetric methods (especially at the stages of determining weighting factors or criteria) may include expert assessments, which are to some extent subjective. It is important to ensure high qualifications and objectivity of experts [1]. The use of qualimetric methods requires researchers not only to have knowledge in their field, but also to understand the basics of qualimetry, metrology, mathematical statistics and possibly work with specialized software [2]. Obtaining an integral quality indicator (a single number characterizing the overall quality) can be difficult in terms of correct interpretation. It is important to understand which factors and with what weight influence this indicator [3; 7; 11].

The solution to the problem of underuse of qualimetry in scientific research in sports is multifaceted and requires a comprehensive approach. Here are some possible ways:

development and standardization of qualimetric methods: it is necessary to create and unify clear, valid and reliable methods for quantitative assessment of qualitative characteristics in various industries. This will allow researchers to more easily apply qualimetric approaches and ensure comparability of results;

creation of specialized software: development of accessible and convenient software tools for qualimetric data analysis. Automation of calculations and visualization will help simplify the process of applying qualimetry and make it more attractive for researchers;

Integration of qualimetry with other scientific disciplines and technologies: encouraging interdisciplinary research where qualimetry is combined with, for example, biomechanics, big data analysis, artificial intelligence, etc. This opens up new possibilities for analyzing complex phenomena.

The application of these approaches will help to overcome existing barriers and fully realize the potential of qualimetry in modern scientific research, in particular in physical education and sports.

The purpose of the work is to substantiate the data of expert assessment of the significance of motor qualities that are inherent in biathlon.

Research methods: qualimetry, methods of mathematical statistics [1; 2]. The research methodology provided for strict adherence to the ethical standards set out in the Helsinki Declaration of the World Medical Association «Ethical Principles for Medical Research Involving Human Subjects», which guaranteed the protection of the rights and welfare of the participants.

Results. The study of the physical qualities of female athletes allowed us to identify their specific components: speed-strength endurance, strength endurance, speed endurance, coordination endurance, dynamic endurance, static endurance, agility and flexibility [2].

An important methodological premise is the understanding of the interdependence of these qualities, where the activation of some determines the manifestation of others. Thus, the effectiveness of spatial orientation and the variability of ski movements correlate with the level of coordination, which is the functional basis for agility. At the same time, coordination endurance integrates the ability to perform complex locomotor patterns for a long time [8].

It should be noted that the physical qualities of athletes function as an interconnected system, where the manifestation of some directly correlates with the effectiveness of others. For example, the speed of spatial orientation and the ability to quickly change skiing techniques in response to external conditions is a manifestation of coordination, which in turn forms the basis for agility. At the same time, coordination endurance provides support for highly effective performance of these complex technical elements over long time intervals [3].

Flexibility in biathlon is demonstrated in the technique of movement, rapid changes of positions on the shooting range and during manipulations with the weapon. Speed is critical on descents and when overcoming penalty loops, and strength is necessary for effectively overcoming climbs, as well as maintaining balance on turns and descents [10].

The assessment of the degree of significance of the factors considered in the study was carried out using the method of ranking systematization of expert responses. According to this procedure, the factor that received the highest assessment from the expert was ranked first. In cases where several

factors were recognized by the expert as equivalent, they were assigned the same ranking number. The final questionnaire data formed the basis for developing a summary table of ranks 1.

An expert assessment of the physical qualities of female biathletes allowed us to rank their importance for successful competitive activity [6].

Table 1

Distribution of the importance of factors using the rank assignment method

Physical qualities	Average rank, R	Standard deviation, S	SR	Place in the ranking
speed-strength endurance	9	0,232	39	1
strength endurance	12	0,214	36	2
speed endurance	15	0,196	33	3
coordination endurance	28	0,119	20	4
agility	35	0,065	11	5
flexibility	37	0,035	6	6
dynamic endurance	38	0,077	13	7
static endurance	42	0,059	10	8

According to the results of the expert assessment of the physical qualities of female biathletes, speed-strength endurance ($R=9$) was recognized as a priority for competitive activity, since it most fully reflects its nature.

The second most important value, according to experts, is strength endurance ($R=12$). This is explained by the fact that the speed of movement on rough terrain (climbs, descents) directly depends on the power of the push-offs with the legs and arms, and the technical preparedness of biathletes correlates with strength indicators.

Speed endurance ranks third ($R=15$), being important for effectively covering the distance, in particular for quickly taking an advantageous position and maintaining a stable high speed throughout the race (for example, in a mass start or a race behind the leader).

No less significant is coordination endurance ($R=28$), which manifests itself in continuous dynamic and complex coordination locomotor activity throughout the entire distance.

Based on the data obtained, an assessment of the consistency of expert opinions was carried out using the concordance coefficient (W). The calculated value $W=0.796$ indicates a high level of expert agreement. The statistical significance of this coefficient was verified using the Pearson consistency criterion (χ^2). With $df=7$ and the given level of significance $=0.05$, the calculated value of $\chi^2=33.44$ significantly exceeds the critical table value of 14.07. Consequently, the concordance coefficient $W=0.796$ is considered statistically significant ($p<0.05$), which confirms the non-randomness of the obtained results and their suitability for further scientific use.

Conclusions. Qualimetry allows transforming subjective assessments and qualitative data into objective numerical indicators. This significantly increases the scientific reliability and reproducibility of results, reducing their dependence on individual interpretations.

During the study of the physical qualities of female biathletes, we identified the following key components: speed-strength, strength, speed, coordination, dynamic and static endurance, as well as agility and flexibility. Using the expert assessment method, we determined the significance of each of these motor qualities specific to biathlon. However, the analysis of the ranked physical qualities and their comparison with the physical fitness indicators showed an interesting feature: the experts did not single out special endurance as a separate significant quality. This fact requires further consideration, because a significant part of scientific sources emphasizes the leading role of special endurance in ensuring great sports achievements in biathlon. We assume that these differences in views are a consequence of differences in the theoretical basis and practical experience of both experts and researchers.

In our opinion, qualimetry is an indispensable tool for increasing scientific validity, practical efficiency and managerial transparency in the field of physical culture and sports. Its further development and integration open up broad prospects for progress.

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КВАЛІМЕТРІЯ ЯК ІНСТРУМЕНТ ОБРОБКИ НАУКОВИХ ДАНИХ У ФІЗИЧНІЙ КУЛЬТУРІ ТА СПОРТІ: СУЧАСНИЙ ВИМІР

Актуальність проблеми. Кваліметрія залишається потужним та перспективним інструментом у сучасних наукових дослідженнях, відкриваючи нові горизонти для об'єктивного та системного аналізу якості в різних сферах, включаючи фізичну культуру та спорт. Її подальший розвиток та інтеграція з іншими науковими дисциплінами та технологіями дають змогу долати існуючі труднощі та підвищувати ефективність досліджень.

Мета роботи – обґрунтування даних експертного оцінювання значущості рухових якостей, притаманних біатлону.

Методи дослідження: аналіз літературних джерел, кваліметрія, методи математичної статистики.

Результати дослідження. Аналіз результатів експертного оцінювання фізичних якостей біатлоністок свідчить про домінуючу роль швидкісно-силової витривалості ($R=9$) як ключового чинника змагальної ефективності. Її пріоритетність прямо корелює з характером рухової діяльності у біатлоні. Другою за значущістю якістю, згідно з експертними даними, є силова витривалість ($R=12$). Це зумовлено її безпосереднім впливом на швидкість пересування складним рельєфом, а також на технічну підготовленість спортсменок через формування потужності відштовхувань. Швидкісна витривалість займає третю позицію ($R=15$) у пріоритетному переліку, що підкреслює її значення для динамічного початку гонки та підтримання оптимальної швидкості протягом усієї дистанції (наприклад, у мас-старті чи перегонах за лідером). Важливість координаційної витривалості ($R=28$) також була високо оцінена, що відображає її роль у забезпеченні безперервної ефективності складнокоординаційних локомоторних актів упродовж змагань.

Висновки. Кваліметрія дає змогу перетворювати суб'єктивні оцінки та якісні дані на об'єктивні числові показники. Це підвищує наукову достовірність та відтворюваність результатів дослідження, роблячи їх менш залежними від індивідуальних думок або інтерпретацій. Під час дослідження фізичних якостей спортсменок було виокремлено певні їх складники: швидкісно-силову витривалість, силову витривалість, швидкісну витривалість, координаційну витривалість, динамічну витривалість, статичну витривалість, спритність і гнучкість. Методом експертного оцінювання ідентифіковано вагомість рухових якостей, специфічних для біатлону.

Ключові слова: управління, кваліметрія, експертна оцінка, контроль, фізичні якості, тренувальний процес.

Дата надходження статті: 31.07.2025

Дата прийняття статті: 28.08.2025

Опубліковано: 23.10.2025