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The Dynamics Of The Formation Of Technical Training In Middle-Distance Runners

Djumanov Barlikbay Arzubaevich
Associate Professor, Karakalpak State University, Independent Researcher, Karakalpak State University, Uzbekistan

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Abstract: This article presents the dynamics of technical training development for track and field athletes specializing in middle-distance running, assessed through pedagogical tests, and the effectiveness of the applied research methods. Suggestions and recommendations are provided for improving the technical training of middle-distance runners in the training group from the Aral Sea region of Karakalpakstan. A comparative analysis of the special physical training results for the experimental and control groups at the beginning of the study is presented, and scientific conclusions are formulated based on the obtained data.

Keywords: Technical training, physical training, track and field, middle distance, middle-distance runners, research, step cadence, stride length, climate, national team, training, physical qualities, Aral Sea region.

Introduction: Middle-distance running is considered one of the most competitive disciplines within the athletics system, requiring a high level of speed endurance. The continuous improvement of results observed in international competitions demands from athletes not only the advanced development of physical qualities but also a well-refined running technique and the constant enhancement of all components of training. This is because, in middle-distance running, such technical elements as stride length and rhythm, the duration of the support phase, body posture, and arm movements directly determine the overall efficiency of an athlete's performance. Scientific investigation of the dynamics of running technique formation is of great significance for coaches, as it enables the optimization of the training process, the elimination of individual technical shortcomings, and the development of new, more effective models of competition preparation. Furthermore, the technical readiness of middle-distance runners develops consistently across different age stages. A thorough analysis of the step-by-step dynamics of this process, as well as the identification of relationships between technical indicators and factors such as functional state, physical qualities, and competitive loads, provides opportunities for preparing athletes more effectively while ensuring their adaptation to specific climatic conditions.

LITERATURE REVIEW

In the present day, modern technical tools—such as video analysis systems, digital biomechanical diagnostics, and monitoring software—allow for an in-depth assessment of athletes' technique. However, the improvement of running technique requires the development of solid conceptual and methodological foundations to ensure the effective use of these capabilities. Moreover, the study of changes in the technical preparedness of middle-distance runners under the specific climatic conditions of Karakalpakstan can provide new scientific insights for practical application.

In addition to achieving a high level of general and specialized physical training, the development of the athlete's functional preparedness plays a significant role in enhancing the performance of middle-distance runners [2]. The effectiveness with which these capacities are utilized depends primarily on speed endurance and technical readiness. Athletes must understand the principles of movement and be able to apply methodological approaches that correspond to their individual characteristics, as middle-distance runners need to clearly recognize their strengths and weaknesses.

METHODOLOGY

For this reason, efficient running technique and the

rational distribution of effort throughout the distance are essential for performing the technique correctly [1]. This, in turn, increases the likelihood of achieving high competitive results. Furthermore, this issue remains one of the most relevant topics in the field, carrying both theoretical and practical significance.

Purpose: The purpose of the study is to scientifically investigate the dynamics of the formation of technical preparedness in middle-distance runners.

Tasks:

To analyze scientific and methodological sources related to the technical preparation of middle-distance runners and to summarize existing approaches and scholarly perspectives.

To identify the structural components of running technique—such as stride length, stride frequency, cadence, energy expenditure, arm movement, and body posture.

To examine the dynamics of changes in technical preparedness under the climatic conditions of Karakalpakstan, to study the influence of various factors, and to develop relevant recommendations.

Research Methods: Analysis of scientific and methodological literature, pedagogical observation, organization of research procedures, instrumental methods, pedagogical experimentation, mathematical–statistical methods, and analysis of the obtained results. When analyzing climate data across Asia, it becomes evident that temperatures in Uzbekistan—particularly in the Aral Sea region—are rising, and the climate is becoming increasingly arid. Climate change is expected to transform dry and semi-desert areas into even hotter and more drought-prone zones, suggesting that future drought seasons in Central Asia may become longer and more severe. The extremity or rarity of a weather event is typically determined by how frequently it recurs. Although climate is normally understood as a set of norms that change only slightly over relatively short intervals (e.g., within a decade), humanity is currently altering the climate rapidly, creating “new norms.” For instance, storms that previously occurred once every hundred years now take place approximately once every ten years [4].

Such rapid climate change poses new challenges for specialists and coaches in athletics. Therefore, taking climatic conditions into account when planning and conducting training sessions for middle-distance runners enables more effective preparation for competitive performance.

In the Aral Sea region of Karakalpakstan, the climate during the autumn–winter season is cold, windy, and humid. Therefore, for middle-distance runners, it is crucial to adapt training sessions to the safest and most physiologically comfortable hours of the day. For this reason, based on scientific–methodological sources and the principles of sports meteorology, we developed and recommended the following guidelines for conducting training sessions during the autumn–winter period.

The most optimal time for conducting training sessions aimed at developing general and specific endurance in the autumn–winter season is between 14:00 and 17:00. During these hours, the weather conditions are most favorable for several reasons: daytime temperatures reach their highest point; wind intensity is lower compared to early morning; muscles are less susceptible to cold-related injuries; and the respiratory system is exposed to less severe cold-induced stress.

Light training sessions focused on technical preparation and competitive exercises should be scheduled between 11:00 and 13:00. At this time, the air temperature becomes somewhat warmer, sunlight positively affects immunity, and the conditions are suitable for exercises that do not place excessive strain on the muscles [3].

Morning sessions should be held indoors and are recommended between 09:00 and 10:00. This period is suitable only for light running. Intensive training in the early morning (particularly before 07:00) is not recommended, as temperatures can range from –6°C to –15°C, wind intensity is high, the risk of respiratory illnesses increases, and the cold causes significant narrowing of the airways, which may result in breathing difficulties [3]. These factors must certainly be taken into account.

If weather conditions change—for example, if the temperature drops below –10°C—speed exercises should not be performed; in the event of strong winds, training must be moved indoors; breathing should be done through the nose rather than the mouth; and warm clothing must be worn, including a three-layer sports outfit, as the body expends more energy in cold conditions. These considerations are essential.

Thus, for middle-distance runners in the Aral Sea region of Karakalpakstan during the winter season, the optimal training time is 14:00–17:00, as the climate is milder, wind intensity decreases, and the risk of injury is reduced.

DISCUSSION

In the Aral Sea region, the spring and summer seasons are extremely hot and dry, with temperatures rising to 40–45°C. Therefore, for middle-distance runners, conducting training sessions during the safest and most

physiologically optimal hours is of particular importance. For summer-season training in the Aral Sea region, we recommend the following guidelines.

During the spring–summer period, the most suitable time for the main morning training session is between 06:00 and 08:00. At this time, the weather is still relatively cool (20–26°C), body temperature remains within the normal range, and the athlete's energetic capacity is high. Sun exposure is minimal, and the risk of heat stroke is low. Evening sessions are best held between 19:00 and 21:00, which is preferable compared to other parts of the day. By this time, the sun has set and the air temperature decreases noticeably, allowing for more comfortable breathing. Since the muscles have been active throughout the day, they warm up quickly, making high-intensity exercises easier to perform.

The most convenient period for technical drills and light running is 18:00–19:00. Although the heat has not yet fully subsided, conditions remain suitable for performing low-intensity exercises.

It is not recommended to conduct training between 11:00 and 17:00 during the spring and summer seasons, as air temperatures in the Aral Sea region during this interval typically reach 35–45°C. Consequently, the risks of heat stroke, cardiovascular overload, and dehydration are significantly elevated.

For summer training, athletes must be provided with specific guidelines: drinking 300–500 ml of water 20–30 minutes before training; consuming a few sips of water every 15–20 minutes during the session; wearing light-colored, breathable clothing; avoiding warm-up exercises under direct sunlight; and continuously monitoring breathing and heart rate.

For middle-distance runners, the optimal summer training schedule is as follows:

06:00–08:00 — main running session and endurance loads;

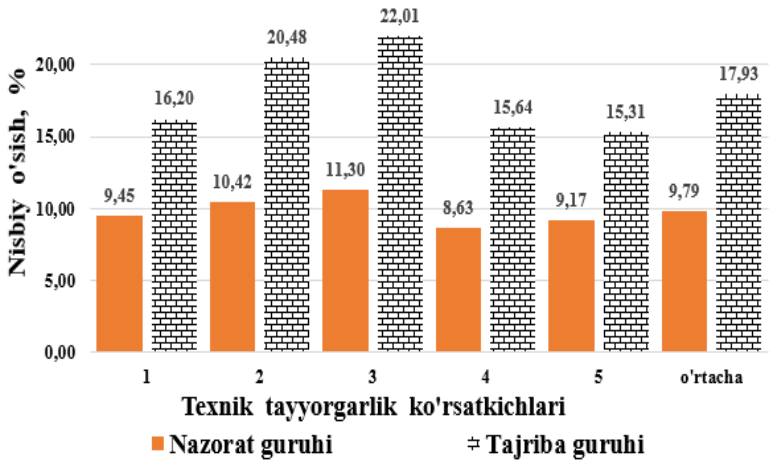
18:00–19:00 — technical drills;

19:00–21:00 — intensive training, including tempo runs and similar high-intensity workloads.

By comparing the dynamics of change in the main statistical characteristics of the technical preparedness indicators of the athletes in the control group (n = 14) and the experimental group (n = 14) during the pedagogical experiment, we obtained the following results. According to the findings, the step length of the participants in the experimental group reached 174.64 ± 12.99 cm. Their step cadence within one minute amounted to 110.93 ± 11.96 repetitions, while in the 30-second on-the-spot running test, organized to assess speed, they achieved a result of 114.57 ± 12.97 repetitions. When running a distance of 1500 m, the athletes expended 366.71 ± 11.99 kcal of energy and required an average of 305.57 ± 13.96 seconds to complete the distance.

At the beginning of the experiment, the participants in the control group demonstrated an average step length of 176.79 ± 12.60 cm. Their step cadence within one minute amounted to 113.07 ± 11.63 repetitions, while in the 30-second on-the-spot running test, they completed 111.93 ± 12.59 repetitions. When running the 1500 m distance, they expended 362.50 ± 11.60 kcal of energy and completed the distance in 310.86 ± 13.59 seconds. An analysis of the test results obtained from both the control and experimental groups at the beginning of the study revealed that their initial indicators were equivalent, which allowed us to proceed with the research.

At the end of our study, the experimental group showed an average step length of 202.93 ± 12.13 cm, with a cadence of 124.86 ± 11.50 steps per minute. In a 30-second standing run test, the number of steps recorded was 139.79 ± 12.14. During a 1500 m run, participants expended 424.07 ± 12.13 kcal of energy; after implementing the proposed methodological intervention, the 1500 m run performance improved, with the time reduced to 258.79 ± 13.10 seconds.



The participants in the control group demonstrated the following results at the end of our study. In the step-length enhancement test, their step length increased to 193.50 ± 12.51 cm, while the step cadence per minute increased to 124.86 ± 11.50 steps. During the 30-second in-place running test, the number of steps recorded was 124.57 ± 12.49. In the 1500 m running test, the control group participants expended 393.79 ± 11.51 kcal of energy and completed the distance in 282.36 ± 13.49 seconds.

CONCLUSION

This study examined the dynamics of technical preparedness in middle-distance runners, with particular focus on the specific features of technical performance development under the sharply continental climate of Karakalpakstan. Modern scientific methods such as video analysis, biomechanical assessment, pedagogical observation, and statistical analysis were employed during the research process. The findings highlighted the interrelationship between climate, functional state, and physical readiness in the optimization of middle-distance running technique. Analysis of differences between the experimental and control groups demonstrated that a specialized methodology, developed taking into account the climatic conditions of the Aral Sea region in Karakalpakstan, had a significant positive effect on athletes' technical preparedness. The experimental group showed statistically significant improvements ($P<0.01$; $P<0.001$) in step length, cadence, running rhythm, energy expenditure, and completion time for the 1500-meter distance. Specifically, step length increased by 28.29 cm, and cadence improved by 22.71 steps per minute. These changes indicated that the overall rate of development in the experimental group was 1.8 times higher than in the control group.

The results also indicated that planning training sessions according to seasonal and climatic conditions (winter: 14:00–17:00; summer: 06:00–08:00 and 19:00–21:00) ensures an optimal physiological state for muscle activity, respiratory function, cardiovascular load, and thermoregulation. Moreover, regular monitoring of technical preparedness, analysis of biomechanical indicators, and individualized methodological approaches under changing climatic conditions proved to be key factors in enhancing athletes' performance.

The study led to the following general conclusions: The climate of the Aral Sea region in Karakalpakstan has a direct impact on middle-distance running technique, and adapting training to climatic conditions increases the effectiveness of the workload. Comprehensive study of the dynamics of technical preparedness allows identification and correction of individual technical deficiencies, significantly improving running performance. Improvements in biomechanical indicators (step length, rhythm, energy expenditure) are decisive factors in enhancing performance over the 1500-meter distance. The proposed specialized methodology ensured statistically significant improvements in technical preparedness indicators in the experimental group and is recommended for practical implementation. Overall, this research scientifically substantiates the importance of climatic conditions, biomechanical analysis, and individualized training models in optimizing middle-distance running technique. The findings have practical value for coaches, sports education institutions, national teams, and sports research centers, providing an important resource for optimizing the preparation of highly skilled athletes.

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