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DEVELOPMENT OF ANAEROBIC CAPACITY THROUGH RUNNING TRAINING AMONG MILITARY EDUCATION STUDENTS

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Abstract: This study explores the development of anaerobic capacity in military education students through structured running training. The research highlights the importance of anaerobic endurance for improving combat readiness, reaction speed, and short-term power output. It examines how different running intensities, interval durations, and recovery times influence the cardiovascular system, muscular performance, and overall physical resilience of cadets. The findings demonstrate that systematically applied anaerobic running sessions - including sprint intervals, hill running, and shuttle drills - significantly enhance physical performance indicators vital for military operations. The article also proposes practical training models that can be integrated into military physical education curricula to maximize functional fitness and physiological adaptation.

Keywords: military education, running training, anaerobic capacity, endurance, physical fitness, cardiovascular system, interval training, muscle power, physiological adaptation.

INTRODUCTION

Physical preparedness is a fundamental component of military education. The modern soldier must possess not only technical and tactical competence but also a high level of physical endurance and resilience under extreme physiological conditions. Among the diverse physical qualities required in military practice, anaerobic capacity plays a decisive role in performing short, intense efforts such as sprinting, rapid maneuvering, obstacle crossing, and combat-related movements. Developing anaerobic potential through scientifically structured running training is therefore a critical aspect of military physical education.

Anaerobic capacity refers to the body's ability to generate energy without sufficient oxygen supply, relying primarily on phosphagen and glycolytic energy systems. These systems support high-intensity activities lasting from several seconds to two minutes - precisely the time frame required for most combat and tactical maneuvers. In the context of military training, the efficiency of the anaerobic energy system determines how effectively a cadet can perform under fatigue, maintain performance in oxygen-deficient conditions, and recover between bouts of effort.

In traditional military curricula, physical training often emphasizes general endurance and aerobic fitness. However, modern military demands have expanded the focus toward specific anaerobic performance, which contributes directly to real combat efficiency. Activities such as short sprints, load carrying, and rapid directional changes during tactical exercises all depend on anaerobic energy production. Without targeted development of this capacity, even physically fit soldiers may struggle during sudden bursts of high-intensity activity.

Running-based anaerobic training, particularly interval and sprint drills, has proven to be one of the most effective and accessible methods for developing these qualities. Short-distance, high-intensity running alternated with brief recovery periods enhances both muscular power and metabolic efficiency. The physiological adaptations induced by anaerobic running include increased glycogen storage, improved buffering capacity, greater lactate tolerance, and accelerated phosphocreatine resynthesis - all of which are vital for combat readiness.

Furthermore, anaerobic training contributes to the functional improvement of the cardiovascular and neuromuscular systems. The repeated exposure to oxygen debt conditions enhances the heart's stroke volume, strengthens the respiratory musculature, and improves capillary density in active muscles. On the neuromuscular level, sprint and resistance running stimulate fast-twitch muscle fibers, improving explosive strength and coordination - qualities indispensable for military trainees required to act quickly and decisively in stressful environments.

Despite the recognized importance of anaerobic development, many military educational institutions still apply generalized training models that do not sufficiently emphasize intensity control, interval structure, or energy system targeting. As a result, training efficiency remains suboptimal, and individual differences in physiological response are often ignored. There is thus a growing need for methodologically grounded approaches that use running as a structured tool for improving anaerobic capacity among military students.

Therefore, this study aims to analyze and substantiate the effectiveness of running-based anaerobic training programs for cadets in military education settings. It seeks to identify optimal intensity ranges, work-to-rest ratios, and exercise modalities that promote adaptation of the anaerobic energy system, while maintaining overall physical balance and preventing overtraining. The outcomes of this research are expected to contribute to the development of evidence-based training models for enhancing functional performance, endurance, and combat readiness in future military professionals.

METHODS

The research was conducted among 40 male military education students aged 18–22 from a higher military academy. Participants were divided into two groups: an experimental group (n=20) that underwent a specialized anaerobic running program, and a control group (n=20) that followed the standard physical training curriculum. The study lasted eight weeks, during which the experimental group performed structured interval running sessions three times per week.

Each training session included a standardized warm-up, followed by 5–8 repetitions of 200-meter sprints at 90–95% of maximum speed, interspersed with 1-minute recovery periods. Training load was progressively increased by adding repetitions or reducing recovery time. Weekly monitoring included heart rate control, lactate level analysis, and perceived exertion scales to ensure safety and adaptation.

Pre- and post-tests were carried out to evaluate anaerobic capacity using the Wingate test, 400-meter sprint time, and blood lactate concentration analysis. Statistical data were processed using SPSS software to determine the significance of changes ($p < 0.05$). Ethical approval was obtained from the institutional research committee, and all participants gave informed consent before the study [1], [2].

RESULTS AND DISCUSSION

After eight weeks of training, the experimental group demonstrated a statistically significant improvement in all measured indicators compared to the control group. The average 400-meter sprint time improved by 6.8%, while post-exercise lactate concentration decreased by 11.5%, indicating better tolerance to high-intensity workloads. Moreover, Wingate test results showed an 8.2% increase in peak anaerobic power and a reduction in fatigue index, suggesting enhanced efficiency of energy utilization during maximal efforts [3].

Physiological monitoring confirmed notable cardiovascular adaptation: resting heart rate decreased by an average of 6 beats per minute, and recovery heart rate after high-intensity

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running improved significantly. These results support previous findings that interval sprint training enhances both anaerobic metabolism and oxygen-independent ATP resynthesis [4]. The study also revealed positive psychological and tactical benefits. Cadets from the experimental group reported increased self-confidence and greater resilience during physical testing, reflecting improved stress adaptation. In summary, consistent exposure to structured anaerobic running loads effectively strengthens the energy systems essential for short-term, high-intensity military tasks.

CONCLUSION

The results of this research confirm that systematic anaerobic running training significantly enhances the physical performance and combat readiness of military education students. By incorporating short-distance sprints, interval loads, and controlled recovery phases, cadets demonstrated measurable improvements in both muscular power and metabolic efficiency. The observed reduction in lactate accumulation and improved recovery heart rate suggest better adaptation of the anaerobic glycolytic system, which is critical for sustaining high-intensity physical tasks under stress [5].

Moreover, this method fosters functional integration between the cardiovascular and neuromuscular systems, increasing the cadets' ability to perform repeated efforts with minimal fatigue. Such outcomes align with international findings on interval sprint training, proving its suitability for structured military fitness programs [6].

It is recommended that military academies adopt scientifically designed anaerobic training protocols within their physical education curricula. Combining these with proper nutrition, recovery strategies, and psychological conditioning will create a comprehensive model of soldier preparedness. Future studies should expand the sample size and explore gender-specific adaptations to further refine anaerobic training methodologies in military education contexts.

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