International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 13s, 2025
https://theaspd.com/index.php/ijes

Correlation Analysis Of Physical Conditioning Components And Performance Outcomes In Middle-Distance Runners: A Study On Student-Athletes

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Abstract:
This study delves into the intricate relationship between biomechanical factors, energy expenditure, and mechanical power, with a particular focus on their collective impact on middle-distance running performance. In middle-distance events, such as the 800 meters and the 3000 meters, athletes must strike a delicate balance between power output and endurance, each being more prominent at different stages of the race. In shorter events like the 800 meters, explosive strength, speed, and acceleration are critical, emphasizing the need for substantial mechanical power to drive rapid, high-intensity efforts. Mechanical power, generated through forceful muscle contractions and efficient energy transfer, is essential for sprinting, quick acceleration, and maintaining high velocity over the course of the race. In contrast, longer events, such as the 3000 meters, demand a different physiological approach. The focus shifts toward energy utilization, aerobic endurance, and the ability to sustain moderate-intensity efforts over a longer period of time. In these events, energy management becomes increasingly important, with athletes needing to carefully regulate their energy stores to avoid premature fatigue and maximize performance throughout the race. This shift underscores the need for robust aerobic conditioning, as well as an effective strategy for pacing and energy conservation. The research advocates for concurrent training, a method that integrates both strength and aerobic conditioning, as the most effective approach for middle-distance runners. By combining explosive strength training with endurance exercises, athletes can optimize both mechanical power and aerobic capacity, two critical components for success in middle-distance events. The study also reveals strong correlations between physical assessments—such as strength, speed, and endurance—and race performance, indicating that a well-rounded training regimen that targets all these attributes is essential for peak performance. Moreover, it highlights the importance of personalized training programs tailored to an athlete's individual strengths and weaknesses, allowing for sustained long-term development. This approach enables athletes to achieve optimal performance across a variety of middle-distance events, enhancing their ability to compete at the highest levels.
Keywords: *endurance, running, strength, physical conditioning, speed.*

INTRODUCTION:

Running is one of the most popular sporting events worldwide. According to Running USA's 2015 annual report 17,114,800 individuals participated in US sanctioned running events [1] while a further 10.5 million runners participated in UK events [2]. The physical conditioning of middle-distance runners

and its various components play an important role in determining their performance outcomes. Physical conditioning is a comprehensive concept that encompasses the athlete's ability to maintain strength, speed, endurance, mobility, and balance required for movement and running. The sport of middle-distance running requires specific physical or physiological skills, which is why it is essential to analyze the conditioning of athletes participating in this sport from various perspectives. Training processes tailored to each athlete include various directions of individual and general physical conditioning aimed at improving and facilitating specific abilities. This necessitates the study of the correlation between different physical factors, i.e., their interrelationship. The correlation coefficient is an important tool in studying the physical conditioning of middle-distance runners. This coefficient helps determine the degree of interrelationship between various physical skills of athletes, such as endurance, strength, and speed. The aim of this study is to identify the correlation between athletes' physical conditioning and their performance outcomes and to understand their mutual influence. By identifying the correlation between conditioning and performance, it is possible to develop the most effective training methods and improve their results.The correlation coefficient is a reliable metric in this study that demonstrates the interrelationship between the components of athletes' physical conditioning and their performance outcomes. It also helps in improving the strategies used in athletes' training processes.

LITERATURE REVIEW :

The relative importance of mechanical power output and energy use likely varies across different middle distance events, as well as over the course of specific middle distance events. For example, power output likely plays a more dominant role in the 800 m than in the 3000 m, and it is suggested that early in the 800 m race mean power output plays a predominant role, whereas energy use is more important later in the race [3]. In terms of the biomechanical factors associated with high-level middle distance performance, the relatively fast velocities require a high mechanical power output, though GRFs are less than what is seen in sprinting [4]. Mechanically we see that middle-distance runners run in a similar manner to sprinters, but differ from distance runners at both maximal and submaximal velocities. The differences between middle distance and distance runners include increased stride length, reduced contact time, increased knee flexion during swing, and greater center of mass oscillation [5]. Changes in running mechanics have been noted to occur during longer middle distance events, such as the 3000 m, with decreases in stride length, flatter foot placement, and forward trunk placement observed toward the end of longer middle distance events [6]. Athletics is a popular sport all over the world that primarily consists of running, jumping, throwing, and walking [7], Running is also popular; a wide range of in disciplines such as track, road, mountain, and ultra-endurance running [8], [10]. Middle-distance events are traditionally defined as track events that fall between short-distance events like the 100m, 200m, 400m, and longer distance events like the 10000m, half-marathon (21.1km), and marathon [9], [10]. African athletics was introduced to the world at the 1960 Olympic Games. Ethiopian and Kenyan athletes have dominated middle- and long-distance events in athletics since the 1968 Mexico Olympics; this dominance has been attributed to physiological, anatomical, psychological, traditional, social, and cultural factors [11]. Athletics in Ethiopia athletes have been shining in the world of athletics since the legend Abebe Bikila laid the groundwork for Ethiopians and all black Africans to be gold medalists at the 1960 Rome Olympics [12],[13]. Concurrent training is a program that combines resistance and endurance training to maximize all aspects of physical performance, Unless an athlete is competing in a pure-endurance sport such as long distance running or a combination of power and endurance attributes are required to excel in mixed-type sports [14]. Some recently studies recognized that combining strength and aerobic training in the same session provides more benefits for neuromuscular and cardiorespiratory functions [15], [16], [17].

EXPERIMENT AND RESULTS:

The subject of the study was the training process of student-athletes specializing in athletics, including short, middle, and long-distance running, at the State University of Physical Education of Uzbekistan. The pedagogical experiment conducted to determine the correlation between physical test results and

their impact on the body for middle-distance runners was analyzed as follows: When examining the correlation between the control group participants' 100-meter running test and the experimental group participants' standing long jump results, it was found that r = -0.33, indicating a moderate negative correlation. In the standing triple jump test, a positive correlation of r = 0.32 was found. The correlation between the control group participants' 400-meter running test and the experimental group participants' 100-meter running results was found to be r = -0.12, indicating a weak negative correlation. In comparison with the 800-meter running test, a weak negative correlation of r = -0.20 was observed. However, in the 3000-meter running test, a strong positive correlation of r = 0.88 was found. Additionally, the correlation between the control group participants' 400-meter running test and the experimental group participants' standing long jump results was r = 0.16, indicating a weak positive correlation. In the three-step standing long jump test, the correlation was found to be r = -0.10, indicating a weak negative correlation. The correlation between the control group participants' 800-meter running results and the experimental group participants' 100-meter running results was r = 0.32, showing a moderate positive correlation. At the beginning of the study, the correlation between the control group participants' 800-meter running results and the experimental group participants' 400-meter running results was r = 0.59, indicating a strong positive correlation. For the 3000-meter running results, the correlation was r = 0.50, showing a moderate positive correlation. The correlation between the control group participants' 800-meter running results and the experimental group participants' standing long jump results was r = 0.30, indicating a weak positive correlation. In the three-step standing long jump test, the correlation was r = -0.23, showing a moderate weak negative correlation. Lastly, the correlation between the control group participants' 3000-meter running results and the experimental group participants' 100-meter running results was r = - 0.18, indicating a weak negative correlation. The results of the 3000-meter running test at the beginning of the study for the control group participants showed a strong positive correlation with the experimental group participants' 400-meter running results, with r = 0.66. In comparison with the 800-meter running test, a weak negative correlation of r = -0.16 was observed. The correlation between the control group participants' 3000-meter running results and the experimental group participants' standing long jump results was r = 0.01, indicating a weak positive correlation. In the three-step standing long jump test, a positive correlation of r = 0.02 was identified. At the beginning of the study, a weak negative correlation of r = -0.10 was observed between the control group participants' standing long jump test and the experimental group participants' 100-meter running results. A weak positive correlation of r = 0.16 was found between the control group participants' standing long jump test and the experimental group participants' 400-meter running results. When compared to the experimental group participants' 800-meter running results, a moderate positive correlation of r = 0.39 was identified. The results of the control group participants' standing long jump test at the beginning of the study showed a moderate positive correlation of r = 0.28 with the experimental group participants' 3000-meter running results. In the three-step standing long jump test, a weak positive correlation of r = 0.11 was found. At the beginning of the study, the correlation between the control group participants' standing long jump (three-step jump) and the experimental group participants' 100-meter running results showed a weak negative correlation of r = -0.25. A strong positive correlation of r = 0.77 was noted between the control group participants' standing three-step long jump results and the experimental group participants' 400-meter running results. When comparing the control group participants' standing three-step long jump results with the experimental group participants' 800-meter running results, the correlation coefficient was found to be r = -0.09, indicating a very weak negative correlation. The correlation between the control group participants' standing three-step long jump results at the beginning of the study and the experimental group participants' 3000-meter running results was found to be R = 0.97, showing a strong positive correlation.Additionally, a weak positive correlation of r = 0.16 was observed between the standing long jump results and the experimental group participants' standing long jump results. The findings of the study lead to the conclusion that it is essential for athletes in middle-distance running to develop speed-endurance qualities. Furthermore, applying methods and techniques that improve their technical training will enhance the ability of student-athletes to perform effectively in sports competitions.

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The correlation coefficient values between the results of the control and experimental group athletes at the beginning of the pedagogical experiment based on the tests conducted in middle-distance running (table 1)

	The experimental group is the experimental head						
		100	400	800	3000	SLJ	TJ
Control group experimental head	100		0,01	-0,20	-0,01	-0,33	0,32
	400	-0,12		-0,20	0,88	0,16	-0,10
	800	0,32	0,59		0,50	0,30	-0,23
	3000	-0,18	0,66	-0,16		0,01	0,02
	SLJ	-0,10	0,16	0,39	0,28		0,11
	TJ	-0,25	0,77	-0,09	0,97	0,16	

Note: SLJ-standing long jump; TJ-triple jump

The results of the control group participants' 100-meter run at the end of the study showed a correlation coefficient of r=0.13, indicating a weak positive correlation with the experimental group participants' 400-meter run. When compared to the 800-meter run test, a weak positive correlation of r=0.26 was observed. For the 3000-meter run, a moderate positive correlation of r=0.22 was found. Additionally, there was a weak negative correlation of r=-0.26 between the control group's 100-meter run and the experimental group's standing long jump results. In the standing triple jump test, a weak negative correlation of r=-0.17 was observed. The correlation between the control group participants' 400-meter run results and the experimental group participants' 100-meter run results showed a weak negative correlation with a value of r=-0.03. When compared to the 800-meter run test, a weak negative correlation of r=-0.34 was observed. For the 3000-meter run, a moderate positive correlation of r=0.09 was found. Additionally, a weak positive correlation of r=0.24 was noted between the control group's 400-meter run and the experimental group participants' standing long jump results. In the standing triple jump test, a negative correlation of r=-0.46 was found. The correlation between the control group participants' 800-meter run results and the experimental group participants' 100-meter run results showed a weak negative correlation with a value of r=-0.17. The correlation between the control group participants' 800-meter run results at the end of the study and the experimental group participants' 400-meter run results showed a moderate weak positive correlation with a value of r=0.15. For the 3000-meter run, a moderate positive correlation of r=0.31 was observed. A weak positive correlation of r=0.21 was observed between the control group participants' 800-meter run results and the experimental group participants' standing long jump results. In the standing triple jump test, a weak positive correlation of r=0.16 was noted. When comparing the control group participants' 3000-meter run results with the experimental group participants' 100-meter run results, a positive correlation of r=0.13 was observed, indicating a weak correlation. The correlation between the control group participants' 3000-meter run results at the beginning of the study and the experimental group participants' 400-meter run results showed a moderate positive correlation with r=0.04. When compared to the next 800-meter run test, a positive correlation of r=0.15 was observed. A weak positive correlation of r=0.26 was noted between the control group participants' 3000-meter run results and the experimental group participants' standing long jump results. In the standing triple jump test, a positive correlation of r=0.23 was found. At the end of the study, the correlation between the control group participants' standing long jump results and the experimental group participants' 100-meter run results was observed to be r=-0.22, indicating a negative correlation. The correlation between the control group participants' standing long jump results and the experimental group participants' 400-meter run results was found to be r=0.48, indicating a strong positive correlation. A small positive correlation of r=0.06 was noted between the control group participants' standing long jump results and the experimental group participants' 800-meter run results. At the end of the study, the control group participants' standing long jump results showed a strong positive correlation of r=0.79 with the experimental group participants' 3000-meter run results. In the standing triple jump test, a negative correlation of r=-0.03 was found. The correlation between the control group participants' standing long jump results and the experimental

group participants' 100-meter run results was r=0.20, indicating a positive correlation. Additionally, the correlation between the control group participants' standing triple jump results and the experimental group participants' 400-meter run results was r=0.25, indicating a moderate positive correlation. The correlation between the control group participants' standing triple jump results and the experimental group participants' 800-meter run results was r=0.06, indicating a small positive correlation. At the end of the study, the control group participants' standing triple jump results showed a strong positive correlation of r=0.45 with the experimental group participants' 3000-meter run results. Additionally, the correlation between the control group participants' standing triple jump results and the experimental group participants' standing long jump results was r=0.11, indicating a small positive correlation.

The correlation coefficient values between the results of the control and experimental group athletes in the tests conducted at the end of the pedagogical experiment for middle-distance runners. (table 2)

Control group at the end of the experiment	Control group end of experiment					
	100	400	800	3000	SLJ	TJ
100		0,13	0,26	0,22	-0,26	-0,17
400	-0,03		-0,34	0,09	0,24	-0,46
800	-0,17	0,15		0,31	0,21	0,16
3000	0,13	0,04	0,15		0,26	0,23
SLJ	-0,22	0,48	0,06	0,79		-0,03
TJ	0,20	0,25	0,06	0,45	0,11	

Note: SLJ-standing long jump; TJ-triple jump

CONCLUSION:

This study provides valuable insights into the correlation between physical conditioning and performance outcomes for middle-distance runners. Strong positive correlations were found between endurance-related tests and 3000- meter results, highlighting the importance of endurance for longer races. In contrast, shorter races like the 100-meter and 400-meter showed weaker or negative correlations with physical tests, reflecting their distinct physical demands. The findings emphasize the need for tailored training programs that focus on speed, endurance, and technical skills. Ultimately, optimizing training methods based on these correlations can enhance performance outcomes for middle-distance runners.

REFERENCES:

[1] Running USA2016 state of the sport—U.S. road race trends [Internet]. May 6, 2016. Running USA [Retreived March 31, 2017] (http://www.runningusa.org/state-of-sport-us-trends-2015).
[2] Sports Marketing Survey's Inc. 2015. Releasing the results of the runner's world survey [Internet]. January 16, 2015. Sports Marketing Surveys Inc. [Retreived March 29, 2017] (http://www.sportsmarketingsurveysinc.com/sports-marketing-surveys-inc-and-runners-world-magazine-release-runners-survey-results/).
[3] Kadono H, EnomotoY, AeM.2007. Change in the energetics of middle distance runners during race. J Biomech 40:S749. Google Scholar
[4] Nilsson J, ThorstenssonA.1989. Ground reaction forces at different speeds of human walking and running. Acta Physiol 136:217–27. Google Scholar
[5] Cunningham R, Hunter I, Seeley M, Feland B.2013. Variations in running technique between female sprinters, middle, and distance runner. Int J Exerc Sci6:43–51.Google Scholar
[6] Elliott B, Roberts A. 1980 . A biomechanical evaluation of the role of fatigue in middle-distance running. Can J Appl Sport Sci 5:203–7.Google Scholar PubMed WorldCat
[7] Trackandfield (http//www.scholastic.com/teachers/article/trackandfield) from the original on 3 november2019.
[8] Charta, M., Chamari, K., Chaouachi, M., Chaouachi, A., Koubaa, D., Feki, Y., Millet, G. P., & Amri, M. (2004). Effects of intra-session concurrent endurance and strength training sequence on aerobic performance and capacity. British Journal of Sports Medicine, 39 (8), 555-60.
[9] A. Markov, L. Hauser, and H. Chaabene, "Effects of Concurrent Strength and Endurance Training on Measures of Physical Fitness in Healthy Middle-Aged and Older Adults: international Journal of Physical Education, Fitness and Sports,., no. 0123456789, 2022, https://doi.org/10.1007/s40279-022-01764-2

[10] C. Training et al., "Effect of Circuit Training on Selected Physical Fitness variables of Middle Distance Runners on Oromia Forest Wild Life Enterprise Athletics club BY: Advisor: Dr. BirukAmare A Thesis Submitted to the Department of Sport Science Presented in the Partial fulfillment of the Requirement of MSc Degree in Sport Science Jimma University," 2019.

[11] M. Gäbler, O. Prieske, T. Hortobágyi, and U. Granacher, "The effects of concurrent strength and endurance training on physical fitness and athletic performance in youth: A systematic review and meta-analysis," journal of Sports Sciences Frontiers in Physiology, vol. 9, no. AUG. Frontiers.

[12] B. R. Rønnestad and I. Mujika, "Optimizing strength training for running and cycling endurance performance: international Journal of Physical Education, Fitness and Sports vol. 24, no. 4, pp. 603–612, 2014, https://doi.org/10.1111/sms.12104

[13] Muralists, Z., Kneffel, Z. and Thalib, L. (2018) The physiological effects of concurrent strength and endurance training sequence on athletic trainee: A systematic review and meta-analysis. Journal of Sports Sciences 36 (11), 1212-1219.

[14] C. Hausswirth, S. Argentin, F. Bieuzen, Y. Le Meur, A. Couturier, and J. Brisswalter, "Endurance and strength training effects on physiological and muscular parameters during prolonged cycling," Asian journal of sports medicine, 3 (1), 21. vol. 20, no. 2, pp. 330–339, 2010, https://doi.org/10.1016/j.jelekin.2009.04.008

[15] H. Ozaki, J. P. Loenneke, R. S. Thiebaud, and T. Abe, "Resistance training induced increase in VO2max in young and older subjects," Eur. Rev. Aging Phys. Act., vol. 10, no. 2, pp. 107–116, 2013,https://doi.org/10.1007/s11556-013-0120-1

[16] R. S. Taipale et al., "Strength training in endurance runners," Int. J. Sports Med., vol. 31, no. 7, pp. 468–476, 2010, https://doi.org/10.1055/s-0029-1243639

[17] Øy. Støren, J. Helgerud, E. M. Støa, and J. Hoff, "Maximal strength training improves running economy in distance runners," journal of Med. Sci. Sports Exerc., vol. 40, no. 6, pp. 1087–1092, 2008, https://doi.org/10.1249/MSS.0b013e318168da2f