Medical Laboratory Journal
Online ISSN: 2538-4449
Golestan University of Medical Sciences

Effects of eight weeks of forward and backward interval running on blood glucose and lipid profiles in young men

Bizhan Hooshmand Moghadam [1], Parisa Pournemati [2*], Maryam Dalirani [2]

1. Department of Exercise Physiology, Faculty of Sport Sciences, Ferdowsi University of Mashhad, Mashhad, Iran
2. Department of Exercise Physiology, Faculty of Physical Education and Sport Sciences, University of Tehran, Tehran, Iran
* Correspondence: Parisa Pournemati. Department of Exercise Physiology, Faculty of Physical Education and Sport Sciences, University of Tehran, Tehran, Iran. Tel: +989367116090; Email: pournemati@ut.ac.ir

Abstract

Background: Regular physical activity plays a key role in improving metabolic health and physical fitness. The current study aimed to investigate and compare the impact of two training methods, forward and backward running, on changes in body composition, lipid profiles, cardiovascular function, and some physical fitness indices in young men.

Methods: Thirty eligible young men were selected and divided into two homogeneous groups: forward and backward running. Both groups performed interval running training four days per week for eight weeks (Two minutes of training at 60-85% of the maximum heart rate and one minute of active rest at 35-50% of the maximum heart rate). The interval training programs of both groups were identical, differing only in directions.

Results: There was a significant difference between the effects of two training methods on body fat percentages, waist-hip ratio, anaerobic power, agility, triglyceride and HDL-C ($P < 0.05$), while they showed no significant difference in terms of weight, body mass index, aerobic power, velocity, glucose, total cholesterol, LDL-C, heart rate (HR), systolic and diastolic blood pressure, and Rate Pressure Product (RPP) ($P > 0.05$).

Conclusion: Results of the present study indicated that eight weeks of backward interval running improved some components of physical fitness, body composition and lipid profiles in young men compared with the forward interval running.

Article Type: Research Article

Article History

Received: 30 January 2023
Received in revised form: 24 April 2023
Accepted: 25 April 2023
Available online: 27 October 2025
DOI: 10.29252/mlj.19.5.40

Keywords

Running
Body composition
Blood Pressure
Physical Fitness
Lipids profile

Introduction

All humans seek new techniques and practices to promote their health. Running is an enjoyable exercise that promotes vitality; however, the sense of vitality could be experienced every day, but the best way to maximize its benefits has long been a subject of debate. Running is usually performed in two ways: forward and backward running (1). In the recent decade, walking and running backward have gained popularity as a kind of training (2). Several studies have been conducted on the effects of forward and backward running in humans, and most of these have compared them in terms of biomechanics and rehabilitation. Rehabilitation research indicates that backward running and walking may be useful for various conditions, such as back pain, knee osteoarthritis, hamstring flexibility, and side effects of stroke. Results of these studies demonstrated pain relief, increased flexibility, improved coordination and endurance, and enhanced muscular balance and strength. Furthermore, some studies have suggested a backward running program to improve forward running performance (1-3). In the field of biomechanics, studies have been conducted on the effects of forward and backward running on knee muscles according to the electromyography, indicating that backward running has a more favorable effect on muscle strength than forward running (4). Some researchers argued that the backward running is the most stable motor pattern according to studied backward walking on a treadmill (5). Few studies have examined backward running in the field of exercise physiology. Some studies indicated that backward running increases cardiorespiratory fitness (CRF) more than forward running (2,6). Terbulanche et al. indicated that backward movement, in both walking and running, imposes more metabolic reactions on the body than forward movement and improved CRF (7,8). In a study by Flynn et al., backward running and walking elicit higher VO_2 (Oxygen consumption), heart rate (HR) and blood lactate compared to forward running and walking at the same speeds (9). The conducted studies on these three fields claimed that backward running have better physiological and functional effects and are more cost-effective than forward running (2). Some researchers believe that similar neural mechanisms may be involved in backward movement as in forward movement, whereas others believe that backward movement abilities result from a series of mechanisms of intrinsic adaptation in the central nervous system (5). This kind of training may increase economic efficiency in improving the economic performance compared to other current exercises. In fact, backward walking and running engage muscles that are not effective in moving forward and weaker than other muscles. Evidence suggests that incorporating backward running into training can increase athletic strength and readiness (1,10,11). Studies have indicated that regular aerobic exercise, such as continuous and interval running, can improve the body composition and metabolic and functional factors. Furthermore, the effect of interval training compared to continuous training has been investigated in some studies (12). Coaches and sports scientists continually seek efficient training methods that can optimize physiological adaptations within a limited time frame. Considering the growing interest in diverse and high-intensity exercise programs, it is essential to identify training protocols with appropriate intensity, duration, and repetition to enhance functional and metabolic capacity. Despite the proven benefits of backward running in rehabilitation and biomechanics, its physiological effects have not been thoroughly studied. Therefore, the present study aimed to compare the effects of forward and backward interval running on body composition, lipid profiles, cardiovascular function, and selected physical fitness indices in young men.

Methods

This study utilized a semi-experimental design with pre- and post-test measurements. Thirty healthy volunteers participated in the study, meeting the inclusion criteria of being between 19 and 29 years old, non-smokers, non-drinkers, not using supplements or certain drugs, and not engaging in regular sports activities during the last six months. Exclusion criteria included hepatic, renal, bone, and cardiovascular diseases, as well as severe hypertension. Before the study, the research objectives and procedures were fully explained to the participants, and written informed consent was obtained after completing the personal information, sport medical record, and physical activity readiness questionnaires. Participants' general health, musculoskeletal, and cardiorespiratory systems were confirmed by medical experts to ensure eligibility. All subjects were healthy, not under any medical treatment, and were instructed to avoid additional physical activity while maintaining their usual diet during the study period. The study was approved by the ethics committee and conducted in accordance with the latest version of the Declaration of Helsinki. Maximal oxygen uptake (VO_2max) was assessed using the Shuttle Run Test to control environmental factors and determine training intensity. Based on the obtained data and indices such as age, height, weight, and BMI, thirty participants were divided into two homogeneous groups (n=15 each): forward running (FR) and backward running (BR). The sample size was calculated using G*Power software (Heinrich-Heine-Universität, Düsseldorf, Germany). Both groups participated in an eight-week interval running program under identical conditions. Participants were asked to maintain similar dietary habits and record their food intake for three days (Two weekdays and one weekend) before and after the intervention. The data were analyzed using Nutritionist software (Version 4) to determine total energy intake and macronutrient composition (Proteins, fats, carbohydrates). Forty-eight hours before training, participants visited the laboratory for fasting blood sampling in the morning and afternoon body composition and cardiovascular measurements. On the following day, they performed functional tests in randomized order with sufficient rest between trials to avoid fatigue. After the eight-week training program, all participants underwent the same post-test procedures at the same time of day and under constant environmental conditions (24 ± 2 °C).

Training protocol

Both groups performed a researcher-designed interval training program developed and piloted based on training science principles and participants' aerobic capacity. Training was conducted four days per week for eight weeks. Each session began with a 10-minute warm-up (Including light exercises, fast walking, and static stretching), followed by interval running as outlined in Table 1: two minutes of running at 60-85% of maximum heart rate (MHR) followed by one minute of active rest at 35-50% MHR in the same direction. Sessions concluded with a 10-minute cool-down of slow walking and stretching. All sessions were conducted on a safe, obstacle-free track, and training intensity was monitored using a Polar heart rate monitor (Finland).

Body composition measurement

Participants' height and weight were measured using a SECA stadiometer (Germany, accuracy <5 mm) and a NETZ digital scale (Germany, accuracy <100 g), respectively. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Body fat percentage was assessed using a Lafayette caliper (USA) following the Jackson–Pollock three-point method (Abdomen, chest, and thigh). Waist-to-hip ratio (WHR) was determined with a tape measure (Precision 0.1 cm), measuring the waist at the narrowest point around the umbilicus and hip at the widest point; WHR was calculated by dividing waist circumference by hip circumference.

Measuring physical fitness factors

Aerobic power was measured using a 20-meter Shuttle run test (Each subject ran 20 meters back and forth, reaching the line before each beep sound). The test was completed if the subject failed to reach the 20-meter line for three consecutive times when the beep sound was heard. Finally, VO_2max was obtained using equation 1 (13). The anaerobic power was measured by RAST test, which included six 35-meter maximal sprints with 10-second rest intervals between repetitions. The maximum power was determined using equation 2 (14). Speed was calculated using a 45-meter test. The time of passing through the finish line was recorded as a record using a timer with a precision of 0.01 seconds (15); agility was measured using the 9x4 test. The time was recorded by stopwatch (12). All measurements were done twice and the mean was recorded. It should be noted that measurements were done in the post-test by the same examiner who recorded the pre-test.

Equation 1: $VO_2max = 61.1 - (2.2 \times sex) - (0.462 \times age) - (0.268 \times BMI) + (0.192 \times courses)$

Equation 2: Maximum Anaerobic Power= weight (kg) $\times 35^2$/ (Fastest repetition time) ^{3}

Table 1. Training protocol for forward and backward running

Group	Week	Training protocol: Warm up	Body (2 minutes of training and 1 minute of active rest)	Cool down
Forward running	1	10 min	9 repetitions - 60-65% MHR	10 min
	2		9 repetitions - 60-65% MHR	
	3		10 repetitions - 65-70% MHR	
	4		10 repetitions - 65-70% MHR	
	5		11 repetitions - 70-75% MHR	
	6		11 repetitions - 70-75% MHR	
	7		12 repetitions - 75-80% MHR	
	8		12 repetitions - 80-85% MHR	
Backward running	1	10 min	9 repetitions - 60-65% MHR	10 min
	2		9 repetitions - 60-65% MHR	
	3		10 repetitions - 65-70% MHR	
	4		10 repetitions - 65-70% MHR	
	5		11 repetitions - 70-75% MHR	
	6		11 repetitions - 70-75% MHR	
	7		12 repetitions - 75-80% MHR	
	8		12 repetitions - 80-85% MHR	

Abbreviations. MHR: Maximum Heart Rate

Measurement of cardiovascular functional indices

Participants' cardiovascular functional indices (Heart rate, systolic blood pressure, diastolic blood pressure and Rate Pressure Product) were measured at the beginning and end under the same conditions. These indices were measured by a physician using a standard mercury barometer ($ALPK_2$, made in Japan) and a Stethoscope ($ALPK_2$, made in Japan).

Measurement of lipid profiles

Ten milliliters of peripheral venous blood samples were collected at two stages (Pre- and post-tests) after 12 hours of fasting overnight and sitting on the chair from the median cubital vein of the left arm of the participants. Blood samples were then transferred to special tubes and centrifuged (3000 rpm for 10 minutes). Serum samples were aliquoted into several microtubes and frozen at -80 °C until measurement. Concentrations of fasting glucose, high-density lipoprotein (HDL-C), and triglyceride (TG) were measured using the Colorimetric Enzymatic method, and low-density lipoprotein (LDL-C) and total cholesterol (TC) by the Enzymatic Photometric method using human kits of Pars Azmun Co. (Sensitivity of 1 mg/dl and intra-group coefficient of variation: 1.2%) made in Iran.

Ethical considerations

In the present study, the researchers, accompanied by a physician and four, the researchers monitored participants' conditions throughout all stages and ensured adherence to ethical standards. At the beginning of the study, all steps, benefits, disadvantages, as well as the training program method were explained to the participants and informed consent forms were collected from them. The participants were allowed to withdraw from the study at any time without providing a reason; fortunately, no one left. All participants' information was also analyzed confidentially.

Statistical analysis

Data were analyzed using SPSS version 19. The Shapiro-Wilk test was first utilized to assess the normality of data. The dependent t-test was then used to determine intra-group differences, and the independent t-test was used to examine inter-group differences. A significance level of $p < 0.05$ was considered for all statistical tests.

Results

There were no significant differences between the two groups in age, height, weight, BMI, and VO_2max in the pre-test. In fact, it represents the homogeneity of groups. The analysis of recorded food data indicates that there is no significant difference in the protein, fat and carbohydrate intake, and calorie uptake in groups before and after the training period.

Table 2. Glucose and lipid profile variables

Blood biochemical parameters (mg/dL)	Group	Pre (M ± SD)	Post (M ± SD)	Intra-groups P-value *	Inter-groups P-value
Glucose	Forward running	10.14±86.21	9.28±82.32	0.034	0.131
	Backward running	8.13±83.61	10.68±77.09	0.021	
HDL-C	Forward running	11.15±45.71	12.34±53.39	0.012	0.009 *
	Backward running	12.17±43.72	10.21±56.42	0.005	
LDL-C	Forward running	24.12±93.07	23.75±77.44	0.026	0.137
	Backward running	27.16±87.79	25.56±70.24	0.014	
TG	Forward running	48.14±129.21	50.19±109.32	0.009	0.211
	Backward running	51.14±117.31	47.58±96.41	0.008	
TC	Forward running	41.17±167.13	40.28±153.22	0.027	0.022 *
	Backward running	39.27±162.78	38.16±142.52	0.011	

Abbreviations: HDL-C: High-Density Lipoprotein, LDL-C: Low-Density Lipoprotein, TG: Triglyceride, TC: Total Cholesterol. Data is presented as mean ± SD.
* $P < 0.05$

Body composition

Results of body composition variables (Dependent t-test) showed improvement in both groups after eight weeks of forward and backward running. Weight, fat percentage, body mass index and waist-to-hip ratio significantly decreased in both groups ($p < 0.05$). The study found significant differences between the forward and backward running groups in percentage (p=0.014) and waist-to-hip ratio (p=0.018), but not in weight and body mass index.

Physical fitness

Results of physical fitness variables (Dependent t-test) indicated that the aerobic power and agility increased significantly after eight weeks of training. The anaerobic power indicated significant difference only in the backward running group (p=0.038). Based on the results of the present study, there are significant differences between Forward running and backward running groups in anaerobic power (p=0.034) and agility (p=0.028). This difference was not significant in aerobic power and speed indices.

Cardiovascular function

Results of cardiovascular function variables (Dependent t-test) showed that the heart rate (HR), systolic blood pressure, and Rate Pressure Product significantly decreased after eight weeks of training in both groups ($p < 0.05$). The results of comparing the two groups did not show any significant differences between the Forward running and backward running groups in heart rate, systolic blood pressure, diastolic blood pressure, and rate-pressure product.

Metabolic profile

Results of lipid profiles and blood glucose (dependent t-test) showed that levels of glucose, LDL-C, TG, and TC significantly decreased after eight weeks of forward and backward running, but HDL-C values increased significantly in both groups after eight weeks. Based on the results of the present study, there are significant differences between the Forward running and backward running groups in HDL-C (p=0.009) and TC (p=0.022). This difference was not significant in glucose, LDL-C, and TG indices (Table 2).

Discussion

The results of this study indicate that both backward and forward running improved body fat percentage, waist-to-hip ratio, anaerobic power, agility, triglycerides, and HDL. No significant differences were observed between groups in weight, BMI, aerobic power, velocity, glucose, total cholesterol, LDL, heart rate, systolic and diastolic blood pressure, or Rate Pressure Product, with both groups showing similar changes. The study assessed these indices after eight weeks of training. Long-term adaptations to backward running remain largely unexplored, with most research limited to single sessions; thus, only indirect evidence and proposed mechanisms could be referenced. Studies suggest that backward running elicits greater metabolic responses and enhances cardiorespiratory fitness compared to forward movement in both walking and running. It also improves lower limb range of motion and muscle strength more effectively than forward running, and is considered beneficial in rehabilitation settings (1,2,6). Terbulanche et al. studied the impact of backward running on increasing oxygen uptake and metabolic effects and reported that in this field, backward running had significant positive effects (8). In another study, Terbulanche found that the metabolic change rate was lower in backward movement than in forward movement (7). Additionally, studies have been conducted to measure metabolic rate of backward movement. Results of research by Chaloupka et al. indicated that the backward movement on a 5% treadmill slope (16). There was a direct and non-linear relationship between oxygen consumption and different speeds of backward movement. Furthermore, there was a non-linear relationship between the heart rate and speed of backward running. This relationship was directed between heart rate and oxygen consumption (17). Studies have suggested that interval aerobic exercise can enhance fat metabolism and improve body composition by increasing the capacity of oxidative enzymes, activities of the electron transport chain enzymes, beta-oxidation cycle enzymes, the lipoprotein lipase activity, and density of β-adrenergic receptors in cells (18). Blood pressure-related mechanisms are not precisely defined, but multiple factors involve neuromuscular systems, structural and neuromuscular hormonal adaptations, as well as a decrease in systemic vascular resistance (19). Some studies have indicated that there is a positive relationship between body fat percentage and blood cholesterol level, and the improved body composition by regular physical activity improves lipid profiles (20). Motor and exercise activities reduce glucose concentrations and improve blood lipids by increasing the total glucose consumption by muscle cells and also increasing the metabolism of lipids. Evidence suggests that catecholamine hormones and growth hormone increase during physical activity, and these hormones can increase lipolysis, and subsequently the use of fat stores increases as a source of energy during physical activity, and may increase HDL and activity of lipoprotein lipase (LPL). LPL enzyme is effective in the conversion of VLDL to HDL and increases HDL-C levels with its activity. On the other hand, Lecithin–cholesterol acyltransferase (LCAT) converts cholesterol into HDL particles in addition to LDL. The increase in this enzyme may be responsible for increasing HDL due to training (20,21). Some factors that may contribute to increasing the anaerobic capacity include: increasing the concentration of muscle's phosphocreatine and its rate of re-production in recovery, activities of anaerobic enzymes, activating motor units, changing fiber types I and IIX to IIa, and increasing muscle buffering capacity (22). Changes in VO_2max may be due to an increase in oxygen delivery in active muscles or an increase in its uptake in active muscles (Increased capillary network, mitochondrial density, and muscle myoglobin content) that ultimately results in increased muscle blood flow (18). Overall, the differences observed in most indices between backward and forward running can be attributed to the specific mechanisms of backward running, including greater motor unit recruitment. Physiological adaptations depend on the type, structure, and characteristics of training programs, and the differences in the present study likely result from the training method itself. Backward running involves rapid movements, increased motor unit firing rates, strength-to-power conversion, enhanced neuromuscular coordination, and biochemical and enzymatic changes, which together may explain the observed improvements. Each step in backward running recruits more muscles than forward running, increasing caloric expenditure, metabolic rate, cardiovascular function, and endurance (1-5). Insufficient duration, intensity, or number of sessions may account for the lack of significant differences in some indices, as intramuscular adaptations typically require 6-62 weeks (23). Overall, backward running may induce greater neuromuscular adaptations, improved motor unit recruitment, frequency, and synchronization, leading to enhanced muscle power, efficiency, and coordination. Given the incomplete understanding of its mechanisms, further long-term studies are needed to clarify the physiological adaptations of this training method.

Conclusion

Results of the present study indicated that eight weeks of backward interval running had greater effects on improving some factors, such as physical fitness, body composition, and lipid profiles than forward interval running in young men. In fact, these findings can be utilized to design a training program by sports coaches and ordinary people. Therefore, it is recommended to use this training method to increase performance, improve body composition and positive metabolic changes.

Acknowledgement

We would like to extend our heartfelt gratitude to all the participants who volunteered for this study. Your willingness to engage in this research and your dedication to the training protocols were essential to the success of our investigation. Thank you for your time, effort, and commitment, which made this study possible.

Funding sources

None declared.

Ethical statement

This study was conducted in accordance with the ethical standards of the Declaration of Helsinki. The study was approved by the ethics committee and carried out in agreement with the latest version of the Declaration of Helsinki. Prior to participation, all subjects were provided with informed consent, and all participants were informed of their right to withdraw from the study at any time without any consequences.

Conflicts of interest

The authors declare no conflicts of interest.

Author contributions

All authors, Bizhan Hooshmand Moghadam, Parisa Pournemati, and Maryam Dalirani, contributed equally to the study. They were involved in the conceptualization, methodology, data collection, analysis, literature review, and writing of the manuscript. Each author has read and approved the final version of the manuscript.

Data availability statement

The data of this study are available from the corresponding author upon reasonable request.

References

1. Amoozade khalili M, Hajihasani AH. Comoparison between the effects of forward and backward running exercises on lower limb function tests. J rafsanjan univ Med Sci. 2011;10(3):205-14. [View at Publisher] [Google Scholar]
2. Ordway JD, Laubach LL, Vanderburgh PM, Jackson KJ. The Effects of Backwards Running Training on Forward Running Economy in Trained Males. J Strength Cond Res. 2016;30(3):763-7. [View at Publisher] [DOI] [PMID] [Google Scholar]
3. Mehdizadeh S, Arshi AR, Davids K. Quantifying coordination and coordination variability in backward versus forward running: Implications for control of motion. Gait Posture. 2015;42(2):172-7. [View at Publisher] [DOI] [PMID] [Google Scholar]
4. Dufek J, House A, Mangus B, Melcher G, Mercer J. Backward walking: A possible active exercise for low back pain reduction and enhanced function in athletes. J Exerc Physiol Online. 2011;14(2):17-26. [View at Publisher] [Google Scholar]
5. Hoogkamer, W, Meyns, P, Duysens J. Steps forward in understanding backward gait: From basic circuits to rehabilitation. Exerc Sport Sci Rev. 2014;42(1):23-9. [View at Publisher] [DOI] [PMID] [Google Scholar]
6. Whitley CR, Dufek JS. Effects of backward walking on hamstring flexibility and low back range of motion. Int J Exerc Sci.2011;4(3):192-8. [View at Publisher] [DOI] [Google Scholar]
7. Terblanche E, Cloete WA, du Plessis PAL, Sadie JN, Strauss A, Unger M. The metabolic transition speed between backward walking and running. Eur J Appl Physiol. 2003;90(5-6):520-5. [View at Publisher] [DOI] [PMID] [Google Scholar]
8. Terblanche E, Page C, Kroff J, Venter RE. The effect of backward locomotion training on the body composition and cardiorespiratory fitness of young women. Int J Sports Med. 2005;26(3):214-9. [View at Publisher] [DOI] [PMID] [Google Scholar]
9. Flynn TW, Connery SM, Smutok MA, Zeballos RJ, Weisman IM. Comparison of cardiopulmonary responses to forward and backward walking and running. Med Sci Sports Exerc. 1994;26(1):89-94. [View at Publisher] [DOI] [PMID] [Google Scholar]
10. Kim Y-S, Park J, Shim JK. Effects of aquatic backward locomotion exercise and progressive resistance exercise on lumbar extension strength in patients who have undergone lumbar diskectomy. Arch Phys Med Rehabil. 2010;91(2):208-14. [View at Publisher] [DOI] [PMID] [Google Scholar]
11. Shankar P, Bhandiwad RMA, Pai H. Effectiveness of retrowalking in chronic osteoarthritis of knee joint. Innovative J MedHealth Sci. 2013; 3: 19-22. [View at Publisher] [Google Scholar]
12. Fakourian A, Azarbaijani MA, Peeri M. Effect a period of selective military training on physical fitness, body mass index, mental health and mood in officer students. J Army Univ Med Sci. 2012;10(1):17-27. [View at Publisher]
13. Behrad A, Askari R, Hamedinia MR.The effect of high intensity interval training and circuit resistance training on respiratory function and body composition in overweight females. Journal of Practical Studies of Biosciences in Sport. 2016;4(7):89-101. [View at Publisher] [DOI] [Google Scholar]
14. Nikbakht H, Keshavarz S, Ebrahim K. The effects of tapering on repeated sprint ability (RSA) and maximal aerobic power in male soccer players. American Journal of Scientific Research. 2011;30:125-33. [View at Publisher] [Google Scholar]
15. Arazi H, Abbasi M, Eghbali E. Effect of Hype energy drink on performance indicators and blood lactate levels in elite badminton players. sport physiology and management investigations. 2015;7(4):9-20 [View at Publisher] [Google Scholar]
16. Chaloupka EC, Kang J, Mastrangelo MA, Donnelly MS. Cardiorespiratory and metabolic responses during forward and backward walking. J Orthop Sports Phys Ther. 1997;25(5):302-6. [View at Publisher] [DOI] [PMID] [Google Scholar]
17. Myatt G, Baxter R, Dougherty R, Williams G, Halle J, Stetts D. The cardiopulmonary cost of backward walking at selected speeds. J Orthop Sports Phys Ther. 1995;21(3):132-8. [View at Publisher] [DOI] [PMID] [Google Scholar]
18. MacInnis MJ, Gibala MJ. Physiological adaptations to interval training and the role of exercise intensity. J Physiol. 2017;95(9):2915-30. [View at Publisher] [DOI] [PMID] [Google Scholar]
19. Lemes IR, Turi-Lynch BC, Cavero-Redondo I, Linares SN, Monteiro HL. Aerobic training reduces blood pressure and waist circumference and increases HDL-c in metabolic syndrome: a systematic review and meta-analysis of randomized controlled trials. J Am Soc Hypertens. 2018; 12(8):580-8. [View at Publisher] [DOI] [PMID] [Google Scholar]

20. Bey L, Hamilton MT. Suppression of skeletal muscle lipoprotein lipase activity during physical inactivity: a molecular reason to maintain daily low-intensity activity. J Physiol. 2003;551(2):673-82. [View at Publisher] [DOI] [PMID] [Google Scholar]
21. Rashidlamir A, Alizadeh A, Ebrahimiatri A, Dastani M. The effect of four-week period of aerobic exercise with cinnamon consumption on lipoprotein indicates and blood sugar in diabetic female patients (type 2). J Shahid Sadoughi Univ Med Sci. 2012;20(5):605-14. [View at Publisher] [Google Scholar]
22. Mazurek K, Krawczyk K, Zmijewski P, Norkowski H, Czajkowska A. Effects of aerobic interval training versus continuous moderate exercise programme on aerobic and anaerobic capacity, somatic features and blood lipid profile in collegate females. Ann Agric Environ Med. 2014;21(4):844-9. [View at Publisher] [DOI] [PMID] [Google Scholar]
23. Keyhanian A, Ebrahim K, Rajabi H, Marandi S M. Compaison the effect of resistance exercise with active and passive rest on aerobic and anaerobic fitness in soccer players. jsmt. 2015;13(9):47-62. [View at Publisher] [DOI] [Google Scholar]

Cite this article as:

Hooshmand Moghadam B, Pournemati P, Dalirani M. Effects of eight weeks of forward and backward interval running on blood glucose and lipid profiles in young men. *Med Lab J.* 2025;19(5):40-4. http://dx.doi.org/10.29252/mlj.19.5.40