New Approaches in Exercise Physiology (NAEP)
Vol. 6, No.12, December 2024
www.nass.atu.ac.ir
DOI: 10.22054/nass.2025.88111.1183

ATU PRESS

Studying the effect of 12 weeks of combined training (resistance + aerobic) on serum levels of some cardiovascular risk factors in female patients with type 2 diabetes

Mohammad Mohammadi *
Department of Sports Sciences, Faculty of human Sciences, Malayer University, Malayer, Iran.

Mahsa Alirezaei
BSc in Physical Education and sport sciences, Department of Sports Sciences, Faculty of human Sciences, Malayer University, Malayer, Iran.

Gohar Rostaei
BSc in Physical Education and sport sciences, Department of Sports Sciences, Faculty of human Sciences, Malayer University, Malayer, Iran.

Original Research   Accepted: September 25, 2025   Received: August 10, 2025

* Corresponding Author: mohammadi.m123@gmail.com.
How to Cite: Mohammadi, M, Alirezaei, M., & Rostaei, G. (2024). Studying the effect of 12 weeks of combined training (resistance + aerobic) on serum levels of some cardiovascular risk factors in female patients with type 2 diabetes, *Journal of New Approaches in Exercise Physiology*, 6(12), 5-20.
DOI: 10.22054/nass.2025.88111.1183

Abstract

Purpose: In many countries, type 2 diabetes has emerged as a chronic non-communicable disease. Type 2 diabetes is usually associated with increased cardiovascular risk factors. The role of physical activity has been proven as a useful intervention in the prevention, management and treatment of type 2 diabetes. The aim of the present study was to study the effect of 12 weeks of combined training (resistance + aerobic) on serum levels of some cardiovascular risk factors in patients with type 2 diabetes. **Method:** In this study, 22 individuals with type 2 diabetes, aged 30 to 60 years, participated. The subjects were randomly assigned to one of two combined training and control groups, 11 in number. The training program assigned to each group was carried out for 12 weeks and three sessions per week. To investigate the dependent variables, blood samples were taken from all subjects one day before and 48 hours after the last training session. Data analysis was performed using paired t-tests and independent t-tests ($P<0.50$). **Results:** After 12 weeks of participation in sports activities, the mean total cholesterol ($p=0.001$), low-density lipoprotein ($p=0.001$), triglyceride ($p=0.011$), and body mass index ($p=0.01$) in the combined training group (resistance + aerobic) significantly decreased, and high-density lipoprotein levels ($p=0.036$) in this group significantly increased after training interventions. **Conclusion:** According to the results of the present study, it seems that combined training improves the body's lipid profile by significantly reducing the levels of total cholesterol, low-density lipoprotein, triglyceride, and body mass index. Therefore, combined exercises are recommended as an effective intervention in reducing cardiovascular risk factors in type two diabetic patients.

Keywords: exercise training, combined exercise, type 2 diabetes, lipid profile.

Introduction

Type 2 diabetes is a metabolic disease characterized by absolute or relative insulin deficiency, elevated blood glucose, and impaired carbohydrate, fat, and protein metabolism (Fasihi, Agha-Alinejad, Gharakhanlou, & J Amaro Gahete, 2025; Regufe, Pinto, & Perez, 2020). Physical activity has been proposed as an important non-pharmacological treatment for type 2 diabetes (Coomans de Brachene et al., 2023). Most people know that type 2 diabetes is caused by a sedentary lifestyle, and daily exercise or physical activity is one of the health components that is effective in the treatment and prevention of type 2 diabetes(Fasihi, Siahkouhian, Jafarnezhadgero, & Fasihi, 2025) (Burr, Rowan, Jamnik, & Riddell, 2010). Improving blood glucose levels, increasing insulin sensitivity, preventing or delaying the development of type 2 diabetes, and reducing glucose concentrations are all benefits of regular exercise for patients with diabetes (Way, Hackett, Baker, & Johnson, 2016). Regular physical activity prevents the development of chronic non-communicable diseases and, as a result, reduces the risk of premature mortality (Magkos, Hjorth, & Astrup, 2020). In addition, exercise prevents many atherosclerotic risk factors, including high blood pressure, insulin resistance and glucose intolerance, triglyceride concentrations, and high cholesterol (Sanz, Gautier, & Hanaire, 2010). Over the past two decades, the American College of Sports Medicine has recognized resistance training as an important component of comprehensive fitness programs to improve cardiovascular function at all ages (Nelson et al., 2007).

Atherosclerotic cardiovascular disease (ASCVD) refers to a condition that involves the accumulation of cholesterol in the arteries and most commonly manifests as coronary heart disease, cerebrovascular disease, and peripheral artery disease of atherosclerotic origin (Rosenblit, 2019). ASCVD is a leading cause of morbidity and mortality among people with diabetes worldwide, resulting in an estimated annual cost of $37.3 billion (Osoro, Kumar, & Sharma, 2023). Type 2 diabetes mellitus (T2DM) is associated with an early onset of ASCVDs (Marwick et al., 2009). Specifically, diabetic patients typically develop cardiovascular abnormalities 14.6 years earlier than patients without diabetes (DM) (Marwick et al., 2009). Established risk factors for ASCVD include hypertension and dyslipidemia, which are common in patients with T2DM (Jarvie et al., 2019; Krchegani & Savari, 2025). Studies have shown that patients who were pre-conditioned with dyslipidemia had disturbed lipid and glucose metabolism (insulin resistance), which led to a poorer prognosis for ASCVD (Di Murro et al., 2023; Trinks, 2024). Diabetic dyslipidemia is characterized specifically by elevated triglycerides (TG) and decreased high-density lipoprotein cholesterol (HDL-C) levels, although low-density lipoprotein cholesterol (LDL-C) concentrations usually remain normal (Vavlukis & Kedev, 2018).

Exercise reduces fasting or postprandial TG and increases HDL-C by improving the concentration and activity of lipoprotein lipase (LPL) in skeletal muscle and accelerating the transport, breakdown, and excretion of fat (Katsanos, Grandjean, & Moffatt, 2004). 8 to 14 weeks of aerobic exercise have been shown to reduce fasting TG levels by 4 to 37% and increase HDL-C concentrations by 4 to 18% (Tartibian, Fasihi, & Eslami, 2020; Zhao, Zhong, Sun, & Zhang, 2021). In this regard, Ghorbani et al. (2012) investigated the effect of 10 weeks of aerobic exercise on lipid profile and body composition in people with diabetes (Ghorbani, Ziaee, Yazdi, KHOEYNI, & Khoshpanjeh, 2012). The results of this study showed that aerobic exercise and walking with appropriate volume and intensity could affect lipid profile and body composition in diabetic patients and reduce the risk of cardiovascular diseases, especially atherosclerosis in these patients. In addition, Shi-Wei Shen et al. (2018) showed in a cross-sectional study on 27,827 Chinese men that physical activity significantly reduced AIP after adjusting for age, body mass index, diastolic blood pressure, and fasting blood glucose and uric acid levels (Shen et al., 2018). In addition, they reported that moderate-intensity aerobic exercise for 90 minutes or more per week was associated with a reduction in AIP among middle-aged men in southeastern China.

However, at present, few studies have examined the effect of different exercise programs on lipid profile levels. Therefore, the present study aimed to investigate the effect of 12 weeks of aerobic, resistance, and combined (resistance + aerobic) training on serum levels of some cardiovascular risk factors in patients with type 2 diabetes.

Methods

The statistical population of the present study consisted of all people with diabetes in the province. From the statistical population, 44 eligible males with an age range of 30 to 60 years and a mean body mass index of 45.75±14.35 were selected by the examiners and randomly divided into two equal groups: control and combined training. All subjects completed the informed consent form before the start of the course.

The weight of all individuals was measured in a fasting state using a Seca model 813 digital scales made in Germany with an accuracy of 0.1 kg, without shoes and with minimal clothing. Height was measured in centimeters using a non-retractable tape measure with an accuracy of 0.1 cm between 8:00 AM and 10:00 AM (at the same time as weight measurement), without shoes or socks, while standing flat against a wall with heels, hips, shoulders, and back of the head in contact with the wall. Resting and activity heart rates were measured using a Polar heart rate monitor made in Sweden.

The inclusion criteria for the present study included not participating in regular sports activities during the year leading up to the study, not using drugs, not having a history of or suffering from certain diseases, including (cancer, cardiovascular and pulmonary diseases, liver diseases), and having the necessary physical fitness to start the exercise program. The exclusion criteria included a history of taking hormonal drugs, having a chronic illness, and missing more than two exercise sessions. Subjects in each group completed their specific training program under the supervision of the examiner for 12 weeks and three sessions per week (Saturday, Monday, and Wednesday). Each session included three warm-up phases, the main phase, and a cool-down phase.

Stretching and flexibility exercises were used for 10 minutes in the warm-up phase. Then, each group performed their specific training according to the following programs.

Training program

The training protocol included 12 weeks of combined training (resistance + aerobic). Training sessions were designed to be performed at a specific time of day to maintain circadian rhythm. Each training session lasted 50 minutes, starting with a 10-minute warm-up including slow walking and stretching, followed by the main body of the exercise for 30 minutes, and ending with a 10-minute cool-down including slow walking, stretching, and muscle relaxation. The subjects in the combined training group completed both aerobic and resistance training programs for 12 weeks, 3 sessions per week. The subjects first performed the resistance-training program, which included running on a treadmill for 30 minutes at an intensity of 60% to 70% of maximum heart rate, alternating between 3 periods of 10 minutes with a 5-minute rest between each period. After that, they rested for 15 minutes and then the aerobic training program included eight movements in the form of stations, which included three sets of 8-10 repetitions and an intensity of 60% of one repetition maximum. The rest time between each station was 30 seconds, and the rest time between each set was 120 seconds. The stations included leg press, back leg press, front leg press, chest press, forearm press, bilateral pull-down, seated row, and bicep curl, which involved the large muscles of the upper and lower body. In order to comply with the principle of overload, the subjects were re-tested for the one-repetition maximum test at the end of the second week to calculate 60% of their one-repetition maximum. The subjects in the control group were advised to refrain from regular physical activities and unusual diets during the study period. In order to examine the levels of cholesterol, triglyceride, LDL, and HDL, 5 cc blood samples were taken from the left brachial vein of each subject 24 hours before the first training session and 48 hours after the last training session and after a 12-hour fast. All samples were taken at a specific time of day (between eight and 10 am). Cholesterol levels were measured by enzymatic photometry (Pars Azmoun Company, Iran), triglycerides by enzymatic calorimetric (Pars Azmoun Company, Iran), LDL and HDL were also measured by enzymatic calorimetric (Randox Commercial Kit, County Antrim Company, England.

To check the normality of the data, the Shapiro-Wilk statistical test was used, to examine the intra-group changes of the measured variables, the paired t-test was used, and the independent t-test was used to examine the differences between the groups in the two stages of the pre-test and post-test. The significance level of the present study was considered to be $P<0.05$. All data were analyzed using SPSS version 26 software.

Results

The results of the Kolmogorov-Smirnov test indicated a normal distribution of data in different groups. Levine's test was also used to examine the homogeneity of variances, which indicated equality of variances in different groups ($p>0.05$).

The mean and standard deviation of the general and physiological characteristics of the two groups are presented in Table 1.

Table 1. Anthropometric characteristics of subjects

Variables	**Groups**	
	combined training (resistance + aerobic) Mean + SD	**Control Mean + SD**
Age (Year)	28.15±7.14	31.86±9.23
Weight (kg)	71.11±5.3	76.21±5.17
Height (cm)	158.01 ± 5.15	156.21±7.23
BMD (kg/m2)	27.48± 1.24	27.71±1.83

The results of the independent t-test showed that none of the measured indicators in the two groups were significantly different at baseline ($p>0.05$). The average changes in the levels of cardio metabolic risk factors from baseline to after the exercise intervention for the subjects based on different groups are shown in Table 2. The results of this table show that there is no significant difference between the groups at baseline. In the combined exercise group, after 12 weeks of exercise intervention, a significant decrease in total cholesterol ($p=0.001$), low-density lipoprotein ($p=0.001$), and triglyceride ($p=0.011$) was observed. On the other hand, high-density lipoprotein levels ($p=0.036$) increased significantly in this group after exercise interventions (Table 2).

Table 2: Comparison of mean and standard deviation of variables before and after exercise intervention in the combined exercise and control groups

Variable	group	pre-test Mean + SD	post-test Mean + SD	P Value
TG (mg/dl)	combined training (resistance + aerobic)	163.12 ± 48.44	138.62±31.46	0.036
	Control	162.32±30.61	162.12±31.51	0.458
	P*	0.442	0.022	
LDL-C (mg/dl)	combined training (resistance + aerobic)	134.62±28.63	95.75±22.48	0.031
	Control	134.26±30.34	134.75±27.14	0.752
	P*	0.336	0.014	
TC (mg/L)	combined training (resistance + aerobic)	198.12 ± 37.72	152.50±35.90	0.032
	Control	197.20 ± 41.34	198.50±40.53	0.123
	P*	0.731	0.031	

BMI (kg/m2)	combined training (resistance + aerobic)	27.47±0.92	25.96±1.23	0.012
	Control	27.07±0.88	27.01±0.90	0.657
	P*	0.502	0.028	

Discussion

In summary, the results of the present study showed that combined training after 12 weeks caused favorable changes in serum levels of some cardiovascular risk factors in patients with diabetes. 12 weeks of exercise significantly reduced total cholesterol and low-density lipoprotein plasma levels in the combined training groups. On the other hand, the mean high-density lipoprotein in this group increased significantly. However, in the resistance training group, only total cholesterol decreased significantly, but no significant changes were observed in the other variables studied. From the results, it seems that the volume and intensity of exercise in the combined training group were at a favorable level and this training method is likely to be more effective in reducing cardiovascular risk factors than other training methods studied. These results are consistent with the findings of Kraus et al. These researchers stated in their study that TC and LDL levels were affected by the intensity of exercise and that high-intensity exercise has a significant effect on these indicators (Kraus et al., 2002; Tartibian et al., 2020). Therefore, it can be said that one of the reasons for the lack of significant reduction in these indices in the present study may be the low intensity of the exercise programs. However, previous studies have reported that moderate-intensity exercise was also effective in reducing these indices (Fasihi, Tartibian, Eslami, & Fasihi, 2022; Magalhães et al., 2020; Shlool & Qandeel, 2023).

On the other hand, the results of some studies have shown that the higher the initial levels of the blood lipid profile, the greater the changes caused by exercise (Doewes, Gharibian, Zaman, & Akhavan-Sigari, 2023; Zhao et al., 2021). The results of previous studies show that in order to create significant changes in atherogenic indices, it is necessary to have sufficient volume and intensity of exercise (Tambalis, Panagiotakos, Kavouras, & Sidossis, 2009). In this regard, Edwards et al. reported a negative relationship between the amount of physical activity and the plasma atherogenic index. This means that the more physical activity a person has, the lower the plasma atherogenic index (Edwards, Blaha, & Loprinzi, 2017). Exercise reduces low-density lipoprotein, triglycerides and cholesterol and increases high-density lipoprotein by increasing the enzyme lipoprotein lipase (LPL) in skeletal muscles and lecithin cholesterol acyltransferase (LCAT) (Wang & Xu, 2017). Lipoprotein lipase increases VLDL and low-density lipoprotein catabolism after exercise (Blazek, Rutsky, Osei, Maiseyeu, & Rajagopalan, 2013). An increase in lecithin-cholesterol acyltransferase activity after exercise can increase cholesterol esterification and, as a result, more transfer to the high-density lipoprotein core (Durstine, Anderson, Porter, & Wang, 2019). It also reduces serum cholesterol levels and enables the high-density lipoprotein molecule to increase high-density lipoprotein levels by further esterifying cholesterol. One of the limitations of the present study is the lack of measurement of these enzymes. Other limitations of the present study include the lack of full-time access to the subjects and the lack of control over their nutrition, the lack of measurement of muscle mass, and the amount of visceral fat.

Conclusion

The results of the present study showed that exercise caused favorable changes in cardiovascular risk factors in people with type 2 diabetes. Combined exercise significantly reduced cardiovascular risk factors such as total cholesterol levels and plasma low-density lipoprotein and significantly increased high-density lipoprotein. Combined exercise with lipid profile improvement along with other therapeutic methods can probably be recommended as an effective intervention in reducing cardiovascular risk factors in type two diabetic patients.

Conflict of interest

The authors declare that there is no conflict of interest.

Acknowledgment

The authors are grateful to the subjects who participated in the study.

ORCID

Mohammad Mohammadi **https://orcid.org/**
Mahsa Alizadeh **https://orcid.org/**
Gohar Rostaei **https://orcid.org/**

Reference

Blazek, A., Rutsky, J., Osei, K., Maiseyeu, A., & Rajagopalan, S. (2013). Exercise-mediated changes in high-density lipoprotein: impact on form and function. *American heart journal, 166*(3), 392–400.

Burr, J. F., Rowan, C. P., Jamnik, V. K., & Riddell, M. C. (2010). The role of physical activity in type 2 diabetes prevention: physiological and practical perspectives. *The Physician and sportsmedicine*, *38*(1), 72–82.

Coomans de Brachene, A., Scoubeau, C., Musuaya, A. E., Costa-Junior, J. M., Castela, A., Carpentier, J., . . . Eizirik, D. L. (2023). Exercise as a non-pharmacological intervention to protect pancreatic beta cells in individuals with type 1 and type 2 diabetes. *Diabetologia, 66*(3), 450–460.

Di Murro, E., Di Giuseppe, G., Soldovieri, L., Moffa, S., Improta, I., Capece, U., . . . Brunetti, M. (2023). Physical activity and type 2 diabetes: in search of a personalized approach to improving β-cell function. *Nutrients, 15*(19), 4202.

Doewes, R. I., Gharibian, G., Zaman, B. A., & Akhavan-Sigari, R. (2023). An updated systematic review on the effects of aerobic exercise on human blood lipid profile. *Current problems in cardiology, 48*(5), 101108.

Durstine, J. L., Anderson, E., Porter, R. R., & Wang, X. (2019). Physical activity, exercise, and lipids and lipoproteins. In *Cardiorespiratory Fitness in Cardiometabolic Diseases:*

Prevention and Management in Clinical Practice (pp. 265–293): Springer.

Edwards, M. K., Blaha, M. J., & Loprinzi, P. D. (2017). Influence of sedentary behavior, physical activity, and cardiorespiratory fitness on the atherogenic index of plasma. *Journal of clinical lipidology, 11*(1), 119–125.

Fasihi, L., Agha-Alinejad, H., Gharakhanlou, R., & J Amaro Gahete, F. (2025). Comparison and Prediction of Breast Cancer Using Discriminant Analysis Algorithm in Active and Inactive Women. *Physical Treatments-Specific Physical Therapy Journal, 15*(3), 0–0.

Fasihi, L., Siahkouhian, M., Jafarnezhadgero, A., & Fasihi, A. (2025). The effect of fatigue induced by running at heart rate deflection point in people with pronated versus healthy feet. *Communications Medicine, 5*(1), 471.

Fasihi, L., Tartibian, B., Eslami, R., & Fasihi, H. (2022). Artificial intelligence used to diagnose osteoporosis from risk factors in clinical data and proposing sports protocols. *Scientific reports, 12*(1), 18330.

Ghorbani, A., Ziaee, A., Yazdi, Z., KHOEYNI, M. H., & Khoshpanjeh, M. (2012). Effects of short-term exercise program on blood glucose, lipids, and hba1c in type 2 diabetes.

Jarvie, J. L., Pandey, A., Ayers, C. R., McGavock, J. M., Sénéchal, M., Berry, J. D., . . . McGuire, D. K. (2019). Aerobic fitness and adherence to guideline-recommended minimum physical activity among ambulatory patients with type 2 diabetes mellitus. *Diabetes care, 42*(7), 1333–1339.

Katsanos, C. S., Grandjean, P. W., & Moffatt, R. J. (2004). Effects of low and moderate exercise intensity on postprandial lipemia and postheparin plasma lipoprotein lipase activity in physically active men. *Journal of applied physiology, 96*(1), 181–188.

Kraus, W. E., Houmard, J. A., Duscha, B. D., Knetzger, K. J., Wharton, M. B., McCartney, J. S., . . . Otvos, J. D. (2002). Effects of the amount and intensity of exercise on plasma lipoproteins. *New England Journal of Medicine, 347*(19), 1483–1492.

Krchegani, A. M., & Savari, M. (2025). Integrating the Protection Motivation Model with Place Attachment Theory to Examine Rural Residents' Intentions toward Low-Carbon Behaviors: Empirical Evidence from Iran. *Results in Engineering*, 107180.

Magalhães, J. P., Santos, D. A., Correia, I. R., Hetherington-Rauth, M., Ribeiro, R., Raposo, J. F., . . . Sardinha, L. B. (2020). Impact of combined training with different exercise intensities on inflammatory and lipid markers in type 2 diabetes: a secondary analysis from a 1-year randomized controlled trial. *Cardiovascular diabetology, 19*(1), 169.

Magkos, F., Hjorth, M. F., & Astrup, A. (2020). Diet and exercise in the prevention and treatment of type 2 diabetes mellitus. *Nature Reviews Endocrinology, 16*(10), 545–555.

Marwick, T. H., Hordern, M. D., Miller, T., Chyun, D. A., Bertoni, A. G., Blumenthal, R. S., . . . Rocchini, A. (2009). Exercise training for type 2 diabetes mellitus: impact on cardiovascular risk: a scientific statement from the American Heart Association. *Circulation, 119*(25), 3244–3262.

Nelson, M. E., Rejeski, W. J., Blair, S. N., Duncan, P. W., Judge, J. O., King, A. C., . . . Castaneda-Sceppa, C. (2007). Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Circulation, 116*(9), 1094.

Osoro, I., Kumar, R., & Sharma, A. (2023). Ten-year risk assessment for cardiovascular diseases using ASCVD risk estimator plus: outcomes from hypertension and diabetes patients. *Diabetology & Metabolic Syndrome, 15*(1), 216.

Regufe, V. M., Pinto, C. M., & Perez, P. M. (2020). Metabolic syndrome in type 2 diabetic patients: A review of current evidence. *Porto biomedical journal, 5*(6), e101.

Rosenblit, P. D. (2019). Extreme atherosclerotic cardiovascular disease (ASCVD) risk recognition. *Current diabetes reports, 19*(8), 61.

Sanz, C., Gautier, J.-F., & Hanaire, H. (2010). Physical exercise for the prevention and treatment of type 2 diabetes. *Diabetes & metabolism, 36*(5), 346–351.

Shen, S.-W., Lu, Y., Li, F., Yang, C.-J., Feng, Y.-B., Li, H.-W., . . . Shen, Z.-H. (2018). Atherogenic index of plasma is an effective index for estimating abdominal obesity. *Lipids in Health and Disease*, *17*(1), 11.

Shlool, H. A., & Qandeel, N. N. (2023). Intensity Level of Endurance Exercise and its Effect on Males with Elevated Blood LDL-C Levels. *J Hum Sport Exerc*.

Tambalis, K., Panagiotakos, D. B., Kavouras, S. A., & Sidossis, L. S. (2009). Responses of blood lipids to aerobic, resistance, and combined aerobic with resistance exercise training: a systematic review of current evidence. *Angiology*, *60*(5), 614–632.

Tartibian, B., Fasihi, L., & Eslami, R. (2020). Prediction of osteoporosis by K-NN algorithm and prescribing physical activity for elderly women. *New Approaches in Exercise Physiology*, *2*(4), 87–100.

Trinks, N. (2024). *Low Physical Fitness and Low Thyroid Function as Cardiovascular and Metabolic Risk Factors in Diabetes Mellitus.* Dissertation, Düsseldorf, Heinrich-Heine-Universität, 2024,

Vavlukis, M., & Kedev, S. (2018). Effects of high intensity statin therapy in the treatment of diabetic dyslipidemia in patients with coronary artery disease. *Current Pharmaceutical Design*, *24*(4), 427–441.

Wang, Y., & Xu, D. (2017). Effects of aerobic exercise on lipids and lipoproteins. *Lipids in Health and Disease*, *16*(1), 132.

Way, K. L., Hackett, D. A., Baker, M. K., & Johnson, N. A. (2016). The effect of regular exercise on insulin sensitivity in type 2 diabetes mellitus: a systematic review and meta-analysis. *Diabetes & metabolism journal*, *40*(4).

Zhao, S., Zhong, J., Sun, C., & Zhang, J. (2021). Effects of aerobic exercise on TC, HDL-C, LDL-C and TG in patients with hyperlipidemia: A protocol of systematic review and meta-analysis. *Medicine*, *100*(10), e25103.

Corresponding Author: mohammadi.m123@gmail.com.

How to Cite: Mohammadi, M, Alirezaei, M., & Rostaei, G. (2024). Studying the effect of 12 weeks of combined training (resistance + aerobic) on serum levels of some cardiovascular risk factors in female patients with type 2 diabetes, *Journal of New Approaches in Exercise Physiology*, 6(12), 5-20.
DOI: 10.22054/nass.2025.88111.1183.