Effect of combined resistance training and nutritional counseling on glucolipid profiles in sedentary adults: A randomized controlled trial

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ABSTRACT

Sedentary behavior is strongly associated with metabolic dysfunction, including impaired glycemic control and adverse lipid profiles. While resistance training is known to improve musculoskeletal health, its metabolic benefits, particularly when combined with nutritional counseling, remain underexplored. This study aimed to investigate the effects of 12-week resistance training with nutritional counseling intervention on lipid and glycemic parameters in sedentary adults. Twenty sedentary adults (mean age: 47.30 ± 4.30 years) were randomly assigned to either a resistance training with nutritional counseling group or a control group (n = 10 per group). Total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and fasting blood glucose (FBG) were assessed at baseline and after the intervention. Data were analyzed using a two-way mixed ANOVA to examine the effects of time, group, and their interaction, followed by pairwise comparisons. The intervention group demonstrated significant reductions in TC (MD = −17.5, $p < 0.001$), TG (MD = −14.4, $p < 0.001$), LDL-C (MD = −25.8, $p < 0.001$) and FBG (MD = −12, $p < 0.001$), alongside an increase in HDL-C (MD = 10.7, $p < 0.001$). In contrast, no statistically significant changes were observed in the control group. Two-way mixed ANOVA revealed significant main effects of group for TC ($F_{1, 18} = 39.8$, $p < 0.001$, $\eta^2p = 0.69$), TG ($F_{1, 18} = 58.9$, $p < 0.001$, $\eta^2p = 0.77$), LDL-C ($F_{1, 18} = 66.4$, $p < 0.001$, $\eta^2p = 0.79$), HDL-C ($F_{1, 18} = 14.1$, $p = 0.001$, $\eta^2p = 0.44$), and FBG ($F_{1, 18} = 66.3$, $p < 0.001$, $\eta^2p = 0.79$). The findings suggest that combining resistance training with nutritional counseling significantly reduced TC, TG, LDL-C and FBG while increasing HDL-C in sedentary adults. Therefore, health and fitness professionals should implement both to reduce metabolic risks and enhance cardiometabolic health in sedentary populations.

Keywords: Inactive adults; Strength training; Dietary advice; Glycemic control; Lipid profiles
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INTRODUCTION

Sedentary behavior is a major contributor to the global rise in metabolic disorders, characterized by impaired glycemic control, dyslipidemia, and central adiposity (Franssen et al., 2025; Romanzini et al., 2025). Even in the absence of clinical obesity, prolonged physical inactivity in adults is associated with reduced insulin sensitivity and unfavorable lipid profiles, representing early manifestations of metabolic dysfunction (Dimitriadis et al., 2025; Lin et al., 2025). Consequently, identifying scalable non-pharmacological interventions to mitigate these risks has been recognized as a critical priority in preventive medicine (Halle et al., 2025; Hodkinson et al., 2025). Resistance training (RT) has emerged as an effective strategy for improving metabolic health, extending beyond its traditional role in enhancing musculoskeletal strength and hypertrophy (Feng et al., 2025; Jingwen et al., 2025). Skeletal muscle is the principal site of postprandial glucose disposal, accounting for the majority of insulin-stimulated glucose uptake (Richter et al., 2025). Although the benefits of resistance training for muscle mass and mechanical performance are well documented (Radaelli et al., 2025), its metabolic effects have received comparatively less attention in the literature (Paquin et al., 2024). In particular, limited evidence exists regarding the impact of resistance training on detailed glycemic markers and lipid subfractions in sedentary populations, as many studies remain predominantly hypertrophy-focused (Han et al., 2025; Ruojiang et al., 2025). Furthermore, the metabolic benefits of exercise are often attenuated in the absence of appropriate dietary modification (Beals et al., 2023; Memelink et al., 2023; Kazeminasab et al., 2025). Nutritional counseling (NC) facilitates sustainable improvements in macronutrient quality and caloric balance, which are essential for long-term cardiometabolic health (Moreira et al., 2024). The Dietary Approaches to Stop Hypertension (DASH) dietary pattern has demonstrated benefits for vascular and metabolic health (Zheng et al., 2025), however, evidence regarding its combined implementation with structured resistance training for improving glycemic control and lipid profiles remains limited (Cao et al., 2025; Chouk et al., 2025; Ruojiang et al., 2025).

Despite extensive research on resistance training, most studies have prioritized muscular outcomes over metabolic markers (Norris et al., 2024; Han et al., 2025; Basami et al., 2026). Although the independent benefits of exercise and dietary interventions are well-documented, substantial gaps remain regarding their integrated application in sedentary adults (Robinson et al., 2024; Cao et al., 2025; Prieto-González et al., 2025). Consequently, few studies have directly compared the isolated and combined effects of resistance training and nutritional counseling on comprehensive glucolipid profiles (Cao et al., 2025; Ma et al., 2025). There is limited research examining the effects of combined resistance training and nutritional counseling on glucolipid profiles. Further studies are needed to better understand how this integrated intervention influences metabolic health in high-risk sedentary adults. Therefore, this study aimed to evaluate the effects of a combined resistance training and nutritional counseling intervention on total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and fasting blood glucose (FBG) among sedentary adult male employees of public and private banks in Debre Markos, Ethiopia. It was hypothesized that a 12-week combined resistance training and nutritional counseling intervention would significantly improve glycemic control and lipid profiles in sedentary participants compared to a control group.

MATERIALS AND METHODS

Research design

This study was conducted in Debre Markos city, located about 300 km northwest of Addis Ababa, Ethiopia. The city lies at an altitude of approximately 2,446 meters above sea level, within latitude and longitude coordinates of 10°21′N 37°43′E. The annual average temperature ranges between 14–26 °C, with an average relative humidity of approximately 60% (Anteneh et al., 2023). This study used a 12-week, parallel-group randomized controlled trial with a pre-post-test design to assess the effects of combined resistance training and nutritional counseling program on the glucolipid profiles of sedentary adult male employees of public and private commercial banks in Debre Markos, Ethiopia. This study design was selected to reduce bias and support causal inference, which are essential for identifying the effects of the intervention in workplace health research (AlRahma et al., 2025).

Study participants

This study involved twenty sedentary adult male employees (mean age: 47.30 ± 4.30 years) who were recruited as volunteers from public and private commercial banks in Debre Markos, Amhara Regional State, Ethiopia. Participants were recruited through local radio announcements and public notice boards prior to baseline assessment. All procedures were conducted in accordance with the Declaration of Helsinki regarding the use of human subjects. Written informed consent was obtained from all participants prior to enrollment. The follow-up period extended from 20 January 2025 to 20 April 2025.

Inclusion and exclusion criteria

The inclusion criteria were: (a) body mass index (BMI): of 18.5 to 29.9 kg/m², targeting a critical window for early intervention before cardiometabolic risks significantly increase (Nitschke et al., 2022, Deressa et al., 2024), (b) not meeting WHO physical activity guidelines (<150 minutes of moderate or <75 minutes of vigorous exercise per week), and (c) confirmed eligibility via a medical history form and the physical activity readiness questionnaire (PAR-Q). Exclusion criteria were: (a) diagnosed diabetes (FBG ≥126 mg/dL), hypertension (≥140/90 mmHg), or recent myocardial infarction (heart attack), (b) musculoskeletal disorders that contraindicate resistance exercise and (c) active infections, and (d) severe liver dysfunction.

Sample size and sampling techniques

Sample size was determined using G*Power (version 3.1.9.7) based on parameters reported by (Amare et al., 2024), the calculation, assuming a Cohen's F effect size of 0.442 (corresponding to an anticipated mean difference of 9.3 mg/dL in LDL-C), a significance level (α) of 0.05, and statistical power ($1 - \beta$) of 0.80, indicated that a total of 14 participants were required for the study. To account for a potential 30% dropout rate, the total number of participants enrolled was increased to 20. From 31 initially screened volunteers, 24 met the inclusion criteria. Using a stratified random selection procedure based on age and BMI categories, 20 eligible participants were selected to ensure baseline equivalence between groups. Participants were then randomized in a 1:1 ratio using a sealed-envelope lottery method into the RT + NC group (n = 10) or control group (n = 10). Outcome assessors were blinded to group allocation during data collection and analysis.

The study adhered to CONSORT guidelines to promote high-quality and transparent reporting of clinical trials (Moher et al., 2025) (Figure 1). Baseline data were collected before the intervention, and follow-up data were collected at the end of the 12-week intervention period. All assessments were conducted at Debre Markos Referral Hospital.

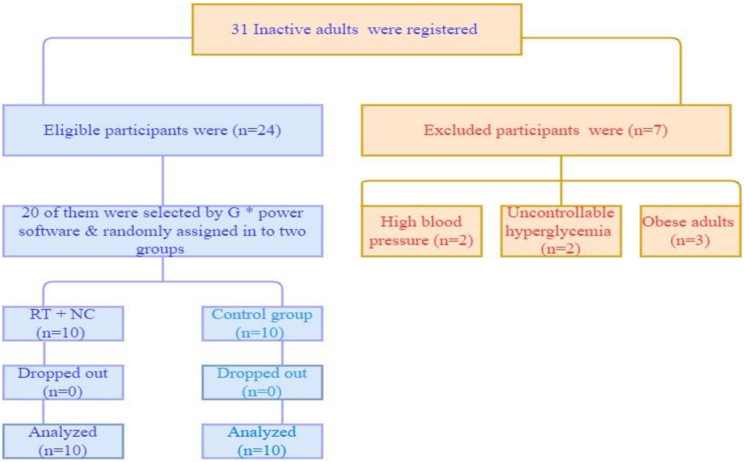

Figure 1. CONSORT flow diagram of randomization, allocation, and analysis of participants' intervention. Note: RT + NC= resistance training with nutritional counseling

Measurement of study variables

Fasting blood glucose level test

Blood glucose levels were measured at rest using an Accu-Chek glucometer. Participants' fasting blood glucose levels were assessed before and after a 12-week intervention program under the supervision of a medical laboratory expert. Blood samples were collected by a trained medical laboratory technician following an overnight fast, then transported to a standard tertiary care laboratory and subsequently forwarded to Debre Markos Referral Hospital for analysis. The laboratory technician involved in the study was blinded to the measurements at both baseline and post-intervention.

Lipid profiles test

After a 12-hour overnight fast, 5 mL of venous blood was collected from the left median cubital vein of seated participants at 8:00 AM. Blood samples were allowed to clot and were immediately centrifuged; the serum was separated and refrigerated until analysis. All samples were analyzed within 24 hours of collection. Lipid profile parameters were measured using an enzymatic colorimetric method with an Alpha X autoanalyzer (Hitachi, Tokyo, Japan) and E2HL-100 reagent kits, with an analytical sensitivity of 0.1 mmol/L for lipid measurement.

Resistance training intervention

The exercise intervention was designed in accordance with the American College of Sports Medicine (ACSM) guidelines for exercise testing and prescription (Bayles, 2023). Each training session lasted 60 minutes and included warm-up, main exercise, and cool down phases. The main exercise phase was maintained at 45–50 minutes, with the remaining time (10–15 minutes) allocated to warm-up and cool down (Ambelu and Teferi, 2023). Participants in the resistance training group trained three times per week, performing a circuit of nine exercises: leg press, hamstring curl, quadriceps extension, chest press, lat pull down, shoulder press, biceps curl, triceps extension, and abdominal crunch. Each exercise consisted of three sets of 8–12 repetitions at 50–80% of the estimated one-repetition maximum (1-RM). Rest intervals were set at 15–20 seconds between exercises and 1–2 minutes between sets (Brellenthin et al., 2019). Training loads were calculated using a submaximal testing protocol and the Brzycki equation (Yavuz et al., 2025), an approach favored for its safety and accuracy in non-athletic, middle-aged populations (Rohmann et al., 2024). To ensure data integrity, participant compliance was strictly monitored; only individuals who attended at least 80% of sessions (≥29 out of 36) were included in the final analysis (Brellenthin et al., 2019).

Nutritional counseling

At baseline, participants predominantly consumed pro-inflammatory, high-glycemic diets with low fiber intake. Dietary intake was assessed at baseline and post-intervention using validated Food Frequency Questionnaires (FFQs) over three nonconsecutive days (fasting day, non-fasting, and weekend day) (Fikadu et al., 2024). All participants in the intervention group received standardized dietary counseling during 30-minute group sessions held three times per week and led by a licensed clinical dietitian, with all 10 participants attending each session. This session frequency was chosen to promote adherence and support behavioral changes during the short-term intervention (Barkmeijer et al., 2022). These sessions followed a culturally adapted DASH (Dietary Approaches to Stop Hypertension) model (Sangouni et al., 2024). To enhance adherence, the dietitian provided individualized meal plans, educational materials, and guidance on meal timing, fiber intake, hydration, and reducing refined carbohydrates. In contrast, the control group maintained their usual dietary habits without structured counseling. This standardized dietary counseling was provided to mitigate nutritional confounding variables, thereby enhancing the impact of resistance training on metabolic outcomes.

Statistical analysis

Statistical analysis was conducted using IBM SPSS Statistics version 27 (IBM Corporation), which is commonly used in behavioral, health, and exercise science research (George and Mallery, 2024). Descriptive data are reported as mean ± standard deviation. A two-way mixed ANOVA was conducted to assess the main effects of the within and between-subjects factors on the outcome variables. Data normality was assessed using the Shapiro–Wilk test. Statistical analyses were conducted with a significance threshold set at $p < 0.05$ for TC, TG, LDL-C, HDL-C, and FBG. Effect sizes were calculated using partial eta squared ($\eta^2 p$), representing the proportion of variance explained by each effect after accounting for other model terms (Norouzian and Plonsky, 2018). Values were interpreted as small (0.01), medium (0.06), and large (≥ 0.14) (Myors et al., 2010). In addition, mean differences with 95% confidence intervals (95% CI) were reported alongside *p*-values to support interpretation of the results.

Ethical consideration

Ethical approval was obtained from the Institutional Review Board of the College of Natural and Computational Sciences at Addis Ababa University (Approval No: CNCS: 06/2017/2025) and the study was prospectively registered with the Pan African Clinical Trial Registry (registration number: ACTR202501649861961) on 09 January 2025, prior to participant recruitment.

RESULTS AND DISCUSSIONS

Participant Characteristics

The study participant’s baseline characteristics are summarized in Table 1. Participant age was comparable between the intervention (47.20 ± 4.30 years) and control groups (47.40 ± 4.50 years), as was mean body mass index, which measured 25.00 ± 1.70 kg/m², and 25.30 ± 1.30 kg/m², respectively. Similarly, baseline lipid and glycemic parameters were comparable between the intervention and control groups. The mean TC values were 198.70 ± 3.70 mg/dL in the intervention group and 197.80 ± 2.10 mg/dL in the control group. Mean TG levels were 142.80 ± 3.30 mg/dL and 143.40 ± 2.40 mg/dL, mean LDL-C levels were 128.50 ± 1.70 mg/dL and 127.50 ± 0.80 mg/dL, and mean HDL-C levels were 41.90 ± 3.30 mg/dL and 42.60 ± 3.40 mg/dL in the intervention and control groups, respectively. Mean FBG values were 116.90 ± 2.10 mg/dL and 117.30 ± 1.60 mg/dL in the intervention and control group, respectively. Overall, baseline characteristics were well balanced between the intervention and control groups, with no statistically significant differences observed in demographic, lipid, or glycemic parameters.

Table 1. Baseline and follow-up characteristics

Variables	**RT + NC group**		**Control group**	
	Baseline (Mean ± SD)	**Follow-Up (Mean ±SD)**	**Baseline (Mean ±SD)**	**Follow Up (Mean ± SD)**
Age (year)	47.20 ± 4.30		47.40 ± 4.50	
BMI ($kg/m^{2)}$	25.00 ± 1.70		25.30 ± 1.30	
TC (mg/dL)	198.70 ± 3.70	181.20 ± 3.20	197.80 ± 2.10	198.90 ± 3.20
TG (mg/dL)	142.80 ± 3.30	128.40 ± 1.20	143.40 ± 2.40	143.80 ± 2.80
LDL-C (mg/dL)	128.50 ± 1.70	102.70 ± 7.90	127.50 ± 0.80	127.50 ± 2.10
HDL-C (mg/dL)	41.90 ± 3.30	52.60 ± 3.80	42.60 ± 3.40	42.10 ± 2.40
FBG (mg/dL)	116.90 ± 2.10	104.90 ± 2.10	117.30 ± 1.60	117.50 ± 1.50

Note: Values are expressed as Mean ± SD of demographic and outcome variables for participants at baseline and follow-up (n = 20). BMI = body mass index; TC= total cholesterol; TG = triglycerides; LDL-C = low-density lipoprotein cholesterol; HDL-C = high-density lipoprotein cholesterol; FBG = fasting blood glucose; SD = standard deviation; RT + NC = resistance training combined with nutritional counseling.

A two-way mixed ANOVA was conducted to examine the effects of time and group on TC, TG, LDL-C, HDL-C and FBG levels (Table 2). The analysis revealed a significant main effect of time on TC, $F_{1,18} = 528$, $p < .001$, $\eta^2 p = 0.97$; TG, $F_{1,18} = 226$, $p < .001$, $\eta^2 p = 0.93$; LDL-C, $F_{1,18} = 123$, $p < .001$, $\eta^2 p = 0.87$; HDL-C, $F_{1,18} = 67$, $p < .001$, $\eta^2 p = 0.79$, and FBG, F1,18 = 743, $p < .001$, $\eta^2 p = 0.98$, indicating that, TC, TG, LDL-C and FBG significantly decreased, whereas HDL-C significantly increased over the intervention period. Consistent with these findings, pairwise comparisons between pre- and post-intervention assessments demonstrated significant reductions in TC (mean difference [MD] = −8.2 mg/dL, $p < .001$), TG (MD = −7 mg/dL, $p < .001$), LDL-C (MD = −12.9 mg/dL, $p < .001$), and FBG (MD = −5.9 mg/dL, $p < .001$) alongside a significant increase in HDL-C (MD = 5.1 mg/dL, $p < .001$). In addition, a significant time × group interaction effect was observed for TC, $F_{1,18} = 677$, $p < .001$, $\eta^2 p = 0.97$; TG, $F_{1,18} = 252$, $p < .001$, $\eta^2 p = 0.93$; LDL-C, $F_{1,18} = 123$, $p < .001$, $\eta^2 p = 0.87$; HDL-C, $F_{1,18} = 80$, $p < .001$, $\eta^2 p = 0.82$, and FBG, $F_{1,18} = 804$, $p < .001$, $\eta^2 p = 0.98$, indicating that the intervention group exhibited significantly greater improvements in all outcomes compared with the control group over time (Figure 2).

Table 2. Within-subject, pairwise comparison, and Time × group interaction effects on lipid and glycemic profile outcomes

Variables	Within subject effects			Pairwise comparison					Interaction effect Time * group		
							95% CI				
	F	Sig	η^2p	MD	SE	Sig[b]	Lower bound	Upper bound	F	Sig	η^2p
TC	528	<.001	0.97	-8.2	0.4	<.001	-8.9	-7.4	677	<.001	0.97
TG	226	<.001	0.93	-7.0	0.5	<.001	-8.0	-6.0	252	<.001	0.93
LDL-C	123	<.001	0.87	-12.9	1.2	<.001	-15.4	-10.5	123	<.001	0.87
HDL-C	67	<.001	0.79	5.1	0.6	<.001	3.8	6.4	80	<.001	0.82
FBG	743	<.001	0.98	-5.9	0.2	<.001	-6.3	-5.4	804	<.001	0.98

Note: Results are derived from two-way mixed ANOVA assessing within-subject effects of time and the Time × group interaction on lipid profile and glycemic control outcomes. The table presents F-values, significance levels (Sig.), partial eta squared (η^2p), mean differences (MD), standard errors (SE), 95% confidence intervals (CI), and interaction effects. Statistical significance was set at $p < .001$. TC= total cholesterol; TG = triglycerides; LDL-C = low-density lipoprotein cholesterol; HDL-C = high-density lipoprotein cholesterol; FBG = fasting blood glucose; group = resistance training combined with nutritional counseling and control group; Time × group = interaction between time and intervention condition.

A significant main effect of group was observed for TC, $F_{1,18} = 39.8$, $p < .001$, $\eta^2p = 0.69$; TG, $F_{1,18} = 58.9$, $p < .001$, $\eta^2p = 0.77$; LDL-C, $F_{1,18} = 66.4$, $p < .001$, $\eta^2p = 0.79$; HDL-C, $F_{1,18} = 14.1$, $p = .001$, $\eta^2p = 0.44$, and FBG, F1,18 = 66.3, $p < .001$, $\eta^2p = 0.79$ indicated statistically significant between-group differences in lipid profile and glycemic control outcomes (Table 3). Pairwise comparisons (Table 3) showed that, compared with the control group, the intervention group had significantly decreased TC (MD = −8.4 mg/dL, $p < .001$), TG (MD = −8 mg/dL, $p < .001$), LDL-C (MD = −11.9 mg/dL, $p < .001$), and FBG (MD = −6.5 mg/dL, $p < .001$) alongside a significant increase in HDL-C (MD = 4.9 mg/dL, $p = .001$).

Table 3. Summary of between-subjects effects and pairwise comparisons between the RT+NC and control groups on glycemic and lipid profile outcomes.

Variables	Between-subject effects			Pairwise comparison					
	F	Sig	η^2p	Training groups	MD	SE	Sig[b]	95% CI	
								Lower bound	Upper bound
TC	39.8	<.001	0.69	RT + NC-CG	-8.4	1.3	<.001	-11.3	-5.6
TG	58.9	<.001	0.77	RT + NC-CG	-8.0	1.0	<.001	-10.2	-5.8
LDL-C	66.4	<.001	0.79	RT + NC-CG	-11.9	1.5	<.001	-15.0	-8.9
HDL-C	14.1	.001	0.44	RT + NC-CG	4.9	1.3	.001	2.2	7.6
FBG	66.3	<.001	0.79	RT + NC-CG	-6.5	0.8	<.001	-8.2	-4.9

Note**:** The results were obtained using a two-way mixed ANOVA to examine differences between the RT + NC intervention group and the control group on metabolic outcomes. TC= total cholesterol; TG = triglycerides; LDL-C = low-density lipoprotein cholesterol; HDL-C = high-density lipoprotein cholesterol; FBG = fasting blood glucose; RT + NC = resistance training combined with nutritional counseling; CG = control group; MD = mean difference; SE = standard error; CI = confidence interval; η^2p = partial eta squared; Sig[b] = significance level for pairwise comparisons. Statistical significance was set at $p < .05$.

Overall, these findings indicated that the RT + NC intervention led to statistically significant improvements in both lipid profiles and glycemic control outcomes (Figure 2).

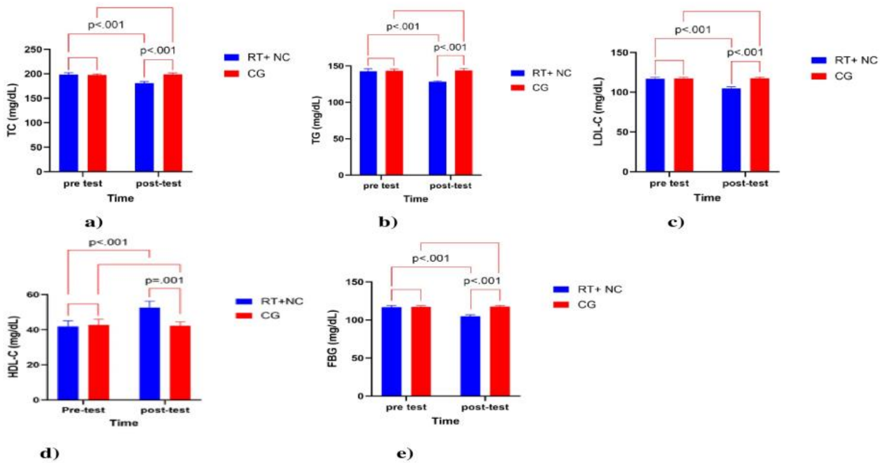

Figure 2. Pairwise comparisons of pre- and post-intervention changes in TC, TG, LDL-C, HDL-C and FBG levels between the RT+NC and control groups.

The purpose of the present study was to evaluate the effects of 12-week combined resistance training with nutritional counseling (RT + NC) intervention on glucolipid profiles in sedentary adults. The main finding demonstrated that the intervention significantly improved glucolipid profiles, characterized by decreased TC, TG, LDL-C and FBG along with an increase in HDL-C. No significant metabolic changes occurred in the control group. These findings suggest that integrating resistance training with structured nutritional guidance is an effective strategy for improving glycemic control and lipid metabolism in sedentary populations.

These findings reinforce the efficacy of combined lifestyle interventions for improving metabolic health in sedentary adults (Teixeira et al., 2025). Consistent with our results, previous studies indicate that integrated diet and physical activity programs significantly improve metabolic markers by reducing TC, TG, LDL-C and FBG, while increasing HDL-C outcomes not observed in control groups (Chouk et al., 2025). Likewise, studies in individuals with obesity have shown that calorie-restricted dietary programs combined with regular exercise produce meaningful improvements in cardiometabolic risk factors (Chen et al., 2025). Our findings extend this evidence by showing that even in sedentary adults, a relatively short 12-week combined resistance training and nutritional counseling program is sufficient to induce significant metabolic benefits.

In relation to glycemic control, the present study aligns with previous findings showing that combining structured exercise with dietary modification enhances glucose regulation more effectively than either intervention alone (Huang et al., 2026, He et al., 2026). However, the magnitude of improvement observed in our study appears more pronounced than in some earlier exercise-only interventions, suggesting that nutritional counseling may have played a key additive role. This interpretation is supported by evidence indicating that resistance training improves insulin-mediated glucose uptake through increased skeletal muscle GLUT4 translocation (Richter et al., 2025, Soo et al., 2023), while dietary counseling enhances glucose control by promoting higher fiber intake and improved dietary quality (Wang et al., 2025). Therefore, the synergistic effect observed in the present study likely reflects complementary physiological adaptations induced by the combined resistance training and nutritional counseling intervention.

The current study demonstrates that a 12-week intervention combining resistance training and nutritional counseling significantly improves lipid profiles by reducing TC, TG, and LDL-C and increasing HDL-C. These results align with previous research showing that integrated exercise and dietary programs outperform diet-only approaches in optimizing metabolic risk markers (Heo et al., 2025). Furthermore, our findings corroborate evidence that combining caloric restriction with exercise is a superior strategy for enhancing lipid metabolism (Hei and Xie, 2025). Mechanistically, the lipid improvements observed in the present study can be explained by complementary physiological adaptations. Resistance training enhances lipid utilization in skeletal muscle, increases insulin sensitivity, and upregulates lipoprotein lipase activity, thereby facilitating triglyceride clearance and contributing to increased HDL-C levels (Kambic et al., 2023). Concurrently, dietary modification influences hepatic lipid metabolism by reducing cholesterol synthesis and improving lipoprotein clearance (Wu et al., 2026).

Evidence regarding the effects of resistance training alone on glycemic control and lipid profiles remains inconsistent. Several studies have reported favorable effects of resistance training on metabolic health, including reductions in TC, TG and LDL-C and increases in HDL-C in postmenopausal women (He et al., 2023). Overall, these findings support resistance training as an effective strategy for improving metabolic health (Doulatyari et al., 2023). Conversely, other studies have found no significant effects of resistance training on glycemic control or lipid profiles among older adults with type 2 diabetes mellitus (De Seixas Soares et al., 2025). Similarly, resistance training during dietary weight loss interventions in individuals with overweight did not significantly improve cardiometabolic markers (Binmahfoz et al., 2025). These inconsistencies suggest that resistance training effects depend on participant characteristics, training intensity, diet control, and intervention duration. In contrast, the present study implemented combined resistance training and nutritional counseling, which yielded more consistent metabolic improvements.

The existing literature regarding the metabolic impact of dietary interventions alone is nuanced, reflecting both significant benefits and notable limitations. Many studies support our findings, reporting that structured nutritional counseling improves lipid profiles, particularly by reducing TC, TG and LDL-C and increasing HDL-C compared with control groups (Khalil, 2024, Wu et al., 2026) These effects are primarily attributed to the modulation of hepatic cholesterol metabolism and LDL receptor activity (Nestel and Mori, 2023). However, some evidence indicates that dietary modifications alone may not lead to significant improvements in insulin resistance or lipid parameters in individuals with cardiometabolic risk (Ghadimi et al., 2021). These inconsistent findings suggest that the effectiveness of dietary interventions may depend on baseline participant characteristics and the extent to which dietary strategies are combined with other lifestyle modifications, such as resistance training interventions.

The findings of this study support the view that combined resistance training and nutritional counseling is a more effective strategy for improving glucolipid metabolism. The improvements observed in TC, TG, LDL-C, HDL-C and FBG; highlight the synergistic interaction between resistance training induced metabolic adaptations and diet-induced improvements in substrate availability and lipid handling. These findings reinforce current recommendations promoting integrated lifestyle interventions for the prevention and management of cardiometabolic risk in sedentary adults. This study was limited to sedentary adult bank employees, which may restrict the generalizability of the findings to other populations. In addition, the relatively short intervention period of 12 weeks may have limited the ability to observe the full physiological effects of the intervention. Furthermore, the absence of separate intervention arms (e.g., resistance training only or nutritional counseling only) precluded the assessment of the independent effects of each component. As both interventions were implemented simultaneously, it is not possible to determine the extent to which each contributed to the observed outcomes. Future studies should consider longer intervention durations and include isolated intervention groups to better clarify the independent and combined effects of resistance training and nutritional counseling.

CONCLUSIONS

The findings indicated that combining resistance training with nutritional counseling significantly reduced total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C) and fasting blood glucose (FBG), while increasing high-density lipoprotein cholesterol (HDL-C) (all $p < 0.001$), whereas no significant changes were observed in the control group of sedentary adults. Therefore, health practitioners and fitness professionals should incorporate structured resistance training alongside tailored nutritional guidance to mitigate metabolic risk factors and enhance overall cardiometabolic health in sedentary populations.

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