International Journal of Engineering Research and Modern Education (IJERME)
International Peer Reviewed - Refereed Research Journal, Website: www.rdmodernresearch.com
Impact Factor: 7.018, ISSN (Online): 2455 - 4200, Volume 9, Issue 1, January - June, 2024

IMPACT OF 16 WEEKS OF LOW-INTENSITY AEROBIC TRAINING AND SUBSEQUENT DETRAINING ON VLDL-C IN MALE AND FEMALE STUDENTS

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Cite This Article: Jemil Priskillal J, "Impact of 16 Weeks of Low-Intensity Aerobic Training and Subsequent Detraining on VLDL-C in Male and Female Students", International Journal of Engineering Research and Modern Education, International Peer Reviewed - Refereed Research Journal, Volume 9, Issue 1, January - June, Page Number 28-30, 2024.

Abstract:

This study investigated the effects of long-term low-intensity aerobic training and subsequent detraining on very low-density lipoprotein (VLDL-C) in male and female students. Thirty participants (15 men and 15 women) were randomly selected and underwent a 16-week low-intensity aerobic training program. Blood samples were collected before and after training, and during a five-week detraining phase (once per week). Data were analyzed using dependent and independent t-tests, and repeated-measures ANOVA with Scheffé's post hoc test. Results indicated a significant reduction in VLDL-C following training in both men and women, with a greater decrease observed in men. However, VLDL-C levels significantly increased during detraining, approaching pre-training levels by the fifth week. These findings suggest that low-intensity aerobic exercise effectively reduces VLDL-C in both genders, but the benefits are diminished after detraining, highlighting the importance of exercise continuity for lipid regulation.

Key Words: Aerobic Training, Detraining, VLDL-C, Lipoproteins, Gender Differences

Introduction:

Physical inactivity and sedentary lifestyles are major contributors to the growing prevalence of metabolic and cardiovascular disorders. Regular aerobic exercise is widely recognized for its beneficial effects on lipid metabolism, weight regulation, cardiovascular function, and overall health. Aerobic training enhances lipid utilization, improves mitochondrial efficiency, increases parasympathetic tone, and reduces risk factors for coronary heart disease (Sinderman, Pedersen & Kjekshus, 1997). Low-intensity aerobic exercise, when performed consistently, can reduce circulating triglycerides and very low-density lipoprotein cholesterol (VLDL-C), both of which are associated with atherogenesis and cardiovascular risk. However, discontinuation of training, or detraining, may reverse these benefits (Giada et al., 1995; Chun, Yeh & Ha, 1996). This study aimed to examine the effects of 16 weeks of low-intensity aerobic training followed by five weeks of detraining on VLDL-C levels in male and female students.

Methods:

Participants:

Thirty healthy university students (15 men and 15 women) volunteered for this study. Participants were randomly selected and provided informed consent.

Training Protocol:

Both groups underwent a supervised low-intensity aerobic training program for 16 weeks. The program included rhythmic, whole-body activities (e.g., jogging, cycling, brisk walking) performed 4-5 times per week at 50-60% of maximum heart rate.

Detraining Phase:

Following the training period, participants discontinued structured exercise for five weeks. Blood samples were collected weekly during detraining to assess changes in VLDL-C.

Data Collection:

Fasting venous blood samples were collected pre-training, post-training, and weekly during detraining. VLDL-C was measured using enzymatic methods.

Statistical Analysis:

Data were analyzed using dependent t-tests (within groups), independent t-tests (between groups), and two-way repeated-measures ANOVA (gender × time). Scheffé's test was applied for post hoc comparisons. The level of significance was set at $p < 0.05$.

Results:

The mean, standard deviation and dependent 't' ratio on the data obtained for Very Low-Density Lipoprotein of pre and post-test of men and women groups have been presented in table 1.

Table 1: Mean, Standard Deviation and 't' Ratio on Very Low-Density Lipoprotein for Pre and Post Test Low Intensity Aerobic Training of Men and Female

Groups		Mean	S.D	DM	't'-ratio
Men Group	Pre-Test	18.27	3.49	5.07	14.15*
	Post-Test	13.2	2.59		
Women Group	Pre-Test	22.4	3.58	3.8	10.72*
	Post-Test	18.6	3.62		

*Significant at 0.05 level

The table value required for significant for df 14 is 2.14.

Training Effects:

- Men: VLDL-C decreased significantly from 18.27 ± 3.49 to 13.20 ± 2.59 ($t = 14.15$, $p < 0.05$).
- Women: VLDL-C decreased from 22.40 ± 3.58 to 18.60 ± 3.62 ($t = 10.72$, $p < 0.05$).

Table 2: Comparison of Mean Gain on Very Low-Density Lipoprotein between Paired Means between Men and Female

Groups	Mean	S.D	SE	t-ratio
Men	5.07	1.39	0.36	2.51*
Female	3.8	1.37	0.35	

- *Significant at 0.05 level
- The table value required for significance for df 28 is 2.05

Gender Comparison:

The mean reduction was significantly greater in men (5.07 ± 1.39) than women (3.80 ± 1.37), ($t = 2.51$, $p < 0.05$).

Detraining Effects:

Table 3: Summary of Anova for 2 X 5 Repeated Measures on the Last Factor of VLDL-C

Source of Variation	SS	df	MS	F
A (Gender)	726.8803	1	726.8803	91.07*
B (Times)	361.0423	4	90.26058	11.31*
AB (Gender X Times)	13.97507	4	3.493768	0.44
WSS (Error)	1117.437	140	7.981693	
Total	2219.335	149		

*Table value required for significance at 0.05 level with df 1, 140 & 4, 140 were 3.92 and 2.44

Repeated-measures ANOVA revealed significant effects of gender ($F = 91.07$, $p < 0.05$) and time ($F = 11.31$, $p < 0.05$), but no significant gender × time interaction.

- Men: VLDL-C increased progressively during detraining (13.53 → 18.71).
- Women: VLDL-C increased more steeply (18.84 → 22.15). By the fifth week, VLDL-C values nearly returned to baseline (pre-test levels).

Discussion:

The findings demonstrate that low-intensity aerobic training significantly reduces VLDL-C levels in both men and women, with men showing a slightly greater reduction. This aligns with previous research indicating that aerobic exercise reduces triglyceride-rich lipoproteins while improving HDL-C and lipid metabolism (Leon & Sanchez, 2001; Scheers et al., 2008).

However, the study also highlights the detrimental effects of detraining, as VLDL-C levels increased during the five-week period without structured exercise. These results are consistent with Giada et al. (1995), who reported increases in VLDL-C and fibrinogen after detraining, and Chun, Yeh& Ha (1996), who observed lipid deterioration following exercise withdrawal.

Physiologically, the increase in VLDL-C during detraining may be explained by reduced mitochondrial activity, diminished lipid oxidation, and increased fat storage due to lower energy expenditure. The greater rebound effect in women may reflect gender differences in lipid metabolism and hormonal influences.

Conclusion:

Long-term low-intensity aerobic training is effective in reducing VLDL-C levels in both men and women, with men showing a greater reduction. However, these benefits diminish rapidly after detraining, with VLDL-C returning close to baseline within five weeks. The findings underscore the importance of continuous engagement in aerobic exercise to sustain lipid and cardiovascular health benefits.

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