

Combined Exercise Effects on Lipid Profiles in Hypertensive Patients

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Abstract

Objective: The purpose of the study was to examine combined aerobic and resistance exercise training effect on lipid profiles in hypertensive patients.

Method: A total of forty-six hypertensive patients aged between 31 and 45 years were randomly assigned into two groups: control group (n=23) and exercise group (n=23). Total cholesterol (TC), high density lipoprotein cholesterol (HDL-c), low density lipoprotein cholesterol (LDL-c), and triglycerides (TGs) data were collected at baseline and after 16 weeks of the study period. Analyses of within group and between group comparisons were done using paired sample t-test and independent sample t-test, respectively.

Results: Pre-intervention data of TC, LDL-c, TGs, and HDL-c were homogeneous compared with groups ($P>0.05$). After completion of the study significant between group mean change difference was found in TC (-7.2 mg/dl; $P=0.0001$), LDL-c (-10 mg/dl; $P=0.0001$), TGs (-14.3 mg/dl; $P=0.0001$), and in HDL-c (3.8 mg/dl; $P=0.001$). In EG participants performed combined aerobic and resistance exercise training.

Conclusions: Combined aerobic and resistance exercise training significantly reduced TC, LDL-c, TGs and significantly increased HDL-c levels in hypertensive patients. Public awareness promotion should be designed and implemented by concerned bodies for hypertensive patients to realize the importance of combined exercise trainings and thereby increases their adherence to exercise programs.

Trial Registration: Clinicaltrials.gov Identifier: NCT03029767 on 20/01/2017.

Keywords: *Combined aerobic and resistance exercise, Lipid profiles, Hypertensive patients*

Introduction

The behavioral change of contemporary public is associated with increasing of urbanization and these behavioral changes lead people to rise of inactive

lifestyle¹. In modern urbanized society to prevent cardiovascular and other disease levels of physical activity are clearly insufficient². Physical inactivity raises risk of cardiovascular diseases (CVD), mainly hypertension (HTN)³. Raised occurrence of CVD in adolescents and adults is associated with low fitness levels⁴, a small level of high density lipoprotein cholesterol (HDL) and elevated levels of low density lipoprotein cholesterol (LDL-c)⁵. Raised levels of total cholesterol (TC) and low level of HDL-c are among the main risk factors for HTN⁶. It is well recognized that CVD in general and HTN in particular is related to high levels of TC, LDL-C, triglycerides (TGs), and

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with low levels of HDL-c. Leading sedentary lifestyle plays great role in the risk of HTN⁷. Adherence to the exercise training is a crucial aspect for the achievement of the maximum significance of the intervention on HTN⁸. Hypertensive individuals inadequately adhere to appropriate treatment and the suggested lifestyles⁹. Studies reports showing sedentary lifestyle, rising in low income countries like Ethiopia, causing acceleration in the prevalence of HTN and hypertensive patients have low adherence to exercise in Ethiopia^{10, 11}. In human beings continued primary HTN has an effect on different body parts¹². Adjustment of lifestyles, together with increased participation in exercise training should be the primary alternative to fight the rising spread of HTN in low- and middle income countries¹³. For the urban communities presently in Ethiopia for exercise training appropriate emphasis is not given¹⁴. Involvement in exercise training on a regular basis is a significant non pharmacological approach to reduce CVD^{15, 16}. Persons those continue to engage in physical exercise on a regular basis have been revealed to have a decreased risk of CVD, this may be because of performing exercise training can positively change blood lipid profiles by increasing HDL-c and reducing TGs concentrations¹⁷. The risk for an increase of CVD may be decreased by raising HDL-C and by reducing levels of LDL-C and TGs¹⁸. Combined aerobic and resistance exercise training will give participants the special advantages of each type of exercise¹⁹. To the best of our knowledge studies were not carried out in Ethiopia regarding combined aerobic and resistance exercise training as an alternative treatment and preventive lifestyle intervention approach for mild hypertensive patients, mainly in the present study area. Hence, the purpose of this study was to evaluate the combined aerobic and resistance exercise training effect on lipid profiles in hypertensive patients.

Material and Method

Study Area: The study was conducted at Hawassa University Referral Hospital (HURH), Hawassa City administration, Southern Region. Hawassa is the capital city of, Southern Region, located 275 km from Addis Ababa the capital city of Ethiopia.

Study design and participants: This study was registered in clinicaltrials.gov Identifier: NCT03029767 and conducted from February 20/2017 to June 17//2017 in Southern Ethiopia at HURH. Stage 1 hypertensive patients in the age range of 31 to 45 years; individuals who gave written informed consent, participants who

live in the study area for the period of study, individuals who are on a single anti-hypertensive drug were included in the study. Pregnant women, individuals with known renal and cardiac problems, diabetic patients, participants who consume medications for lipid, and females who use contraceptives were excluded from the study.

Randomization: Forty six eligible participants were randomly assigned to exercise group (n=23) and control group (n=23) using a stratified random sampling method after acquisition of signed informed consent and eligibility assessment. The allocation of eligible participants in the exercise group (EG) and the control group (CG) was done by a statistician who did not take part in the study by means of computer produced random numbers in pre prepared and sealed numbered envelopes.

Procedures: The EG engaged in combined aerobic and resistance exercise training for 16 weeks. The CG participants did not take part in any structured exercise intervention program, but they sustained their usual daily activities during the period of study and were completed medical symptom's questionnaire forms monthly for the study period. The exercise intervention was given for 48 uninterrupted sessions, three sessions per week for the total of 16 consecutive weeks. To familiarize study participants with the types of exercise and its dosage two familiarization sessions were carried out before continuing the main exercise intervention and with the help of that the participants of the study became familiar to study the procedures of exercise intervention. The exercise intervention was supervised by an exercise physiologist. The EG performed 23 minutes aerobic exercises and 22 minutes resistance exercises. Intensity of exercise was progressive. Participants performed aerobic exercise (brisk walking) for 30 to 40% of heart rate reserve (HRR) or 9-11 rate of perceived exertion (RPE) from first to fourth week, and 40-60% of HRR or 12-13 RPE from fifth to sixteenth week. In addition to aerobic exercise eight resistance exercises were also made by EG. These were biceps curl, triceps extension, shoulder press, squat, heel raise, side leg raises, lower leg lift and curl-up. Resistance exercise was performed using one set and one minute rest between exercises. Intensity of resistance exercise was 30 to 40% of 1 repetition maximum (1RM) for upper body part and 50 to 60% of 1RM for the lower body part. Resistance exercises were conducted alternating between lower-body and upper- body exercises. At baseline five milliliters of

venous blood sample were collected after 48 hours of vigorous physical activity and after ten to twelve hours of overnight fasting in a sitting position from an antecubital vein from all participants. The blood sample collection was done early in the morning from 8 AM to 10 AM. Analysis of lipid profiles was conducted using serum sample. For the test of TGs and TC enzymatic colorimetric assay technique was applied, whereas direct homogeneous enzymatic colorimetric assay technique was used for the test of LDL-c and HDL-c. The senior laboratory technologist of HURH collected the blood samples. Quality control samples were analyzed before performing of patient sample and sideways with patient samples for checking the right functioning of instruments and lab reagents including technical acts. Further, standard operating procedure was strictly followed for all laboratory performances from sample collection to result releasing. Post intervention data were collected following similar procedures to baseline data.

Statistical Analysis: Data entry and analysis were done using Statistical Package for Social Sciences (SPSS) Version 20. Categorical variables were summarized

as frequencies, and the change was summarized in percentages, while mean values, and standard deviations were tabulated for continuous variables. Comparison of quantitative variables at the pre-intervention and after post-intervention of the same group was analyzed with paired sample t-test. Comparison of continuous variables between intervention and CG was performed using an independent sample t test. Finally, in all situations, the significance level was set at $p < 0.05$.

Results

Baseline characteristics of study participants: A total of 46 (20 females and 26 males) study participants were enrolled in the study, of them 44 completed the study. However, one individual (male) from both study groups was discontinued and their data not included in the analysis. In the EG who completed the study, adherence to exercise was 98% and the mean attendance of the study participants was 47 from 48 total exercise sessions. There were no statistically significant differences between the mean age and lipid profiles between groups (P -value > 0.05) (Table 1).

Table 1: Baseline between groups' comparison of lipid profiles of the study participants

Variables	EG	CG	p-value
Mean age in years	38.8(± 4.3)	38.3(± 4.2)	0.72
Mean TC in mg/dl	180(± 13.2)	178.2(± 10.4)	0.6
Mean LDL-c in mg/dl	104.4(± 10.5)	103.5(± 7.9)	0.76
Mean TGs in mg/dl	162.4(± 16.9)	159.8(± 10.8)	0.54
Mean HDL-c in mg/dl	42.6(± 3.1)	42.4(± 2.4)	0.8

EG= exercise group; CG=Control group; TC=total cholesterol; HDL-c; high density lipoprotein cholesterol; LDL-c; low density lipoprotein cholesterol; TGs; triglycerides; mg/dl=milligram per deciliter

Post exercise between group comparisons of lipid the profiles of study participants: After 16 weeks in EG mean TC, LDL-c and TG decreased significantly

compared to CG. However, mean HDL-c significantly increased in EG compared to CG (Table 2).

Table 2: Comparisons of lipid profiles of study participants

Variables & Groups	Baseline	16 Weeks	Between Group Mean Change Difference	P-value
TC mg/dl				
Combined exercise	180(± 13.2)	177(± 12.53)	-7.2	0.0001
Control	178.2(± 10.4)	182.4(± 10.3)		
LDL-c mg/dl				
Combined exercise	104.4(± 10.5)	99.1(± 10.48)	-10	0.0001
Control	103.5(± 7.9)	108.2(± 8.05)		

Variables & Groups	Baseline	16 Weeks	Between Group Mean Change Difference	P-value
TGs mg/dl				
Combined exercise	162.4(±16.9)	154.3(±19)	-14.3	0.0001
Control	159.8(±10.8)	165.9(±12.07)		
HDL-c mg/dl				
Combined exercise	42.6(±3.1)	44.5(±3.19)	3.8	0.001
Control	42.4(±2.4)	40.6(±2.5)		

Discussion

This study was aimed to examine the effect of combined aerobic and resistance exercise training on TC, HDL-c, LDL-c, and TGs in hypertensive patients. Findings from the present study showed a significant reduction in TC, LDL-c, and TGs and a significant increase in HDL-c in EG compared to CG. The findings of the current study are similar to previous studies that also found significant decrement in TC, LDL-c, and TGs and significant increase in HDL-c^{20, 21} in EG compared to CG. Various studies conducted in hypertensive patients and their reports showed that TC, LDL-c, and TGs were decreased significantly and HDL-c increased significantly in combined aerobic and resistance exercise participants^{20, 21}. The findings of these studies agreed with the present study. In addition, the current study is in agreement with the study of Shaw et al.²² in which LDL-c decreases significantly and the study of Tseng et al.²³ and Tokudome et al.²⁴ showed a significant decrease in TGs and a significant increase in HDL-c in combined aerobic and resistance exercise training compared to CG. HDL acts as a remover of bad cholesterol in the reverse transport of cholesterol²⁵. In our study high adherence to exercise (98%) was found and this may be also the possible reason for the improvement of lipid profiles in the EG. So this study has valuable clinical significance for the participants of the study in improving their lipid profiles. Application of randomized controlled studies, higher adherence level of the participants in the exercise, provision of alternative approach research to treat HTN in Ethiopia for the first time are the strength of the study. Whereas the inclusion of only mild hypertensive patients in the study and exclusion of individuals out of the study area due to feasibility risks were the limitations of the study. The findings from the current study suggest that physicians, fitness instructors, and physical education teachers should encourage hypertensive patients to engage in combined aerobic and resistance exercise training program on a regular basis.

Conclusion

Combined aerobic and resistance exercise training significantly reduced TC, LDL-c, TGs and significantly increased HDL-c levels in hypertensive patients. Public awareness promotion should be designed and implemented by concerned bodies for hypertensive patients to realize the importance of combined exercise trainings and thereby increases their adherence to exercise programs.

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Conflict of Interest: Nil.

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Ethical Clearance: The study was approved by Health Research Ethics Review Committee of Health Sciences College of Mekelle University with Ref. ERC07752016. Before continuing the study written informed consent was obtained from all study participants after reading and explaining of information sheets in their local language (Amharic) regarding procedures, confidentiality and risks of the study. Further, the privacy of private data was strictly preserved.

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