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Isolated and combined effect of hydraulic and ladder training on TCL, LDL and HDL cholesterol among college women students

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***Abstract*---**The study involved 12 weeks of hydraulic resistance training, Ladder training and was given alternative days for 50 minutes a day. The variables tested on day 1 of the pre and post-testing sessions included T.C., LDL, and HDL tests measured in a laboratory unit of measurement in milligrams of cholesterol per deciliter of blood. Analysis of covariance on the data obtained on total cholesterol (T.C.), low-density lipoprotein cholesterol (LDL), and high-density lipoprotein cholesterol (HDL) from the subjects in the pre-test, post-test, and adjusted post-test mean of the hydraulic training group (H.T.G.), ladder training group (LLTG), combined hydraulic and ladder training group (CHLTG), and control group (C.G.) have presented and defining aspects and differential analysis of T.C., LDL, and HDL of karpagam academy of higher education college women students. The Statistical analysis from the H.T.G., LTG, CHLTG, and the C.G. of F ratio of the post-test was more significant than the table value of the degree of freedom 3, 56 required for the significance at 0.05 level. The adjusted post-test F ratio of T.C., LDL, and HDL cholesterol in the confidence interval is 3.32, 2.36, and 3.55. The above analysis of the study indicates a significant difference among the adjusted post-test means of the H.T.G., LTG, CHLTG, and C.G. The result of this study validates that 12 weeks of H.T. and L.T. improve T.C., LDL, and HDL among college women students.

***Keywords*---**hydraulic training, ladder training, total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol.

Introduction

Today, balancing faculty obligations and retaining a personal lifestyle, exercise, and nutrition can, without problems, slip to the lowest concern for college women students. The Muscle Pharm Sports Science Institute, Denver, Colorado Falcone, Paul H., et al. recommended the new investigated unique training methods with the same duration to compare caloric expenditure.[11] Weltman A et al. (1986), the studies involved effects of hydraulic resistance strength in prepubertal males. The results show that, In contrast, six strength training subjects sustained injuries during activities of daily living, resulting in 47 missed strength training sessions. In the short-term, supervised concentric strength training using hydraulic resistance equipment is safe and effective in prepubertal boys.[16] Arthur Weltman et al. (1987) describe the study of the effect of hydraulic resistance strength training on serum lipid levels in prepubertal boys. Positive changes occur in adult populations with elevated levels of high-density lipoprotein cholesterol (HDL-C), or decreased levels of low-density lipoprotein cholesterol have a lower incidence of coronary artery disease.[15]

The compression of air or liquid produces hydraulic resistance. Hydraulic resistance machines are generally costly but have particular properties that make them advantageous for some athletes. However, there is a mechanical distinction between hydraulic structures and pneumatic devices because hydraulic machines use oil and air pressure. Typically, a weight is lifted concentrically and decreased eccentrically. In the case of hydraulic machines, it is more significant than lifting a weight up and then pushing it down.

Similarly, hydraulic schooling gadgets no longer rely upon gravity to offer resistance and are designed in one of these ways. The load on working muscular tissues terminates; as a result, the system no longer immediately returns to the beginning position. However, it is unknown if adequate exercise can supply advantages because the level of resistance intensity depends on the individual's attempt and pace for the duration of every repetition[3]. The ladder Training Method would help athletes increase performance in muscle endurance, power endurance, speed endurance, coordination, and coordination range. Ladder training is efficient for its calisthenics-based scheme of exercises, followed in sequence.

Ladder Workout is an excellent tool for agility-primarily based exercising because it's lightweight and transportable with countless variations to perform at home and outdoors. To kick up metabolism and incinerate fats, accentuate the aerobic and conditioning nature of the workout. It is a high-intensity interval training to attack fats: accomplish extra in much less time.

These brief bursts of excessive effort are observed via a short pause, blast fats, and burn greater calories. Exercises like the lateral endure move slowly pounce and plank in-and-out journey would challenge core endurance. All those movements get the heart pumping and decorate conditioning.

Methods

Participations

Recruiting untrained healthy women was a target. Sixty women Participations from karpagam Academy of Higher Education, Coimbatore, volunteered to participate in the study. Participants were not involved in any organized sports activity but were required to perform an average of 50 minutes per session. Their ages ranged between 18 to 24 years, respectively, after having been informed about the objective and protocol of the study. They gave their return consent to participate in the study. They adopted to randomized pre-post-test control group design for this study. The Participations were assigned randomly into Four groups experimental group 1, hydraulic resistance training (HTG N=15), experimental group 2, ladder agility training (LTG N=15), experimental group 3 combined group (HLTG N=15), and the control group (CG N=15). The training was given for experimental group Participation in 12 weeks of hydraulic resistance training and a weekly three days morning session Monday, Wednesday, and Friday, the ladder training was given alternative days of three days a week in the morning session Tuesday, Thursday, and Saturday, and the combined training was given a morning session of alternative days of Monday to Saturday for 50 minutes a day. The control group did not go under any training.

Methods of Training Session

The Hydraulic, ladder agility and combined training took place at an academy fitness center where the participants exercised for 50 minutes per session. Each training contacted alternative days of the week taken for hydraulic training, Tuesday, Thursday, and Saturday morning sessions for ladder training, and the alternative days for combined training of hydraulic and ladder training of alternative days of Monday to Saturday evening sessions of 3 days per week for 12 weeks. Each session was led by trained fitness instructors and supervised by the researchers. They performed training on 3 different days of the week with at least 1 day of rest between sessions. The exercise program consisted of stretching and warm-up exercise (10 minutes), H.D.T. (30 minutes), ladder training (30 minutes), and cool-down and relaxation exercise (10 minutes). The warm-up consisted of stretching exercises followed by slow-paced walking. The researcher conducted the exercise using hydraulic resistance machines with the following exercises: chest press and pull Shoulder press and Pull, low back flexion and extension, leg adduction and abduction, leg press and elbow extension, and flexion. During the initial stage, participants performed at least 1 set of each exercise and performed 2 to 3 sets once they became accustomed to the exercise in the subsequent stages.

The constructed of ladder agility training by the following exercise Hop Scotch Drill, Lateral Feet Drill, In-out Drill, Tango Drill, Five Count Drill, Cross Over, Lateral' Zig-Zags', and Moving Forward (In/Our Sequence). The training was divided into three phases workout to train the mind and physical level adopted their level training. Participants performed each exercise in 2 sets and a recovery period of 30 seconds between the sets.

For combined training, participants participated in both pieces of hydraulic and ladder training on alternative days of the week same above mention sequence of training.

Testing Procedure

The blood samples were taken from the participants' consent for the study. The pre and post-testing measurements were conducted in two different ways separately for a minimum of 24 hours. The variables tested on day 1 of the pre, and post-testing sessions included total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol test measured in a laboratory unit of measurement in milligrams (mg) of cholesterol per deciliter (dL) of blood. Venous blood becomes accrued in the early morning after the topics abstained from foods and drinks besides water for 12 hours to estimate the chosen biochemical variables. After that, the blood samples were taken ten ml from the participants, anti cubical vein with the aid of using venous puncture method, and the samples had been accrued earlier than and after an experimental duration of 12 weeks. All the achieved biochemical parameters were obtained using a biochemistry analyzer by a biochemist (model RA-50).

Material and Method

Sixty female Participations from karpagam academy of higher education college students volunteered to participate in the study. Participants were not involved in any organized sports activity but were required to perform an average of 50 minutes per week of hydraulic training, ladder training, and combined training practice. The mean (S.D.) age, height, mass, and B.M.I. of the group were 18.84 ±1.4 years, 178.4 ± 4.6cm, 62.4 ±6.47kg, and 22.2 ±2.4kg /m^2 respectively. After being informed about the study's objective and protocol and giving their return consent to participate, the randomized pre-post-test control group design was adopted.

Statistical Technique

The data collected from the experimental groups and control groups before and after experimentation on selected variables were statistically examined by analysis of covariance ANCOVA; whenever the 'F' ratio for adjusted post-test means was found to be significant, Scheff's test was followed, as a post hoc test to determine which of the paired mean differences was significant. In all the cases, the significance at a 0.05 level of confidence was fixed.

Analysis of covariance on the data obtained on total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol from the Participations in the pre-test, post-test, and adjusted post-test mean of the hydraulic training group, ladder training group, combined hydraulic and ladder training group, and control group have been presented in a Table- 1.

Results

Table 1 reveals the defining aspects and differential analysis of total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol of karpagam academy of higher education college women students.

The Statistical analysis from the table shows the hydraulic training group, ladder training group, combined training group, and the control group of F ratio. The obtained f ratio of total cholesterol is 41.01*, low-density lipoprotein is 40.44*, and high-density lipoprotein cholesterol is 31.59* of post-test was more significant than the table value of the degree of freedom 3,56 required for the significance at 0.05 level.

Table -1
Analysis of covariance of total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol of experimental groups and control group
(Lab test means count in mg/dl)

Bio-Chemical Parameters		HTG	LTG	CHLTG	CG	SOV	SOS	Df	M S	F Ratio
Total Cholesterol	Pre Test Mean	177	174.93	177.13	175.60	B/G	52.067	3	17.356	1.28
						W/G	756.267	56	13.505	
	Post Test Mean	168	163.87	169.20	176.13	B/G	1168.73	3	389.57	41.01*
						W/G	531.86	56	9.49	
	Adjusted Post-Test Mean	167.20	164.27	175.8	177.79	B/G	1387.33	3	462.44	39.53
						W/G	655.06	55	11.69	
Low-density lipoprotein cholesterol	Pre Test Mean	99.27	99.47	98.60	100.47	B/G	9.65	3	3.217	.41
						W/G	435.6	56	7.779	
	Post Test Mean	89.73	89.80	85.73	99.53	B/G	1138.05	3	379.35	40.44*
						W/G	525.2	56	9.37	
	Adjusted Post-Test Mean	94.73	93.93	88.80	98.73	B/G	749.65	3	249.88	26.44
						W/G	529.20	55	9.45	
High-density lipoprotein cholesterol	Pre Test Mean	59.80	59.93	60.80	60.33	B/G	9.117	3	3.039	.13
						W/G	1313.06	56	23.44	
	Post Test Mean	70.93	72.47	75.27	60.07	B/G	2013.73	3	671.24	31.59*
						W/G	1189.6	56	21.24	
	Adjusted Post-Test Mean	75.93	76.47	78.33	64.60	B/G	1583.8	3	527.93	27.54
						W/G	1073.2	55	19.16	

* Significant at 0.05 level of confidence Table value for df (3, 56) at 0.05 level = 2.76 Table value for df (3, 55) at 0.05 level = 2.78

The adjusted post-test f ratio of total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol is 39.53*, 26.44*, and 27.54* is also more remarkable than the table value of 2.78 for a degree of freedom 3, 55 required for significance at 0.05 level.

THE above analysis of the study indicates that there was a significant difference among the adjusted post-test means of the hydraulic training group, ladder training group, combined training group, and control group. Further, to determine which of the four paired means had a significant difference, the scheffe was applied as a post hoc test, and the result was presented in Table 2

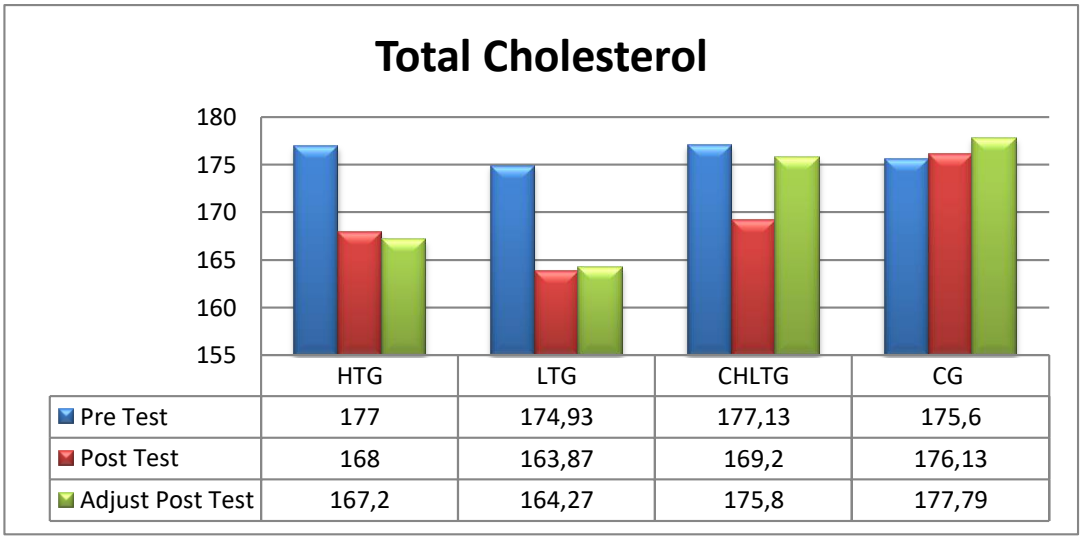
Table- 2
Scheffe's test for the difference between the adjusted post-test paired means on total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol
(Lab test means count in mg/dl)

Bio-Chemical Parameters	HTG	LTG	CHLT	CG	MD	C.I V
Total Cholesterol	167.20	164.27			2.93	3.32
	167.20		175.8		8.6*	
	167.20			177.73	10.53*	
		164.27	175.8		11.53*	
		164.27		177.73	13.46*	
			175.8	177.73	1.93	
Low-density lipoprotein cholesterol	94.73	93.93			0.8	2.36
	94.73		88.80		5.93*	
	94.73			98.73	4*	
		93.93	88.80		5.13*	
		93.93		98.73	4.8*	
			88.80	98.73	9.93*	
High-density lipoprotein cholesterol	75.93	76.47			0.54	3.55
	75.93		78.33		2.4	
	75.93			64.60	11.33*	
		76.47	78.33		1.86	
		76.47		64.60	11.87*	
			78.33	64.60	13.73*	

*significance at 0.05 level.

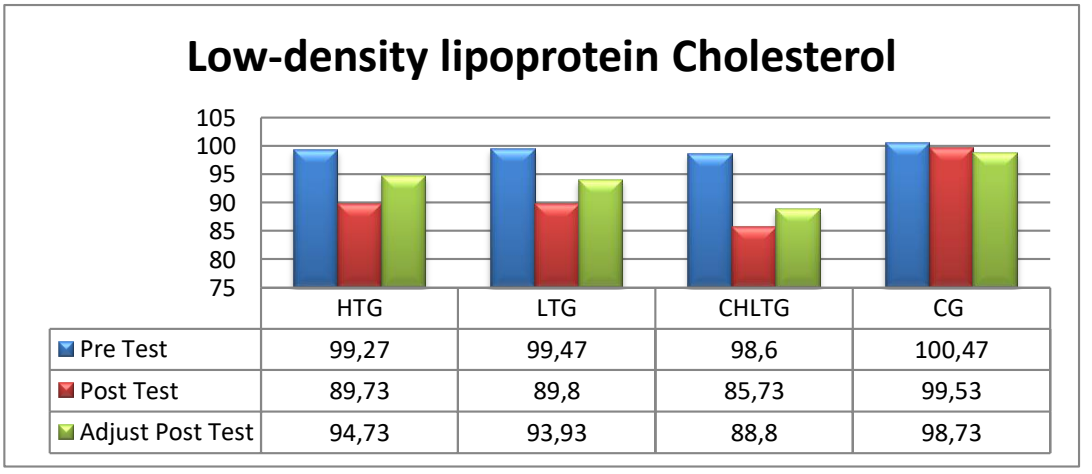
They presented the results of scheffe's post hoc test in the above table. The data were analyzed, and the table shows the mean difference between the hydraulic training group and ladder training, hydraulic training group and combined training group, hydraulic training group and control group, ladder training group and combined training group, ladder training group, and control group, and combined training group and control group for total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol. The confidence interval value for total cholesterol is 3.32*, low-density lipoprotein cholesterol is 2.36*, and high-density lipoprotein cholesterol is 3.55*. Noticed from the table above that the combined training group responded to the training with a more positive influence on low-density lipoprotein and high-density lipoprotein cholesterol when compared with the hydraulic training group, ladder training group, control group, and the hydraulic training group, ladder training group was better than the control group.

The total cholesterol was more effective than the ladder training group when compared to the other three groups: the hydraulic training group, the combined training group, and the control group. The Pre, Post, and adjusted post-test mean values of the hydraulic training group, ladder training group, combined training group, and control groups on total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol are graphically represented in figures 1, 2, and 3.



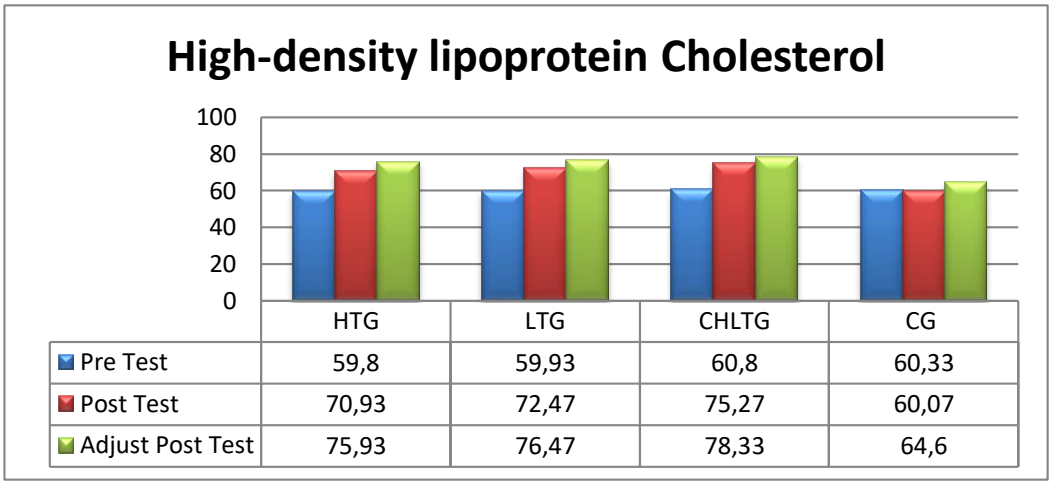
	HTG	LTG	CHLTG	CG
Pre Test	177	174,93	177,13	175,6
Post Test	168	163,87	169,2	176,13
Adjust Post Test	167,2	164,27	175,8	177,79

Figure 1pre post and adjusted post-test mean of HTG, LTG, CHLTG, and CG on total cholesterol among college women students



	HTG	LTG	CHLTG	CG
Pre Test	99,27	99,47	98,6	100,47
Post Test	89,73	89,8	85,73	99,53
Adjust Post Test	94,73	93,93	88,8	98,73

Figure 2: pre, post and adjusted post-test mean of HTG, LTG, CHLTG, and CG on low-density lipoprotein cholesterol among college women students



	HTG	LTG	CHLTG	CG
Pre Test	59,8	59,93	60,8	60,33
Post Test	70,93	72,47	75,27	60,07
Adjust Post Test	75,93	76,47	78,33	64,6

Figure 3: pre post and adjusted post-test mean of htg, ltg, chltg, and cg on high-density lipoprotein cholesterol among college women students

Discussion

The result of this study validates that 12 weeks of Hydraulic resistance training and ladder improve total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol among college women students. As shown in the results, all the parameters in the hydraulic (resistance) training group show statistically significant with hydraulic (resistance) exercise and ladder (agility drills) exercise practices. Therefore, statistically significant improvement of total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol after regular hydraulic (resistance) training, ladder training, and combined training practice is attributed. In addition, it was observed that regular hydraulic (resistance) exercises and ladder drills reduce basal cardiac output changes and regulate the metabolic rate, resting oxygen consumption, and overall fitness level.

As shown in the results, all the parameters in the hydraulic training, ladder training, and combined training show statistically significant with hydraulic resistance and ladder agility drills exercises. Statistically significant improvement in total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol after regular practice of hydraulic resistance exercise and ladder agility drills is attributed to a decreased level of cholesterol. In the present study, all the parameters, such as the lipid profiles, total cholesterol, LDL cholesterol, and HDL cholesterol, are shown to have statistically significant reductions after hydraulic resistance exercise and ladder agility drills training. However, after the training, there was a significant increase in LDL, HDL, and total cholesterol after hydraulic resistance exercise, ladder agility training, and combination training.

Conclusion

The results of the present study suggest that hydraulic training, ladder training, and combined training of hydraulic and ladder training appear to be effective and safe means by which to achieve significant improvement in total cholesterol, low-

density lipoprotein, and high-density lipoprotein cholesterol among college women students. These advantages may enhance with the training program, whereas the total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol can be used as simple and effective methods to prescribe work intensities and to provide progressive increases in intensity that are necessary for continued increases in total cholesterol, low-density lipoprotein, and high-density lipoprotein cholesterol. The present study showed significant improvement in total cholesterol levels, low-density lipoprotein cholesterol levels, and the change from cholesterol with high-density lipoprotein content after 12 weeks of training. In addition, the reduction of the high-density lipoprotein/low-density lipoprotein ratio, if there was one, was significant at the levels obtained in the present study because of the various groups trained at different intensities.

List of Abbreviations

H.T.G.- Hydraulic Training Group,
LTG- Ladder Training,
CHLTG- Combined Hydraulic and Ladder Training group,
C.G.- Control Group,
SOV- Sum of Variance,
S.O.S.- Sum of Square,
df- degree of freedom,
M.S.- Mean square,
B.G.- Between in Group,
W.G.- Within Group.
M.D- Mean Difference
C.I V – Confidence interval value
SPSS- Statistical Packages of Social Science

Practical Application

The prescription of hydraulic and ladder training is likely to influence the total cholesterol, LDL and HDL experienced during sets that have been demonstrated to be an indicator of neuromuscular fatigue. While taking the training procedure the exercise was demonstrated by the trainer and coaches to understand the exercises and instructed advantages of the training importance of the level of cholesterol for women. The training and exercises are conducted in the fitness center of the karpagam institution. The selection of Participations are women college students who was taken blood samples with their consent and acknowledged analyzing the blood lap test with the help of lap technicians of karaikudi lab center karikudi. After the completion of the lap test, the data was applied in SPSS 64-bit to find their level of ratio.

Declarations
Ethics approval and Consent Participation

The project entitled "Isolated and Combined Effect of Hydraulic and Ladder Training on Selected Physical Physiological and Biochemical Variables of College Women Students" was approved by the Alagappa University College of Physical Education, Alagappa University, Karaikudi, Tamil Nadu, India. Therefore, this

manuscript was created, and all participants gave their written consent to participate in the experiments according to the principles outlined in the Declaration of W.M.A. Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Participations. All methods were performed according to relevant guidelines and regulations.

Consent for Publication
Not Applicable.

Availability of data and materials

The datasets used and/or analyzed by SPSS 64-bit during the current study are not publicly available due to confidential information about the participants but are available from the corresponding author on reasonable request at [manoandsport@gmail.com].

Competing interests
The authors declare that they have no competing interests.

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Author's Contributions

Ms.K.Manosakthi and Dr.K.Divya have given good-sized contributions to the idea or the layout of the manuscript, Ms.K.Manosakthi amassed the data, Ms.K. manosakthi and Dr.K.Divya analyzed and interpreted data. All authors have participated in drafting the manuscript, and Dr.K.Divya revised it critically. All authors study and accepted the very last model of the manuscript.

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