Effects of Isolated and Concurrent Low Intensity Strength and Endurance Trainings on Selected Strength Parameters

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ABSTRACT

The purpose of the present investigation is to examine the effects of isolated and concurrent low-intensity strength and endurance training on selected strength parameters of untrained college men. To achieve the purpose of the study, a total of 60 untrained college men were selected randomly as subjects. The age of the subjects ranged between 17 and 23. All of them were healthy and normal. The number of groups was limited to four, viz. Experimental group I, Experimental group II, Experimental group III and Control (CON). Group I performed low-intensity strength training, group II performed low-intensity endurance training, group III was assigned concurrent low-intensity strength and endurance training, and group IV acted as a control. The data collected from the four groups prior to and post experimentation on selected strength parameters were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since four groups were involved, whenever the obtained 'F' ratio value was found to be significant for adjusted post-test means, the Scheffe's test was applied as a post hoc test to determine the paired mean differences, if any. In all the cases, the level of confidence was fixed at 0.05 for significance. Due to low-intensity strength training, low-intensity endurance training, and concurrent training, the untrained college men's arm and shoulder strength and grip strength were improved significantly. Although low intensity strength training (LISTG) and concurrent training (CTG) are better than low intensity endurance training (LIETG), low intensity strength training (LISTG) is better than concurrent training (CTG).

***Keywords:** Concurrent Low Intensity Strength and Endurance Training, Strength Parameters*

INTRODUCTION

The growing awareness of physical inactivity and declining fitness levels among young adults, particularly untrained college men, has drawn considerable attention to the role of structured exercise interventions in improving health- and performance-related fitness. College students often experience a transition phase marked by reduced physical activity due to academic pressure, lifestyle changes, and limited participation in organized sports. As a result, many students exhibit low levels of muscular strength and cardiorespiratory endurance, which may predispose them to health risks and reduced functional capacity. This context underscores the importance of identifying effective, safe, and time-efficient training methods suitable for untrained populations.

Although numerous studies have examined the effects of strength training and endurance training independently, much of the existing literature has primarily focused on moderate to high intensity training protocols, particularly among trained athletes or physically active populations. Comparatively fewer studies have investigated the physiological adaptations resulting from low-intensity strength and endurance training, especially in untrained or recreationally active individuals. This creates a clear research gap regarding how low-intensity training modalities influence strength and endurance parameters when applied either in isolation or in combination.

Furthermore, strength training contributes significantly to musculoskeletal health by increasing muscle mass, muscular strength, bone mineral density, and joint stability. For young adults, improvements in muscular strength support better posture, movement efficiency, and injury prevention during daily activities, occupational tasks, and sports participation. Moreover, resistance training has been shown to improve metabolic health by increasing resting metabolic rate, enhancing insulin sensitivity, and supporting healthy body composition, which is particularly important in combating sedentary lifestyles prevalent among college-aged populations (Westcott, 2012).

Endurance training, on the other hand, primarily enhances the efficiency of the cardiovascular and respiratory systems. Regular aerobic exercise improves maximal oxygen uptake (VO_2max), cardiac output, and oxygen utilization by working muscles. These adaptations contribute to improved stamina, reduced fatigue, and better stress tolerance in young adults. Additionally, endurance training is strongly associated with reductions in cardiovascular disease risk factors, including hypertension, dyslipidemia, and obesity, thereby promoting long-term cardiovascular health (Blair et al., 2001).

The combined inclusion of strength and endurance training yields complementary physiological benefits. While strength training improves neuromuscular function and musculoskeletal resilience, endurance training enhances aerobic capacity and energy efficiency. Together, they promote balanced fitness development, enabling young adults to meet the physical demands of academic life, work, recreation, and sport. Research also indicates that concurrent strength and endurance training can positively influence mental health, self-esteem, and overall quality of life among young adults (Garber et al., 2011).

The need for selecting this research title arises from its practical relevance and scientific significance. Low-intensity training is widely recommended for untrained college men due to its safety, accessibility, and lower risk of injury. Understanding whether isolated or concurrent low-intensity training is more effective in improving strength parameters can help physical educators, coaches, and health professionals design efficient and sustainable training programs for beginners. Additionally, this study contributes to filling the research gap by providing systematic evidence on training-induced adaptations under low-intensity conditions, thereby extending existing knowledge beyond high-intensity and athlete-centered research.

In summary, the present study is justified by the limited availability of research on low-intensity isolated and concurrent training, the inconsistent findings related to concurrent training adaptations, and the need for scientifically validated training guidelines for untrained populations. The findings are expected to offer valuable insights for exercise prescription, health promotion, and future research in training science.

METHODOLOGY

Subjects and Variables

To achieve the purpose of the study, a total of 60 untrained college men were selected randomly as subjects. The age of the subjects ranged between 17 and 23. All of them were healthy and normal. The number of groups was limited to four, viz. Experimental group I, Experimental group II, Experimental group III, and Control (CON). Group I performed low-intensity strength training, group II performed low-intensity endurance training, group III was assigned concurrent low-intensity strength and endurance training, and group IV acted as a control. All four groups were assessed before and immediately after a 12-week training period on arm and shoulder strength and grip strength by conducting pull-ups and using a grip dynamometer, respectively.

Training Protocol

The low-intensity strength training schedule is systematically designed to develop muscular strength, strength endurance, and neuromuscular coordination in a safe and progressive manner over a 12-week period. During Weeks 1–4 (Adaptation Phase), the training intensity is deliberately kept low at approximately 40% effort or 40% of one-repetition maximum (1RM). The Development Phase (Weeks 5–8) introduces a moderate increase in training intensity to around 50% of 1RM, marking a transition from general adaptation to structured strength development. In the Progressive Strength Phase (Weeks 9–12), training intensity is further increased to approximately 60% of 1RM, which remains within the low-to-moderate intensity range but provides sufficient overload to stimulate strength improvements.

The low-intensity endurance training schedule is systematically planned to enhance cardio-respiratory endurance, aerobic capacity, and general stamina over a 12-week period through gradual and controlled progression. During the Initial Adaptation Phase (Weeks 1–4), the primary objective is to prepare the cardiovascular, respiratory, and musculoskeletal systems for sustained aerobic activity. The Development Phase (Weeks 5–8) involves a moderate increase in both training duration and intensity (55–60% HRmax), marking a transition toward improved aerobic endurance. In the Progressive Endurance Phase (Weeks 9–12), the program emphasizes continuous and interval-based aerobic work at 60–65% HRmax, which significantly improves cardio-respiratory endurance and fatigue resistance.

The concurrent low-intensity strength and endurance training schedule is scientifically structured to develop muscular strength, muscular endurance, and cardio-respiratory endurance simultaneously over a 12-week training period. During the Adaptation Phase (Weeks 1–4), the primary objective is to prepare the neuromuscular and cardiovascular systems for combined training demands. In the Development Phase (Weeks 5–8), both training volume and intensity are moderately increased to stimulate further adaptation. The Progressive Phase (Weeks 9–12) represents the highest training stimulus within the low-intensity framework.

Collection of the Data

The data on the selected strength parameters were collected prior to the commencement of the experiment (pre-test) and after twelve weeks of training period (post-test). Both the pre and post tests were administered under identical conditions, with the same apparatus, testing personnel, and testing procedures.

Statistical Technique

The data collected from the experimental and control groups on selected dependent variables were statistically analyzed by a paired ‘t’ test to find out the significant differences, if any, between the pre- and post-test. Further, the percentage of changes was calculated to find out the chances in selected dependent variables due to the impact of the experimental treatment. Further, the data collected from the three groups prior to and post experimentation on selected dependent variables were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since four groups were involved, whenever the obtained 'F' ratio value in the adjusted post-test mean was found to be significant, the Scheffe's test was applied as a post hoc test to determine the paired mean differences, if any. The level of confidence was fixed at 0.05 for significance.

RESULT

The descriptive and dependent t-test results, on arm and shoulder strength of untrained college men, belong to isolated and concurrent low intensity strength and endurance training and control groups, are shown in Table I.

Table I: Descriptive Analysis on Arm and Shoulder Strength of Isolated and Concurrent Low Intensity Strength and Endurance Training and Control Groups

Groups Selected	Tests	No	Mean Scores	S.D	M. Diff.	't' – test	Progress in%
Low Intensity Strength Training (LISTG)	Pre	15	8.8667	1.68466	4.467	27.033*	50.38%
	Post		13.3333	2.05866			
Low Intensity Endurance Training (LIETG)	Pre	15	8.9333	1.27988	1.400	7.359*	15.67%
	Post		10.3333	1.29099			
Concurrent Training (CTG)	Pre	15	9.0000	1.55839	2.800	12.582*	31.11%
	Post		11.8000	2.14476			
Control (CG)	Pre	15	9.0667	1.33452	0.133	0.214	1.47%
	Post		8.9333	1.66762			

*df 14=2.14(Table value-.05level)(*significant)*

The descriptive and dependent 't' test results, confirm that the arm and shoulder strength of untrained college men found between pre (initial) and post (final) test of isolated and concurrent low intensity strength and endurance training and control (LISTG, LIETG, CTG & CG) group's differ obviously, as the 't' values (paired t- test) 27.033 (LISTG), 7. 359(LIETG) and 12.582(CTG) are more than required table value (df14=2.14). Due to low intensity strength training (LISTG =50.38%), low intensity endurance training (LIETG =15.67%), and concurrent training (CTG = 31.11%), the untrained college men's arm and shoulder strength was improved significantly. In Table II, the calculated ANCOVA results on arm and shoulder strength of untrained college men belonging to isolated and concurrent low-intensity strength and endurance training, and the control group are given.

Table II: ANCOVA Results on Arm and Shoulder Strength Isolated and Concurrent Low Intensity Strength and Endurance Training and Control Groups

Mean	**Low Intensity Strength Training (LISTG)**	**Low Intensity Endurance Training (LIETG)**	**Concurrent Training (CTG)**	**Control (CG)**	**SoV**	**SS**	**df**	**MS**	**'F' ratio**
Adjusted Post-test	13.416	10.361	11.772	8.850	B	171.073	3	57.024	30.749*
					W	101.999	55	1.855	

*(Table value for df 3 & 55= 2.77)*Significant (.05 level)*

The applied ANCOVA statistics ‘f’ (30.749) value make obvious that the adjusted arm and shoulder strength mean scores of low intensity strength training (LISTG =13.416), low intensity endurance training (LIETG) =10.361), concurrent training (CTG = 11.772) as well as control group’s (CG=8.850) untrained college men differ significantly from one another. Because the isolated and concurrent low intensity strength and endurance training and control group’s arm and shoulder strength adjusted ‘F’ value (30.749) is more than 2.77 (table value) for df (degrees of freedom) 3 and 55. In Table III, the calculated post hoc test results on arm and shoulder strength of isolated and concurrent low-intensity strength and endurance training, and the control group’s untrained college men are given.

Table III: Post Hoc Analysis Results on Arm and Shoulder Strength Isolated and Concurrent Low Intensity Strength and Endurance Training and Control Groups

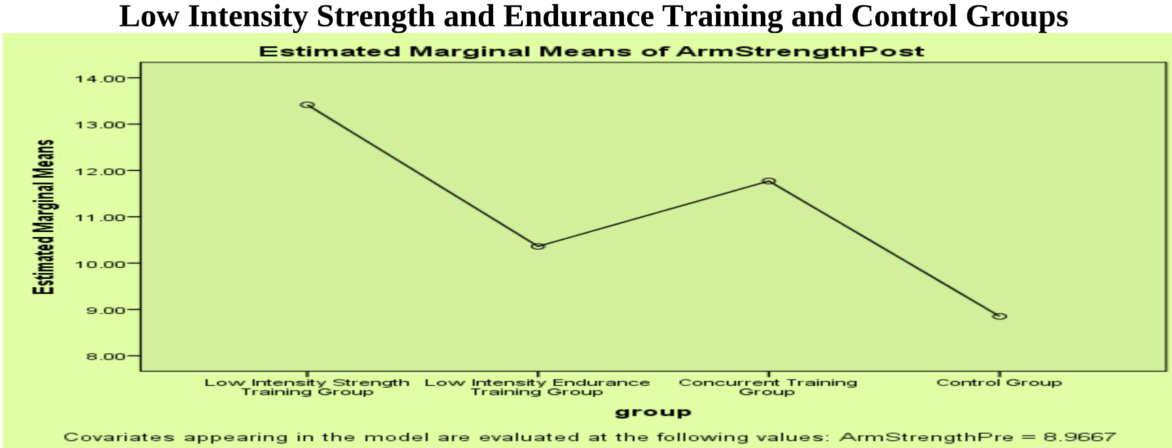
Low Intensity Strength Training (LISTG)	Low Intensity Endurance Training (LIETG)	Concurrent Training (CTG)	Control (CG)	M.D	C.I
13.416	10.361			3.055*	1.404
13.416		11.772		1.644*	1.404
13.416			8.850	4.566*	1.404
	10.361	11.772		1.411*	1.404
	10.361		8.850	1.511*	1.404
		11.772	8.850	2.922*	1.404

**Significant (.05)*

It (Scheffe’s test results**)** makes obvious that because of low intensity strength training (LISTG =4.566), low intensity endurance training (LIETG =1.511) and concurrent training (CTG = 2.922) the untrained college men’s arm and shoulder strength was enhanced immensely, because when comparing these treatment groups with control groups the mean differences (MD) are higher than CI value (1.404). Although low intensity strength training (LISTG) and concurrent training (CTG) are better than low intensity endurance training (LIETG), low intensity strength training (LISTG) is better than concurrent training (CTG).

The graph presented below (Figure I) shows the arm and shoulder strength of untrained college men in isolated and concurrent low-intensity strength and endurance training and control groups.

Figure I: Graph Showing the Arm and Shoulder Strength Isolated and Concurrent Low Intensity Strength and Endurance Training and Control Groups



Analysis of Grip Strength

The descriptive and dependent t-test results, on grip strength of untrained college men, belong to isolated and concurrent low intensity strength and endurance training and control groups, are shown in Table IV.

Table IV: Descriptive Analysis on Grip Strength of Isolated and Concurrent Low Intensity Strength and Endurance Training and Control Groups

Groups Selected	Tests	No	Mean Scores	S.D	M. Diff.	't' – test	Progress In %
Low Intensity Strength Training (LISTG)	Pre	15	24.4000	2.4437	6.000	61.482*	24.59%
	Post		30.4000	2.5298			
Low Intensity Endurance Training (LIETG)	Pre	15	25.0667	2.0517	1.933	29.00*	7.71%
	Post		27.0000	2.0702			
Concurrent Training (CTG)	Pre	15	24.6000	2.4142	4.133	31.00*	16.80%
	Post		28.7333	2.1865			
Control (CG)	Pre	15	24.2000	2.4261	0.067	0.099	0.28%
	Post		24.1333	2.0656			

*df 14=2.14(Table value-.05level)(*significant)*

The descriptive and dependent 't' test results, confirm that the grip strength of untrained college men found between pre (initial) and post (final) test of isolated and concurrent low intensity strength and endurance training and control (LISTG, LIETG, CTG & CG) group's differ obviously, as the 't' values (paired t- test) 61.482 (LISTG), 29.00(LIETG) and 31.00(CTG) are more than required table value (df14=2.14). Due to low intensity strength training (LISTG =24.59%), low intensity endurance training (LIETG =7.71%), and concurrent training (CTG = 16.80%), the untrained college men's grip strength was improved significantly.

In the table below (Table V), the calculated ANCOVA result on grip strength of untrained college men belonging to isolated and concurrent low-intensity strength and endurance training, and the control group is given.

Table – V: ANCOVA Results on Grip Strength of Isolated and Concurrent Low Intensity Strength and Endurance Training and Control Groups

Mean	**Low Intensity Strength Training (LISTG)**	**Low Intensity Endurance Training (LIETG)**	**Concurrent Training (CTG)**	**Control (CG)**	**SoV**	**SS**	**df**	**MS**	**'F' ratio**
Adjusted Post-test	30.531	26.674	28.707	24.421	B	311.607	3	103.869	66.077*
					W	86.456	55	1.572	

*(Table value for df 3 & 55= 2.77)*Significant (.05 level)*

The applied ANCOVA statistics ‘f’ (66.077) value make obvious that the adjusted grip strength mean scores of low intensity strength training (LISTG =30.531), low intensity endurance training (LIETG =26.674), and concurrent training (CTG = 28.707) as well as the control group’s (CG=24.421) untrained college men differ significantly from one another. Because the isolated and concurrent low intensity strength and endurance training and control (LISTG, LIETG, CTG & CG) group’s grip strength adjusted ‘F’ value (66.077) is more than 2.77 (table value) for df (degrees of freedom) 3 and 55.

In the table below (Table VI), the calculated post hoc test results on grip strength of isolated and concurrent low intensity strength and endurance training, and the control group’s untrained college men are given.

Table – VI: Post Hoc Analysis Results on Grip Strength of Isolated and Concurrent Low Intensity Strength and Endurance Training and Control Groups

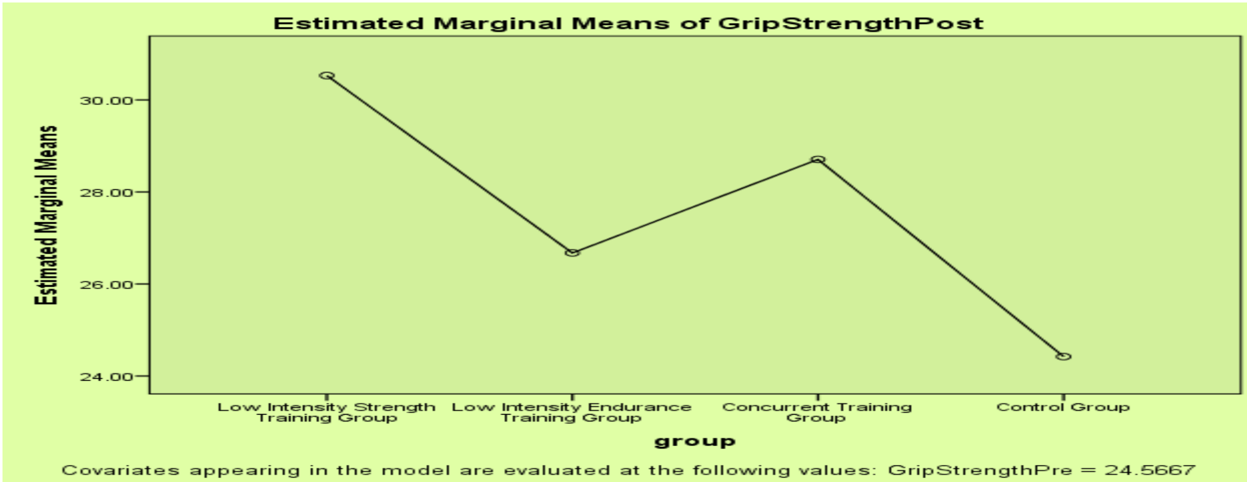
Low Intensity Strength Training (LISTG)	Low Intensity Endurance Training (LIETG)	Concurrent Training (CTG)	Control (CG)	M.D	C.I
30.531	26.674			3.856*	1.320
30.531		28.707		1.824*	1.320
30.531			24.421	6.110*	1.320
	26.674	28.707		2.033*	1.320
	26.674		24.421	2.253*	1.320
		28.707	24.421	4.286*	1.320

**Significant (.05)*

It (Scheffe’s test results**)** makes obvious that because of low intensity strength training (LISTG =6.110), low intensity endurance training (LIETG =2.253) and concurrent training (CTG = 4.286), the untrained college men’s grip strength was enhanced immensely, because when comparing these treatment groups with control groups the mean differences (MD) are higher than CI value (1.320). Although low intensity strength training (LISTG) and concurrent training (CTG) are better than low intensity endurance training (LIETG), low intensity strength training (LISTG) is better than concurrent training (CTG).

The graph presented below (Figure II) shows the grip strength of untrained college men belonging to isolated and concurrent low-intensity strength and endurance training and control groups.

Figure – II: Graph Showing the Grip Strength of Isolated and Concurrent Low Intensity Strength and Endurance Training and Control Groups



DISCUSSION

The current study demonstrated that isolated low-intensity strength training, isolated low-intensity endurance training, and concurrent low-intensity strength and endurance training resulted in considerable enhancements in arm and shoulder strength in untrained college males. This overall enhancement can be ascribed to the tendency of untrained persons to react favorably to low-intensity training stimuli, owing to initial brain adaptations, increased motor unit activation, and augmented inter-muscular coordination. Such adaptations are extensively recorded in the initial stages of training, especially among previously untrained individuals (Moritani & deVries, 1979). Of the three training programs, low-intensity strength training demonstrated marked superiority in improving arm and shoulder strength. This discovery aligns with the idea of training specificity, which asserts that strength improvements are optimized when the training stimulus closely resembles the intended result. Isolated strength training exerts direct mechanical demand on the upper-body musculature, particularly the arm and shoulder muscles, resulting in enhanced neuromuscular adaptations and muscle fiber activation relative to endurance-focused or mixed training modalities (Kraemer & Ratamess, 2004).

The results of the current study demonstrate that isolated low-intensity strength training, isolated low-intensity endurance training, and concurrent low-intensity strength and endurance training significantly enhanced grip strength in untrained college males. The isolated low-intensity endurance training group exhibited notable albeit rather modest enhancements in grip strength. These improvements can be ascribed to repetitive submaximal muscle contractions and prolonged muscular activity associated with endurance training, enhancing muscular endurance and fatigue resistance rather than peak force production. While endurance exercise improves oxidative capacity and local muscle endurance, it is inferior to resistance training in enhancing maximum grip strength (Sale, 1988). The current findings align with previous studies indicating that resistance training, even at minimal intensities, is the most efficacious strategy for enhancing grip strength due to its specificity and capacity to induce neuromuscular changes. Grip strength is especially influenced by resistance exercises that incorporate sustained holds, pulling motions, and repetitive grasping activities, which are more extensively featured in strength training programs (Fleck & Kraemer, 2004).

CONCLUSION

Due to low intensity strength training (LISTG =50.38%), low intensity endurance training (LIETG =15.67%), and concurrent training (CTG = 31.11%), the untrained college men's arm and shoulder strength was improved significantly. Similarly, the untrained college men's grip strength was improved significantly due to low-intensity strength training (LISTG =24.59%), low-intensity endurance training (LIETG =7.71%), and concurrent training (CTG = 16.80%). Although low intensity strength training (LISTG) and concurrent training (CTG) are better than low intensity endurance training (LIETG), low intensity strength training (LISTG) was better than concurrent training (CTG).

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