

Resistance Training As A Stimulus For Skeletal Muscle Hypertrophy In Novice Urban University Students: An Experimental Investigation

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Abstract

The purpose of this investigation was to find out how moderate intensity resistance training influences muscles growth in newbie college students living in urban areas. Forty men under graduate students were randomly selected as subjects and their aged ranged from 17 to 21 years. The selected subjects were randomly assigned into two equal groups namely experimental (n = 20) group (EG) which underwent moderate intensity resistance training for 8 weeks with 3 sessions per week and control (n = 20) group (CG) which did not undergo any special training. The thigh girth, calf girth and upper arm girth were selected as criterion variables for this study. The subjects were measured their thigh girth, calf girth and upper arm girth by a flexible tape. The obtained data were statistically assessed for any significant difference using analysis of co variance (ANCOVA). The result showed that there were significant improvement on thigh girth (56.86 ± 3.73 vs 53.02 ± 3.41 , $p \leq 0.05$) and upper arm girth (33.86 ± 2.25 vs 29.85 ± 2.19 , $p \leq 0.05$) between the experimental group and control group. However there was no significant improvement in calf girth (36.17 ± 2.45 vs 34.93 ± 2.32 , $p \geq 0.05$) between the experimental group and control group. Eight weeks' time is very short to increase the size of the muscles size in significant level, especially for beginners, but here it was increased significantly the thigh muscle size and upper arm muscles of the experimental groups when compare to control group. If the training duration and the intensity were increased, it would have increased the size of calf muscle as well.

Keywords: Resistance training, muscle growth, moderate intensity, thigh muscle, calf muscle, upper arm muscle, newbie college students.

Introduction

In current years athletic typical performance has been converted talent method and schooling big are being constantly superior. Bodily training scientists were training to growth new techniques of education and technique to attain an excessive stage of overall performance in sports activities and video games (Panackalet al, 2012). Resistance education has been shown to promote increases in muscle period (moreover called hypertrophy) (Schoenfeld, 2010). Vital factors make contributions to this physiological phenomenon along with sarcoplasmic hypertrophy (i.e., improved muscle glycogen storage) and myofibrillar hypertrophy (i.e., increased myofibril duration and myofibrillar variety) (Triplett and Haff, 2015). On this regard, resistance training is considered the gold widely recognized for growing muscular tissues (Ahtiainen et al., 2003). Historically, resistance training centered on hypertrophy is characterized with the useful resource of moderate load, excessive ordinary quantity load and quick relaxation durations (Kraemer & Ratamess, 2005).

Training approach is every other variable often referred to as a key aspect of effective resistance education. The time period "training approach" is frequently used to give an explanation for the unique variables that make up a exercise, and it's been proposed that right method can also beautify muscle development (Stone et al, 2007). The requirements of education have long gone via many modifications within the beyond a long time. The training standards, therefore, are not static, know-how they go through changes in preserving pace with the improvement of numerous sciences (Nunes et al., 2021). Maximizing muscle hypertrophy calls for the manipulation of positive resistance schooling variables, along with training quantity, intensity of attempt, and kind of motion (Schoenfeld et al, 2021). Hypertrophy is described as an increase in muscular size, which can be finished through exercising.

Resistance training is a famous and effective modality to enhance muscle characteristic, purposeful overall performance, and health parameters in an intensive range of wholesome and medical populations. Many of the many expected outcomes will boom in muscle length and electricity is considered important and appropriate with the aid of human beings and clinicians each for overall performance or fitness and functional improvement. Inside the Forties, DeLorme and Watkins (DeLorme & Watkins, 1948) proposed task resistance exercising units until neuromuscular volitional failure to maximize such advantages. Although a large body of research work on this location has been posted (Mitchell et al., 2012), issues regarding a manner to optimize resistance training outcomes remain (Schoenfeld et al., 2017).

In resistance training load refers to the mass or quantity of weights utilized for precise bodily sports. The percentage of 1 repetition maximum (IRM) approach turned into used in this education programme. It is the maximum load that may be lifted efficaciously one time via the overall style of motion (Fielding et al. 2002), in percentage approach the weight of IRM is dealt with as hundred percentage (Stone, 2003). On this take a look at 70% of 1 RM turned into used to resistance training, this schooling is used to develop the scale of the muscles. The element of maximal thigh circumference is the thigh girth (Johnson Barry, L. & Nelson Jack, k. 1982).

The muscle thru use turns into more potent and larger. Participation in resistance education will enhance the energy and length of the muscle groups in thigh, calf and notable

additives of the body (Shea, 1966). Rigorous training, mainly at the same time as performed within the path of weights generally consequences in muscle fiber thickening. exclusive issues evaluating resistance schooling masses are related to the heterogeneity of test designs together with the human beings involved, training recognition, experimental layout, assessed outcomes and schooling prescription. There's additionally an increase within the form of capillaries surrounding and nourishing the muscular tissues and a thickening of connective tissues, similarly with the muscle tendons that be a part of muscle mass and ligaments that be a part of muscle to bone (Asaithambiet al, 2012). Those types of modifications are probable to result in yet again in body weight.

Metropolis college male college students can effectively construct muscle with balanced routine incorporating compound physical activities that target a couple of muscle corporations, which may be done in a gymnasium or maybe a dorm room. The exercising can assemble muscle correctly the use of an expansion of physical activities, ranging from bodyweight moves to complex barbell lifts (Bernardezet al, 2021). Effective electricity schooling applications generally contain compound sports activities that focus on predominant muscle businesses and contain innovative resistance. A balanced routine must include sports for the top frame, lower body, and core (www.google.com/search). The sports activities may be achieved the use of specific gym tool in most university fitness facilities, alongside free weights (barbells and dumbbells), weight machines, or even in reality body weight (Abraham, 2014).

Muscle strengthening bodily sports is critical for city college male college students, supplying splendid physical, mental, and academic advantages that assist manipulate the precise stressors of university lifestyles, which includes high instructional desires and social pressures. Power education places stress on bones, developing their density and reducing the risk of osteoporosis later in lifestyles (Abraham, 2011). It may also growth muscle businesses, which naturally declines with age. Muscle is extra metabolically energetic than fats, this means that constructing muscle increases the resting metabolic charge and allows burn power extra efficiently, assisting in weight management and lowering stomach fat (www.google.com/search). Within the present study is investigating how resistance training impacts muscle groups increase in new university college students dwelling in cities.

Materials and Methods

The aim of this investigation was to find out how moderate intensity resistance training influences muscles growth in newbie college students living in urban areas. Forty men under graduate students from the colleges of Ernakulum city, Kerala were randomly selected as subjects and their aged ranged from 17 to 21 years. The selected subjects were randomly assigned into two equal groups namely experimental (n = 20) group (EG) which underwent moderate intensity resistance training for 8 weeks with 3 sessions per week and control (n = 20) group (CG) which did not undergo any special training. The thigh girth, calf girth and upper arm girth were selected as criterion variables for this study. The maximum muscle girth was measured by a flexible tape in centimeters. Before collection of data, the subjects were oriented about the purpose of the study and investigator explained the test to the subjects and about the procedure to be adopted for measuring thigh girth, calf girth and upper arm girth. The experimental group underwent the training with an intensity of 50% to 75% of effort, which was considered as moderate intensity.

The number one consequences of this review were muscle hypertrophy (i.e., described as a measure of muscle tissues or size) and muscle electricity (i.e., described through 1-RM assessments). The investigation becomes carried out up to October 2025 the use of the subsequent electronic databases: Medline, Embase, Scopus and internet of technology. The terms used have been as follows: “resistance training until failure” and “muscle hypertrophy” or “muscle hypertrophy” in association with a listing of touchy phrases to search for experimental research. The statistics extraction changed into accomplished via a standardized shape. Information regarding contributors, resistance training protocols, results, and assessment strategies changed into amassed. Study traits, intervention duration, variety of sessions, experimental layout, schooling reputes, assessed outcomes, and resistance education prescription method have been extracted, along with the principle consequences, whereas results have been extracted of their absolute units (e.g., kilograms for 1-RM assessments, centimeters for muscle thickness).

These are the resistance exercise have given, full squat, front squat, heel raise, hamstring curl, biceps curl, triceps curl, military press, calf raise and sit ups. The data was collected prior to and immediately after the training programme for criterion variables. They were statistically examined for significant differences, if any, by applying analysis of covariance (ANCOVA). The level of confidence was set to priority at 0.05.

Table – I Analysis of Covariance on Thigh Girth between the Experimental and Control Groups

Test		EG	CG	SOV	SS	df	MS	F
Pretest	Mean	53.26	52.76	B	0.17	1	0.17	1.45
	SD	3.28	3.04	W	89.35	38	4.12	
Post test	Mean	56.86	53.02	B	8.73	1	8.73	6.68*
	SD	3.73	3.41	W	78.92	38	3.71	
Adjusted Post test	Mean	56.89	53.03	B	9.15	1	9.15	8.72*
				W	75.04	37	3.41	

$$F = (1, 38) (0.05) = 4.09 \quad P \geq 0.05, \quad F = (1, 37) (0.05) = 4.10 \quad P \leq 0.05$$

Table I shows that the pretest mean of experimental and control groups are 53.26 and 52.76 respectively. The obtained F ratio of 1.45 for pretest mean is less than the table value 4.09 for df 1 and 38 required for significance at 0.05 level. The obtained F ratio of 6.68 for posttest mean is higher than the table value 4.09 for df 1 and 38 required for significance at 0.05 level. The adjusted posttest mean values of experimental and control groups are 56.89 and 53.03 respectively. The obtained F ratio of 8.72 for adjusted posttest mean is also

higher than the required table value 4.10 for df 1 and 37 for significant 0.05 level. The result of the study indicated that there was a significant difference between the adjusted posttest mean of medium intensity resistance training group and control group on thigh girth.

Table - 11 Analysis of Covariance on Calf Girth between the Experimental and Control Groups

Test		EG	CG	SOV	SS	df	MS	F
Pretest	Mean	34.27	35.12	B	4.36	1	4.36	1.15
	SD	2.56	2.14	W	87.49	38	4.76	
Post test	Mean	36.17	34.93	B	7.81	1	7.81	3.46
	SD	2.45	2.32	W	93.47	38	4.91	
Adjusted Post test	Mean	36.23	35.11	B	10.53	1	10.53	3.73
				W	85.04	37	4.11	

$F = (1, 38) (0.05) = 4.09$ $P \geq 0.05$, $F = (1, 37) (0.05) = 4.10$ $P \geq 0.05$

Table II shows that the pretest mean of experimental and control groups are 34.27 and 35.12 respectively. The obtained F ratio of 1.15 for pretest mean is less than the table value 4.09 for df 1 and 38 required for significance at 0.05 level. The obtained F ratio of 3.46 for posttest mean is less than the table value 4.09 for df 1 and 38 required for significance at 0.05 level. The adjusted posttest mean values of experimental and control groups are 36.23 and 35.11 respectively. The obtained F ratio of 3.73 for adjusted posttest mean is also less than the required table value 4.10 for df 1 and 37 for significant 0.05 level. The result of the study indicated that there was no significant difference between the adjusted posttest mean of medium intensity resistance training group and control group on calf girth.

Table - 11I Analysis of Covariance on Upper Arm Girth between the Experimental and Control Groups

Test		EG	CG	SOV	SS	df	MS	F
Pretest	Mean	30.24	29.17	B	1.82	1	1.82	1.14
	SD	2.41	2.03	W	62.78	38	2.83	
Post test	Mean	33.86	29.85	B	71.49	1	71.49	22.56*

	SD	2.25	2.19	W	53.79	38	2.46	
Adjusted Post test	Mean	33.92	29.86	B	87.73	1	87.73	32.14*
				W	34.72	37	1.81	

$$F = (1, 38) (0.05) = 4.09 \quad P \geq 0.05, \quad F = (1, 37) (0.05) = 4.10 \quad P \leq 0.05$$

Table III shows that the pretest mean of experimental and control groups are 30.24 and 29.17 respectively. The obtained F ratio of 1.14 for pretest mean is less than the table value 4.09 for df 1 and 38 required for significance at 0.05 level. The obtained F ratio of 22.56 for posttest mean is higher than the table value 4.09 for df 1 and 38 required for significance at 0.05 level. The adjusted posttest mean values of experimental and control groups are 33.92 and 29.86 respectively. The obtained F ratio of 32.14 for adjusted posttest mean is also higher than the required table value 4.10 for df 1 and 37 for significant 0.05 level. The result of the study indicated that there was a significant difference between the adjusted posttest mean of medium intensity resistance training group and control group on upper arm girth. The mean values of pre, post and adjust posttest of thigh girth, calf girth and upper arm girth are graphically presented in figure 1, 2 and 3.

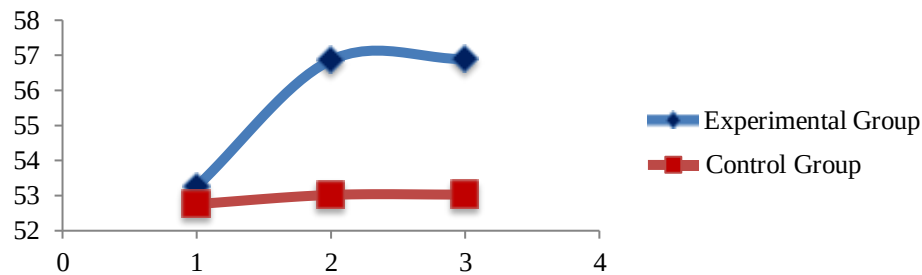


Figure 1: The pre, post and adjusted posttest mean values of experimental group and the control group on Thigh Girth

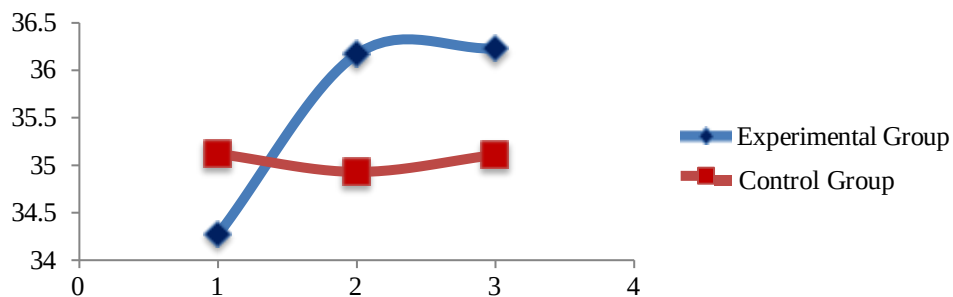


Figure 2: The pre, post and adjusted posttest mean values of experimental group and the control group on Calf Girth

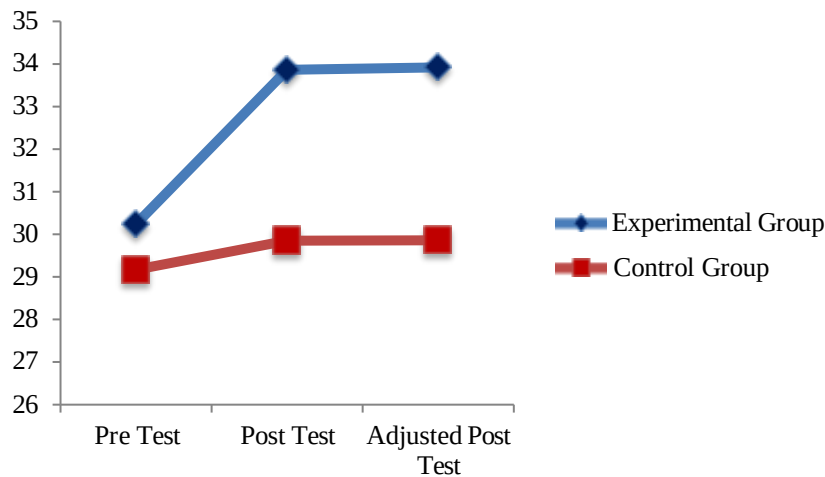


Figure 3: The pre, post and adjusted posttest mean values of experimental group and the control group on Upper Arm Girth

Discussion

The novel findings of the current study were that there are three crucial findings from our systematic assessment and network meta-analysis of the dose response dating among resistance training load and profits in muscle hypertrophy of amateur university college students. The beginners challenge greater resistance training sessions affords advanced muscle size gains in people with preceding schooling enjoy especially in thigh muscle tissue. The research finding of the Lopez et al. (2020) is supporting the have a look at effects. 2nd, consequences on muscle electricity are loaded based, with better masses resulting in greater gains over the tremendously quick interventions reviewed. Laseviciuset al. (2018) without a doubt defined that the resistance education allows booming the hypertrophy of the massive muscle mass. Eventually, the effects for muscle hypertrophy changed into maintained even when most effective the better high-quality research had been considered, that is, research with less risk of bias. Therefore, even though improvements in muscle hypertrophy seem to be load impartial for untrained individuals (Ashokan& Abraham, 2015 and Panackal& Abraham, 2015). Many look at results showed the same end result specifically the systematic resistance education gains the muscle size (Lim et al, 2019; Schoenfeld et al., 2016 and Burs et al., 2012).

This examine finding is that appearing as many repetitions as possible in line with set with distinctive masses over noticeably short interventions ends in similar muscle hypertrophy in individuals with none or slight resistance is training revel in. it seems that any training load can produce a similar value of muscle hypertrophy for extraordinary participants and muscle tissue assessed. As pronounced in preceding literature, educated muscular tissues might also already gift with an expanded move-sectional area (Sale, 1988 and Mcleod et al., 2024) and decrease anabolic signaling as discovered after a resistance training session (Coffey et al., 2006 and Sawan et al., 2023), ensuing in an attenuated hypertrophic response in individuals with previous resistance training revel in. but, our findings also imply greater muscle hypertrophy in recreationally educated contributors

who adopt a better quantity of periods in comparison with the ones mission much less. evidently members with longer revel in in resistance training (Schoenfeld et al., 2015 and Grgic et al., 2017), even though nevertheless not distinctly trained, require a better quantity of training to supply the same or extra hypertrophic model exhibiting the principle of diminishing returns.

Untrained individuals typically show greater initial muscle hypertrophy (growth in muscle length) as compared to people with prior schooling enjoy (Abraham, 2010). Because of the robust superb courting discovered among the muscle's capacity to generate force and their go-sectional region (CSA) (Maughan et al., 1983), hypertrophy is one of the primary dreams pursued by both expert and leisure athletes. Therefore, numerous studies have analyzed the outcomes of resistance training on hypertrophy and its next force level (Hornsby et al., 2018). Muscle hypertrophy diversifications may be received thru numerous resistance schooling packages (Lixandrão et al., 2015; Radaelli et al., 2015 and Fink et al., 2016). But, there's no properly-hooked up consensus on how resistance training variables ought to be manipulated to optimize muscle increase.

Many research studies revealed that the usage of training intensities elicits training variations and similarly it indicate that it is usually the unique variations in girth variables. John et al. (1996) and Faigenbaum et al. (1999) stated that resistance education is effective in improving the decrease body strength and length. Bidwell et al. (1996) and Lacio et al., 2021 pointed out that resistance training is quality for increasing the girth of muscular tissues. Teixeira et al. (2001) talked about that resistance training three times in line with week is as effective as 5 instances consistent with week.

From the results of the present study and literature, it is concluded that the dependent variable such as thigh muscle girth and upper arm girth was significantly improved due to the influence of medium intensity resistance training. However there was no significant improvement calf girth due to medium intensity resistance training.

Conclusion

The result of the study showed that, there was a significant improvement on thigh muscle girth and the upper arm girth between resistance training group and control group. However there was no significant difference on thigh girth and calf girth due to medium intensity resistance training. The repetition method to maximize muscle growth may be greater bendy than previously notion, with the primary variable of influence appearing to be training at large muscle mass. Given the current literature, eccentric and concentric repetition tempos can vary based totally on desire, as long as the whole repetition length is among 2 and 8 sets.

Outcome of this research have tried to in addition discover the idea of what constitutes appropriate resistance method for maximizing hypertrophy and the one of a kind perceptions as well as practices that exists amongst exercising professionals, physique sport athletes, and coaches. additionally, destiny research need to also without delay discover the impact of strict as opposed to extra 'lenient' workout strategies on hypertrophy, particularly specializing in whether or not the contribution of non-centered muscle agencies influences hypertrophy outcomes in physical games intended to target a selected muscle.

In precis, the present look at explored the resistance training dosage for muscle hypertrophy and power in wholesome young adults. This finding advocate that to sell muscle hypertrophy, various loads of resistance training can be undertaken, and one approach is to perform the exercise to the point of volitional failure. However, different strategies for maximizing recruitment of the motor unit pool perhaps as powerful, without the issues defined formerly regarding acting excessive numbers of repetitions with light masses. Hence it has been concluded that the medium intensity resistance training group has improved on thigh girth and the upper arm girth of newbie college male students when compared to control group.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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