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Short Communication

The Exhaustive Resistance Exercises with various Resistances increases the Local Strength of Youth Muscles

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Abstract

The purpose of the research was to survey effect of exhaustive resistance exercises with various resistances on local strength of youth muscles. The resistance exercises are very important in developing physical capacities of individuals. It is necessary to consider several variables including resistance rate and repetition of exercises and rest time between exercise bouts. The subjects was, 44 healthy male students with no history of resistance exercises with age range: 15-17 years (mean age: 16.1 years). Performing exhaustive resistance exercises with 55, 70 and 85% resistance of a maximum repetition significantly increased the strength of upper and lower extremity muscles of 15 to 17 year old male adolescents ($p<0.05$). The effect of exhaustive resistance exercises with 55, 70 and 85% resistance of a maximum repetition had a significant difference on strength of upper and lower extremity muscle strengths ($p<0.05$). Such exercises with 70% maximum repetition were more effective upon strength of upper and lower extremities. So, performing exercises with 70% resistance of maximum repetition for adolescents may be the best way to increase their muscle strength.

Keyword: Exhaustive resistance, local strength, youth muscles, 1 RM.

Introduction

Training is specific in terms of angle, range of motion and even velocity of contractions. Strength training programs can be designing to emphasize muscular strength, power, hypertrophy, or endurance. The resistance exercises are very important in developing physical capacities of individuals. It is necessary to consider several variables including resistance rate and repetition of exercises and rest time between exercise bouts[1-3].When designing strength training programs, many variables such as intensity, volume, frequency, repetition, velocity and rest between sets must be considered[4].

The amount of rest between sets has been considered an important factor that can be manipulated to fit the goal of a program. These factors significantly affect on the metabolic, hormonal and cardiovascular response to an acute bout during resistance exercise, as well as performance of subsequent sets. As resistance exercise schedules should be designed with specific aims and conditions in mind, regarding the conditions of growth phases seems to be necessary. Certainly, adolescence is one of the most important growth phases during life appearing with a peak of physiological and functional changes in the body [5, 6, 7]. However, lack of functional scientific resistance exercises specific to this period has obliged interested adolescents to follow the exercise schedules of adults[6,7].

Previous studies have indicated the important role of nervous system in increasing strength during initial steps of resistance exercises. Studies by some of authors performed on adults suggest exercise schedules with high resistance and low repetition to develop muscular strength[7-9]. And the results of some studies confirm the use of high resistance (6-8 maximum repetition)[10,11].

In studies by other authors which evaluate the effects of different exercise strength bars on muscular strength of youngsters, exercise with 13 to 15 maximum repetitions causing the highest level of change in increased muscular strength of youngsters has been proposed[10,11,12].

However, lack of required investigations on evaluation of the effect of resistance exercises with different bars on muscular strength of adolescents has challenged coaches with the probable of lack of adequate training programs[12,13]. So, the importance of comparison of different resistance exercises in adolescents to improve exercise designing is indicated.

Material and Methods

Subjects: The subjects were, 44 healthy male students with no history of resistance exercises with age range: 15-17 years (mean age: 16.1 years). Individual characteristics were health history and they complete physical activity questionnaire and Anthropometric parameters.

Protocol: The subjects randomly divided into four groups based on the strength of upper extremity and lower extremity: i. Three

experimental groups (N=11 for each group) and ii. control group (N=11)[14,15]. Also, one repetition maximum test (1RM) consideration as: 1RMax= Resistance (kg) / [1-0.02× Repetition] and Exercise training consideration as Resistance training include; chest press and squat press. In addition, duration of weight training was Eight weeks that frequency was three days per week. Duration of session was 45-60 minutes[15]. In extremity, Intensity was 55, 70 and 85% of one repetition maximum until to exhaustion[15].

Statistic analyze: The results were presented as means ($\bar{X}$) and standard deviation (SD). Method of data gathering include that after of gathering unprepared data, initially used from Kolmogorov-Smirnov Test for survey hypnosis of normality in each phase , then used from descriptive statistic for regulation of data and determination of central tendency, measure of variation and graph-drawing. Also, for inferential statistics, used from ANOVA, F test and repeated measure test[16,17]. Also for performance of data analyze, used from some software such as SPSS (V18) and excel (V2007). Statistical significance was accepted at $p < 0/05$.

Results and Discussion

Table-1 show means for age, weight, height and BMI. Performing exhaustive resistance exercises with 55, 70 and 85% of one maximum repetition (1RM) significantly increase the strength of upper and lower extremity muscles in 15 to 17 year old male adolescents ($p<0.05$). The effect of exhaustive resistance exercises with 55, 70 and 85% of one maximum repetition (1RM) had a significant difference on strength of upper and lower extremity muscle strengths ($p<0.05$). Performing exhaustive resistance exercises with 55, 70 and 85% resistance of one maximum repetition (1RM) significantly increase the strength of upper and lower extremity muscles in 15 to 17 year old male adolescents ($p<0.05$). The effect of exhaustive resistance exercises with 55, 70 and 85% resistance of a maximum repetition had a significant difference on strength of upper and lower extremity muscle strengths ($p<0.05$). Such exercises with 70% maximum repetition were more effective upon strength of upper and lower extremities. So, performing exercises with 70% resistance of maximum repetition for adolescents may be best way to increase their muscle strength.

The results demonstrated that as the rest interval between sets increased, the total number of repetitions completed also increased. There was not a significant difference in the squat volume completed between the 1- and 2-minute rest conditions. When lifting a sub maximal amount of resistance, the slow and fast-twitch muscle fibers are recruited but at first the slow-twitch muscle fibers exert force and when the slow-twitch muscle fibers become progressively fatigued, the fast-twitch muscle fibers continue to produce sufficient force. Finally, when all available muscle fibers are fatigued and cannot produce sufficient force, the set is ended. When considering the rest interval between sets, slow twitch muscle fibers would require shorter recovery due to their oxidative characteristics, whereas fast twitch muscle fibers would require longer recovery due to their glycolytic characteristics.

Based on the results of performed research, doing resistance exercises with average resistance (resistance amounting to 70% of maximum repetition) has the highest effect upon muscle strength of male adolescents compared to other percentages that supporting by some of studies, in which they recognized on medium resistance exercises as the most effective way to develop strength [18-21]. But it is not consistent with other studies that indicating high resistance exercises as best way to develop muscle strength[22-25]. As observed in results, there was no significant difference between high and low resistance exercises, and it seems that performing medium resistance exercises can develop muscle strength by causing better neuromuscular coordination.

Conclusion

The squat is a common exercise prescribed in strength training programs. When designing strength training programs, the amount of rest prescribed between sets is likely dependent on the goal, the training status of the individual, and the load being lifted. This study demonstrated that a 3-minute rest interval between sets allowed for the highest volume to be completed when training with 85% of a 1RM load. The ability to perform a higher volume of training with a given load may stimulate greater strength adaptations. A limitation of the current study was that gains in strength were not measured and subjects were not separated into groups designated by different rest intervals. Future research should continue to examine changes in muscular strength, dependent on differences in the rest interval between sets. As doing high resistance exercises may only increase likelihood of injury and has not been superior to other methods used in this research, we suggest that adolescents do lower percent resistance exercises with similar rest intervals and resistance loads that better effect upon strength development instead of near maximum resistance exercises.

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Table-1

Means for age, weight, height and body mass index (BMI) in experimental groups (different in one repeated maximum or 1RM) and control group

variables	Group(s)			
	1RM × (55%)	**1RM × (70%)**	**1RM × (85%)**	**Control**
N	11	11	11	11
Age (year)	16.36	16	15.81	16.36
Weight (Kg)	66.02	65.87	59.37	61.24
Height (cm)	176.36	174	170.09	170.54
BMI (Kg/M^2)	20.76	21.53	20.35	20.64

Table-2
Analysis of variance (within groups) of upper extremity muscle strength

Factor(s)	Group (s)	Session (s)				One-way ANOVA	
		1	12	18	24		
		M±SD	M±SD	M±SD	M±SD	F	P
Upper extremity strength (Kg)	1RM × (55%)	42.5±15.1	49.0±16	52.2±16	54.7±17	146.1	0.0*
	1RM × (70%)	43.4±13	53.4±14	59.0±15	63.6±15	129.7	0.0*
	1RM× (85%)	41.4±14	47.5±14	50.9±13	52.9±14	111.5	0.0*
	control	43.4±12	43.6±13	43.1±13	44.0±13	0.1	0.9

*The mean difference is significant at level of $p < 0.05$

Table-3
Amount of variance analysis (F) and significant differences (P) of upper extremity muscle strength (between groups)

Factor(s)	Group (s)	Session (s)			
		1	12	18	24
		M±SD	M±SD	M±SD	M±SD
Upper extremity strength (Kg)	1RM × (55%)	42.5±15.12	49.0±16.0	52.2±15.9	54.7±17.3
	1RM × (70%)	43.4±12.9	53.4±13.7	59.0±14.9	63.6±15.3
	1RM × (85%)	41.4±13.7	47.5±13.6	50.9±13.3	52.9±13.9
	control	43.4±11.9	43.6±12.6	43.1±13.5	44.0±12.7
One-way ANOVA	F	0.057	0.910	2.229	3.175
	P	0.982	0.445	0.10	0.034*

*The mean difference is significant at level of $p < 0.05$

Table-4
Analysis of variance (within groups) of Lower extremity muscle strength

Factor(s)	Group (s)	Session (s)				One-way ANOVA	
		1	12	18	24		
		M±SD	M±SD	M±SD	M±SD	F	P
Lower extremity strength (Kg)	1RM × (55%)	50.9±11.5	57.0±11.9	60.4±12.6	63.4±12.3	118.7	0.0*
	1RM × (70%)	48.6±11.4	58.4±10.5	64.5±9.4	70.0±9.9	114.2	0.0*
	1RM× (85%)	48.9±10.9	54.0±10.3	57.2±10.6	60.2±11.8	143.7	0.0*
	control	46.8±10.7	47.2±11.7	47.5±12.8	47.7±11.6	0.1	0.98*

*The mean difference is significant at level of $p < 0.05$

Table-5
Amount of variance analysis (F) and significant differences (P) of lower extremity muscle strength (between groups)

Factor(s)	Group (s)	Session (s)			
		1	12	18	24
		M±SD	M±SD	M±SD	M±SD
Lower extremity strength (Kg)	1RM × (55%)	50.9±11.5	57.0±11.9	60.4±12.6	63.4±12.3
	1RM × (70%)	48.6±11.4	58.4±10.5	64.5±9.4	70.0±9.9
	1RM × (85%)	48.9±10.9	54.0±10.3	57.2±10.6	60.2±11.8
	control	46.8±10.7	47.2±11.7	47.5±12.8	47.7±11.6
One-way ANOVA	F	0.247	2.161	4.392	7.257
	P	0.863	0.108	0.009*	0.001*

*The mean difference is significant at level of $p < 0.05$