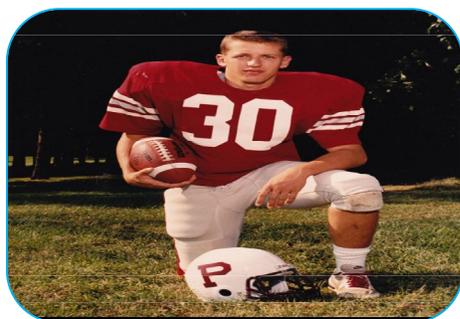




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THE EFFECTS OF RESISTANCE TRAINING ON STRENGTH ENDURANCE AMONG PRE-PUBESCENT, PUBESCENT AND POST-PUBESCENT MALES

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ABSTRACT:

The purpose of the study was to find out the effect of resistance training on strength endurance among pre-pubescent, pubescent and post-pubescent males. To achieve this purpose fifteen (n = 15) male pre-pubescent fifteen (n = 15) male, pubescent and fifteen (n = 15) male and post-pubescent males were randomly selected as subjects for this study (N = 45) from Sri Ramakrishna Higher Secondary School, Chidambaram, Tamil Nadu, India. The selected subjects were assigned as Group I pre-pubescent, Group II

pubescent and Group III post pubescent respectively. All the three groups underwent strength training. The selected criterion variable namely strength endurance was assessed one minute sit up before and after the training period. The collected data from the three groups were statistically analysed by using two way (3 × 2) factorial ANOVA with last factor repeated measures. Whenever the obtained 'F' ratio for interaction effect was found to be significant, the simple effect test was used as a follow up test. To find out significant difference for the paired mean difference Scheffe's test was used whenever it is required. Resistance training improves the strength endurance of post pubescent and pubescent male when compared with pre pubescent male. When comparing the improvement post pubescent group have better effect on strength endurance than pubescent group.

KEYWORDS: Resistance training, Strength endurance, Prepubescent, Pubescent and Post pubescent.

INTRODUCTION:

Physical activity is an important contributor to the physical and psychological development and to the future health status in children and adolescents (Smith et al 2014). Resistance training consists of a variety of resistive loads that are introduced in a progressive manner to improve muscular strength and athletic performance (Faigenbaum et

al 2009). The incorporation of muscle strengthening activities, subsequently referred to as resistance training (RT), is only addressed briefly even though poor muscle strength has been associated with increased cardiovascular disease risk in adolescents as well as lower participation in sports and recreational activities (Hondt et al 2013). The participation of boys in resistance training programs leads to a positive influence on their fitness that results in an increase in sport performance and offers protection from sports

injuries (Kraemer & Fleck, 1993). Resistance training in young boys also improves quality of life and contributes to positive attitude toward illness and exercise (Shephard, 1984). One of the most important characteristics of resistance exercise programs for children must be safety. Emphasis should be placed on proper technique and sessions should be supervised by a qualified instructor. Exercise intensity and interval between exercises should be chosen according to the maturation level of the young athlete, but maximal loading

should be avoided (Bases, 2004). Although generally it is believed that there is a direct linear relationship between the training intensity and the magnitude of strength change, limited data suggest that children and older populations may respond differently to resistance training protocols (Fleck & Kraemer 1997). However, no controlled, prospective trial comparing different resistance training protocols on muscular strength and endurance development in children has been reported, nor has the minimal training intensity for children been established. Although it has been recommended that children should perform at least 1 set of 6 to 15 repetitions on a variety of upper and lower body exercises 2 to 3 days per week, more specific information regarding the most effective resistance training protocol for children would be useful to physical educators, physical therapists, and pediatricians. Therefore, the purpose of this study was to effect of resistance training on strength endurance among different age group school boys.

METHODOLOGY

The purpose of the study was to analyze the effects of resistance training on selected strength endurance variable among pre-pubescent, pubescent and post-pubescent male all the three groups underwent resistance training. For this purpose, forty-five male students were selected at random as subjects. The selected subjects were randomly assigned into three groups of fifteen each. The group-I was pre-pubescent, group-II was pubescent and group-III was post-pubescent for the duration of 12 week training for three day per week. During the training period, the three experimental (pre-pubescent, pubescent and post-pubescent males) groups underwent their respective resistance-training programme, three days per week for twelve weeks in addition to their regular curriculum activities. Every day the workout lasted for about 45 to 60 minutes including warm-up and cool down exercise. The subjects underwent their respective programme under strict supervision. The training was performed between 5.00 PM and 6.30 PM. All the subjects involved in the training programme were enquired about their state throughout the training period. None of them reported injuries, however, muscle sourness was reported in the early weeks by pre pubescent and pubescent but subsided later. On the basis of the pilot study, the initial load and their further progression was fixed for this study, which has been explained in load dynamics. The collected data from the three groups were statistically analysed by using two way (3×2) factorial ANOVA with last factor repeated measures. Whenever the obtained 'F' ratio for interaction effect was found to be significant, the simple effect test was used as a follow up test. To find out significant difference for the paired mean difference Scheffe's test was used whenever it is required. To find out which group responded better for resistance training the mean gains were computed between pre and post test means for the three groups and were tested for significance by applying one way ANOVA followed by Scheffe's test where ever required.

RESULT OF STUDY

Table - I
THE PRE AND POST TEST MEAN AND STANDARD DEVIATION ON STRENGTH ENDURANCE OF PRE PUBESENT, PUBESENT AND POST PUBESENT GROUPS

Groups		Pre Test	Post Test
Pre-pubescent	Mean	19.53	22.86
	SD	2.8	2.41
Pubescent	Mean	27.40	34.80
	SD	1.12	1.89
Post-pubescent	Mean	34.13	44.60
	SD	5.93	5.74

(Strength Endurance scores are expressed in count).

The table indicated pre and post test mean and standard deviation of strength endurance for pre-pubescent, pubescent and post-pubescent groups 19.53 ± 2.8 , 22.86 ± 2.41 , 27.40 ± 1.12 , 34.80 ± 1.89 , 34.13 ± 5.93 and 44.60 ± 5.74 respectively. Two way anova was applied to find out any significant

difference if any an strength endurance among the pre-pubescent, pubescent and post-pubescent groups before the commencement of the training after completion of training and their interaction.

Table-II
TWO FACTOR ANOVA ON strength ENDURANCE OF PRE PUBESCENT, PUBESCENT AND POST PUBESCENT GROUPS

Source of Variance	Sum of Squares	df	Mean Squares	Obtained "F" Ratio
A Factor (Groups)	4963.76	2	2481.88	91.08*
Group Error	1144.46	42	27.25	
B Factor (Tests)	1123.6	1	1123.6	1170.42*
AB Factor (Interaction) (Groups and Tests)	192.07	2	96.03	100.03*
Error	40.33	42	0.96	

(Table values required for significance at .05 levels for df 2 and 42, 1 and 42 & 2 and 42 are 3.22, 4.07 and 3.22 respectively).

The obtained 'F' ratio for Factor A (Groups) is 91.08, which is greater than the table value of 3.22 with df 2 and 42 required for significance at .05 level of confidence. The result of the study indicates that, significant differences exist among pre-pubescent, pubescent and post-pubescent groups on strength endurance irrespective of testing. The obtained 'F' ratio for Factor B (Different stages of Tests) is 1170.42, which is greater than the table value of 4.07 with df 1 and 42 required for significance at .05 level of confidence. The result of the study indicates that strength endurance level differ significantly between pre and post testing irrespective of groups. The obtained 'F' ratio value of interaction (Groups \times Different Tests) is 100.03, which is greater than the table value of 3.22 with df 2 and 42 required for significance at .05 level of confidence. The result of the study shows that significant difference exists among groups and tests on strength endurance. Since the interaction effect is significant, the simple effect test has been applied as follow up test and the results are presented in table II.

Table-III
THE SIMPLE EFFECT SCORES OF GROUPS (ROWS) AT DIFFERENT STAGES OF TESTS (COLUMNS) ON strength ENDURANCE

Source of Variance	Sum of Squares	df	Mean Squares	Obtained "F" Ratio
Groups at Pre test	1601.9111	2	800.9556	56.91*
Groups at Post test	3553.9111	2	1776.9556	125.7*
Tests and Group I	83.3333	1	83.3333	14.45*
Tests and Group II	410.7	1	410.7	169.11*
Tests and Group III	821.6333	1	821.6333	24.08*
Error	40.33	42	0.96	

(Table values required for significance at .05 levels for df 2 and 42, & 1 and 42 are 3.22 and 4.07 respectively.)

The obtained 'F' ratio for groups on pre test and post tests are 56.91 and 125.7 respectively that are higher than the table value of 3.22 with df 2 and 42 required for significance at .05 level of confidence. The result of the study indicates there was significant difference on the strength endurance among the three groups before commencement of resistance training and also after completion of resistance training.

The obtained 'F' ratio for pre-pubescent, pubescent and post-pubescent groups between pre and post were 14.45, 169.11 and 24.08 respectively which are higher than the table value of 4.07 with df 1 and 42 required for significance at .05 level of confidence. The result of the study indicates that there is significant differences between pre and post test mean of pre-pubescent, pubescent and post-pubescent groupson strength endurance.

Table-IV
Paired pre test MEAN DIFFERENCES ON strengthENDURANCE among PRE PUBESCENT, PUBESCENT AND POST PUBESCENT GROUPS

Pre-Pubescent	Pubescent	Post pubescent	Mean difference	Confidence interval
19.53	27.40		7.84*	0.88
19.53		34.13	14.60*	0.88
	27.40	34.13	6.73*	0.88

*Significant at 0.05 level of confidence interval is 0.88.

Table-IV clearly indicated that pre test, paired mean difference between that pre-pubescent and pubescent. pre-pubescent and post pubescent and pubescent and post pubescent are 7.87, 14.60 and 6.73 respectively on strength endurance which are higher than the confidence interval value of 0.88 at 0.05 level of confidence.

TABLE-V
Paired post test MEAN DIFFERENCES on strengthENDURANCE among PRE PUBESCENT, PUBESCENT AND POST PUBESCENT GROUPS

Pre-Pubescent	Pubescent	Post pubescent	Mean difference	Confidence interval
22.86	34.80		11.94*	0.88
22.86		44.60	21.74*	0.88
	34.80	44.60	9.80*	0.88

*Significant at 0.05 level of confidence interval is 0.88.

Table V clearly indicated that post test, paired mean difference between pre-pubescent and pubescent. pre-pubescent and post pubescent and pubescent and post pubescent are 11.94, 21.74 and 9.80 respectively on strength endurance, which are greater than the confidence interval value of 0.88 at 0.05 level of confidence.

DISCUSSION OF THE STUDY

The results of resistance training on strength endurance significantly favorpost pubescent and pubescent groups when compared with pre pubescent group. Among these two groups, post pubescent has better effect in improving strength endurance than pubescent. Hence, it is concluded that resistance training improves strength endurance of post pubescent male.Pre-pubescent, pubescent and post pubescent male underwent a 12 week resistance training program. All three groups had significant strength endurance gain and Pre-pubescent strength gains are accomplished largely without any change in muscle size. **Faigenbaum and Mediate (2006)** suggested medicine ball training for muscular endurance and power. **Zakaset al. (2006)** suggest that the specific cycle training protocol improves muscular strength and local muscular endurance in pubescent and post-pubescent untrained male. **Faigenbaumet al. (1999)** conclude that muscular strength and muscular endurance can be improved during the childhood and favour the prescription of higher repetition moderate load resistance training programs during the initial adaptation period. **Nassis (2005)** recommends that pre-pubertal children should do several sets of multiple repetitions and avoid maximum lifts of ballistic maneuvers. Even

pre-pubescent children can improve their strength, but strength gain is greater after puberty. **Ignjatovic et al. (2007)** conclude that strength-training program has positive effect on maximal isometric muscle force and motor skill. The increase is due to the combined influence of strength training and growth. The improvements in muscular endurance in the present study support the observations of **Ramsay et al (1990)** who reported increases in muscular endurance in children who participated in a 20-week progressive resistance training program. Our finding that higher repetition-moderate load training enhanced lower body muscular endurance more so than low repetition-heavy load training is consistent with findings from previous studies on adults (**Moritani & Others 1979**). In adult populations, however, resistance training programs that are designed to increase strength are not typically as effective in increasing muscular endurance. **Fleck & Kraemer (1997)** the present data demonstrate that in the short term, one form of training (eg, high repetition-moderate load) may be equally effective in enhancing the muscular strength and muscular endurance of untrained children. Thus, it appears that the relationship between training stimulus and response may vary in children versus and older populations.

CONCLUSION

Resistance training improves the strength endurance of post pubescent and pubescent male when compared with pre pubescent male. When comparing the improvement post pubescent group have better effect on strength endurance than pubescent group.

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