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Original Research Article

Effect of Different Neuromucular Training on Muscular Endurance of Junior Athletes

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Abstract

Objectives: This study aimed to investigate the effect of different neuromuscular training on muscular endurance of junior athletes. ***Methods:*** The experimental study enrolled 60 junior athletes' who taking part in the school level zone athletic competitions from Sakthi Higher Secondary School, Erode Tamilnadu. The age ranged between twelve and thirteen years, which were selected to carry out the research. The subjects who met the inclusion criteria were selected using random sampling and divided into three intervention groups and a control group. The test items used to collect the muscular endurance tested by modified it ups test and performance recorded in counts. The 12 weeks of stipulated training was provided to the participants for the period of 60-minute sessions for the three alternative days in a week. ***Statistical Procedure****:* To process the results of the study, analysis of the data was done with the IBM SPSS Statistics 22 software. The statistics obtained were provided by way analysis of co variance. The level of confidence was fixed at 95% and values below $p<0.05$ were considered significant. ***Results****:* The one-way analysis of co variance showed a significant ($p<0.05$) improvement in muscular endurance over the 12 weeks of stipulated training. ***Conclusion:*** The results indicate considerable significant improvement on muscular endurance was observed. The findings indicate that the selected training regimes led to significant improvement on agility.

Keywords: Plyometric, Resistance band, Jump rope, Muscular endurance, Ancova.

INTRODUCTION

Neuromuscular training, as a training program that incorporates general (e.g., fundamental movements) and specific (e.g., sport-specific movements) strength and conditioning activities, Neuromuscular training is a multimodal form of training that uses resistance exercises, dynamic stability, core exercises, and plyometric and agility training performed in short intervals with intermittent periods of rest. The word plyometrics is actually a derivation from the Greek words plyo, which means to increase and metric, which means to measure. Consequently, the purpose of plyometrics may be thought of as "to increase the measurement." Typically, the measurement is sports performance outcomes demonstrated in testing or competition such as throwing, serving velocity, jump height or sprint speed. Jump rope training is a form of training to improve both lower and upper extremities. Today, rope jumping is often featured prominently as part of sports training and fitness programs because it has proven itself as a valuable technique that provides a wide range of benefits and competitive advantages.

METHODOLOGY

The experimental study enrolled 60 junior athletes' who taking part in the school level zone athletic competitions from Sakthi Higher Secondary School, Erode Tamilnadu. The age ranged between twelve and thirteen years, which were selected to carry out the research. The subjects who met the inclusion criteria were selected using random sampling and divided into three intervention groups and a control group. The test items used to collect the muscular endurance tested by modified sit-ups test and performance recorded in counts. The 12 weeks of stipulated training was provided to the participants for the period of 60-minute sessions for the three alternative days in a week. During the training period athletes not reported any injury. The basic training load was fixed based on the performance of pilot study. The progression of the load were raised in once in four weeks during the 12 weeks of training period.

Table-1: The End Results of Analysis of Covariance on Muscular Endurance of Experimental and Control Group (Scores in Counts)

Test	SAQ	RBT	PT	CG	SV	SS	Df	MS	'F' Ratio	p value
Pre Test										
Mean	17.73	17.86	17.93	17.86	Between	0.31	3	0.11	0.189	0.91
S.D.	0.88	0.83	0.70	0.51	Within	31.33	56	0.56		
Post Test										
Mean	24.6	20.93	25.13	17.26	Between	601.7	3	200.5	445.76*	0.00
S.D.	0.63	0.7	0.74	0.59	Within	25.2	36	0.45		
Adjusted Post Test										
Mean	24.61	20.93	25.12	17.26	Between	602.03	3	200.67	442.8*	0.00
					Within	24.92	55	0.45		

(Table F Value for significant at 0.05 level with df 3 and 55 is 2.77)

The pre-test means of muscular endurance were 17.73 and SD 0.88 for speed agility and quickness training, 17.86 and SD 0.83 for resistance band training, 17.93 and SD 0.70 for plyometric training and 17.86 and SD 0.51 for control group. The obtained F ratio 0.189 was lesser than the table F ratio 2.77 .Hence the pre-test was not significant at 0.05 level of confidence for the degrees of freedom 3 and 55. The post-test means of muscular endurance were 24.6 and SD 0.63for speed agility and quickness training, 20.93 and SD 0.7 for resistance band training, 25.13 and SD 0.74 for plyometric training and 17.26 and SD 0.59 for control group. The obtained F ratio 445.76 was higher than the table F ratio 2.77 Hence the pot-test was significant at 0.05 level of confidence for the degrees of freedom 3 and 55. The adjusted post-test means of muscular endurance were 24.61 for speed agility and quickness training, 20.93 for resistance band training, 25,12 for plyometric training and 17.26 for control group. The obtained F ratio 442.8 was higher than the table F ratio 2.77 Hence the adjusted pot-test was significant at 0.05 level of confidence for the degrees of freedom 3 and 55. The results has clearly proved that there was a significant difference noticed among the experimental groups. To observe the superiority effect among the training group the bonferroni multiple pair wise test was observed.

Table-2: Bonferroni Pair Wise Multiple Comparison on Muscular Endurance Among the Experimental and Control Group

SAQ	RBT	PT	CG	Mean Differences	P value
24.61	20.93	-	-	3.67*	0.00
24.61	-	25.12	-	0.52	0.251
24.61	-	-	17.26	7.34*	0.00
-	20.93	25.12	-	4.19*	0.00
-	20.93	-	17.26	3.66*	0.00
-	-	25.12	17.26	7.86*	0.00

Significant Comparisons

1) The speed agility and quickness training and resistance band training.
2) The speed agility and quickness training and control group.
3) The resistance band training and plyometric training.
4) The resistance band training and control group.
5) The plyometric training and control croup.

Similar Effect

The mean differences values of above comparisons were 3.67 7.34, 4.19, 3.66, and 7.86 respectively, which is lesser than the p values of 0.05 level of confidence. Hence the above all comparisons were show the significant different improvement of muscular endurance. Further no difference was observed the comparison of the speed agility and quickness training and plyometric training.

DISCUSSION OF FINDINGS

The Twelve weeks of speed agility and quickness training (SAQ), resistance band training (RBT), plyometric training (PT) resulted in greater improvements in muscular endurance compared to the control group. The following studies in line with the current studies. Lourdu Raj, Maniazhagu Dharuman (2022), their study aims to investigate the effects of concurrent strength and endurance training on the power of junior athletes. The results indicated that both experimental groups showed greater improvement in power compared to the control group. Cincy B Christopher, Urvashi Tiwari, D. Maniazhagu (2025), their study intend to analyze the effect of concurrent neuromuscular training combined with football practice on speed performance among 45 school boys aged 11–12 years from Alagappa Physical Fitness Academy, Karaikudi. Overall, the study effectively demonstrated the impact of training timing on speed development in young football players. Malar Ss, Maniazhagu Dharuman (2019), They attempt to evaluate the effects of two combinations of neuromuscular drills and asana practices on speed performance among 30 school boys aged 10–13 years from Alagappa Fitness Foundation, Karaikudi. Overall, the study confirmed that combined neuromuscular and asana training effectively enhances speed performance in school boys. S. Balaganesh, Maniazhagu Dharuman (2024), they endeavour to study the effect of concurrent neuromuscular training combined with football practice on cardiorespiratory endurance among school boys. The level of significance was set at 0.05 to test the hypotheses. Maniazhagu Dharuman, Soniya James, Malar Ss (2018), they set out to investigate the effects of asana practices and stretching exercises combined with neuromuscular drills on cardiorespiratory endurance among school girls. The findings revealed improvements in both experimental groups, with a greater increase in the AP-NMD group. Overall, asana practice combined with neuromuscular drills proved more effective in enhancing cardiorespiratory endurance than stretching exercises and control conditions. Maria SA *et al.,* (2025), they focus on examining the effects of jump rope training on cardiovascular capacity and muscular strength among university students. The findings indicate that incorporating jump rope training effectively enhances both cardiovascular efficiency and muscular strength in young adults. Zhou, Q *et al.,* (2025), their study work to analyze the biomechanical effects of cycle-tempo variations on motor control in elite jump rope athletes. Overall, the findings highlight significant motor control adaptations with increased jump rope tempo, providing valuable insights for optimizing training efficiency and performance. Nanda Eriko Pratama *et al.,* (2018), their study aimed to examine the effects of ladder drills and jump rope exercises on speed, agility, and lower limb muscle power. The results showed that both training methods significantly improved speed, agility, and muscle power compared to the control group. Ladder drills were more effective in improving speed and agility, while jump rope training showed greater improvement in lower limb muscle power. Overall, both training methods positively influenced physical performance variables. Trecroci A, Cavaggioni L, Caccia R, Alberti G (2015), they undertake to explore the effects of incorporating jumping rope exercises on motor abilities and body balance in preadolescent soccer players. Overall, jumping rope training was found to enhance coordination, balance, and general motor skills in young soccer players, supporting its inclusion in regular training programs. Lorke, N *et al.,* (2022), their study conducts an analysis of the biomechanical characteristics of speed rope skipping with a focus on the contributions of the upper and lower limbs to overall performance in 23 rope skippers. Results showed highly consistent lower-limb movement patterns across participants, whereas upper-limb handle trajectories varied in shape and symmetry depending on performance level. Notably, turning performance showed a strong and significant correlation with overall skipping ability, unlike jumping performance. These findings suggest that rope skipping performance is primarily constrained by upper-limb function, with lower-limb actions adapting to maintain rhythmic stability and coordination. Si X, Liu Y, Feng X & Feng S (2025), their study pursue an investigation into the effects of Speed, Agility, and Quickness (SAQ) training on agility performance in collegiate Sanda athletes, compared with traditional agility training. Notably, large effect sizes were observed in key tests such as the Illinois Agility Test and sport-specific combinations, indicating strong practical significance. Overall, the findings suggest that SAQ training is more effective than traditional methods in enhancing agility performance among collegiate Sanda athletes, supporting its integration into specialized training programs. Chen, C.F, & Wu, H.-J. (2022), their purpose of this study was to explore the utility of an 8-week rope skipping intervention in enhancing standing long jump performance was assessed by means of specific kinematic parameters acquired by 3-D space photography. Based on the results, the velocity of the center of gravity at take-off and landing were significantly improved. In addition, the study confirmed the requirement for forward tilt of the hip joint at landing to increase the velocity of the center of gravity and hence long jump distance. The detailed kinematic analysis described here provided further evidence of the benefits of integrating non-specialized and specialized training activities to enhance athletic performance and offers a contribution to movement theory and practice. Deng L *et al.,* (2024), they quasi-experimental study examined the effects of a 10-week fancy rope skipping intervention on motor coordination and selective attention in 7–9-year-old children. Overall, the findings suggest that structured fancy rope-skipping can effectively enhance both motor coordination and selective attention accuracy in children aged 7-9 years. Barrio E *et al.,* (2023), their systematic review explored how modifying moderator variables within jump rope training (JRT) programs influences health and physical fitness outcomes in school-age participants. Using a comprehensive search across PubMed, Web of Science, and Scopus, eight eligible studies were analyzed and mapped through an evidence-gap framework. The findings revealed that both health- and fitness-related outcomes were moderately represented, though overall research remains limited. Importantly, variables such as rope weight, type of jump, total jump volume, and post-exercise recovery strategies were identified as key factors influencing training effectiveness. The study highlights that strategic manipulation of these variables can optimize JRT outcomes, while also emphasizing the need for further research to address existing gaps in evidence. Wei B, Cheng W & Qiu J (2025), their study be designed to examine the effects of high-intensity intermittent rope skipping (HIIRS) on soccer-specific speed and power in elite players over a 12-week training period. These findings highlight the value of integrating high-intensity rope skipping into soccer training to optimize neuromuscular adaptations and overall speed development.

CONCLUSIONS

1) Twelve weeks of speed agility quickness training (SAQ), resistance band training (RBT) plyometric training (PT) resulted in greater improvements in muscular endurance compared to the control group.
2) Among the three experimental groups, plyometric training (PT), produced the greatest improvement in muscular endurance, outperforming both speed agility quickness training resistance band training (SAQ) and band training (RBT).
3) The speed agility quickness training (SAQ) showed significantly greater improvement than the resistance band training (RBT) group.
4) The least improvement among the experimental groups was observed in the resistance band training (RBT) group.
5) The control group showed no improvement in muscular endurance among junior athletes.

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