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Influence of resistance training on explosive strength: A longitudinal study

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Abstract
Study Aim: The aim of this study was to find out the influence of resistance training on explosive strength.
Materials and Methods: A quasi-experimental study was conducted on sixty, boys (age 18-30 years) from the East Bengal Football Club, Kolkata, India. All the subjects were informed about the objectives and protocol of the study. Subjects with history of any infective or respiratory ailment condition were excluded from the study. The participants participated in the study voluntarily. The Physical fitness variable (*viz*., Explosive Strength) was selected for the purpose the study.
Statistical Analysis: The normality of data was checked by using the Shapiro-Wilk test of normality. A descriptive analysis was used to describe the data distribution. The Paired-Samples t-test test was included in the present study. The statistical techniques were used to analyze the data on Statistical Package for Social Science (SPSS) version 26.0. The level of significance was set at 0.05.
Results: A paired samples t-test was conducted to compare experimental (pre-test) and experimental (post-test) on the variable, "Explosive Strength". There were significant differences (p<0.0001) in scores for experimental (Pre-Test) (M=2.6077, SD= 0.04516) and experimental (Post-Test) (M=2.6397, SD=0.05792). The magnitude of the differences in the means (mean difference=0.03200, 95% CI of difference: 0.02413 to 0.03987) was significant.

Keywords: Resistance training, explosive strength, physical fitness

Introduction
Resistance training has several positive effects on performance and indices [1, 2]. In fact, Liu, *et al*. [3] found participating in resistance training as little as once per week, for less than one hour, was associated with a 40-70% reduced risk of cardiovascular disease (p<0.05). Furthermore, resistance training has been linked to improvements in blood pressure [4], bone density [5], and glucose metabolism [6]. Outcome measures in resistance training studies typically include muscular hypertrophy, strength, endurance, and power. For the purpose of this literature review, hypertrophy is defined as an increase in muscle size [7]. Greater training volume may be associated with promoting an anabolic environment for muscle growth by increasing anabolic hormones, protein synthesis, and fast-twitch fiber activation [8]. Bottaro, *et al*. [9] studied the effects of training volume on upper and lower body muscular strength and hypertrophy.

Materials and Methods
Participants
A quasi-experimental study was conducted on sixty, boys (age 18-30 years) from the East Bengal Football Club, Kolkata, India. All the subjects were informed about the objectives and protocol of the study. Subjects with history of any infective or respiratory ailment condition were excluded from the study. The participants participated in the study voluntarily. The informed consent of participants was not conducted or granted in this study because all participants' privacy and personal identity information were maintained. The study protocol was conducted at East Bengal Football Club, Kolkata. The subjects were purposively divided into two groups:
Group-A: Resistance training
(N_1=30)

Group-B: Control
(N_2=30)

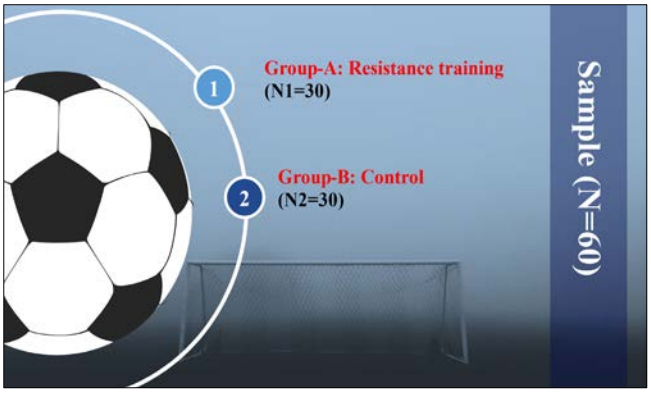

Fig 1: Selection and distribution of subjects.

Table 1: Distribution of respondents in terms of age, height and weight.

Variables	Sample Size (N=60)		
	Total (N=60)	Experimental (N_1=30)	Control (N_2=30)
Age	24.366±3.844	23.933±3.990	24.8±3.708
Height	174.03±7.924	176.566±8.741	171.502±6.173
Weight	71.433±6.641	73.3±6.742	69.566±6.089

The table shows the distribution of the respondents according to their age, height and weight. The mean and standard deviation of age, height, and weight of the respondents are (24.366±3.844), (174.03±7.924) and (71.433±6.641), respectively. Concerning the experimental group, the respondents' respective means and standard deviations are (23.933±3.990), (176.566±8.741) and (73.3±6.742), In contrast, the means and standard deviations of the respondents in the control group are (24.8±3.708), (171.502±6.173), and (69.566±6.089). The Physical fitness variable (*viz.*, Explosive Strength) was selected for the purpose the study.

Fig 2: Selection of tool.

Research Design
All training (*viz.*, Two months) and testing were performed at the same time of day to minimize the effects of diurnal contamination. Prior to training, data and testing all subjects were fully familiarized with training methodologies and testing procedures to minimize learning effects. During the experimental period, all subjects refrained from participation in additional exercise that was not related to the experiment.

Sampling Technique
Purposive sampling technique also known as judgment, selective or subjective sampling method and occurs when "the items selected for the sample are chosen at the discretion of the researcher. Researchers often believe that they can obtain a representative sample through reliable estimation, which saves time and money." were used to select specific group of individuals (Black, K., 2010), (*viz.*, experimental (N_1=30) and control (N_2=30) from the East Bengal Football Club, Kolkata, India. for analysis.

Ethical Considerations
There were some ethical issues in the current study. The researcher considered the following guidelines when collecting and displaying research data:

- Integrity
- Dignity
- Autonomy
- Confidentiality
- Responsibility
- Competence
- Justice and Privacy

Statistical Analysis
The normality of data was checked by using the Shapiro-Wilk test of normality. A descriptive analysis was used to describe the data distribution. The Paired-Samples t-test test was included in the present study. The statistical techniques were used to analyze the data on Statistical Package for Social Science (SPSS) version 26.0. The level of significance was set at 0.05.

Results

Table 2: Descriptive statistics and paired samples t-test result comparing experimental (pre-test) and experimental (post-test) on the variable, "Explosive Strength".

Explosive Strength		
	Experimental (Pre-Test)	Experimental (Post-Test)
Sample size	30	30
Arithmetic mean	2.6077	2.6397
95% CI for the mean	2.5908 to 2.6245	2.6180 to 2.6613
Variance	0.002039	0.003355
Standard deviation	0.04516	0.05792
Standard error of the mean	0.008245	0.01058
Mean difference	0.03200	
Standard deviation of differences	0.02107	
Standard error of mean difference	0.003848	
95% CI of difference	0.02413 to 0.03987	
Test statistic t	8.317	
Degrees of Freedom (DF)	29	
Two-tailed probability	p<0.0001	

A paired samples t-test was conducted to compare experimental (pre-test) and experimental (post-test) on the variable, "Explosive Strength". There were significant differences (p<0.0001) in scores for experimental (Pre-Test) (M=2.6077, SD= 0.04516) and experimental (Post-Test) (M=2.6397, SD=0.05792).
The magnitude of the differences in the means (mean difference=0.03200, 95% CI of difference: 0.02413 to 0.03987) was significant.

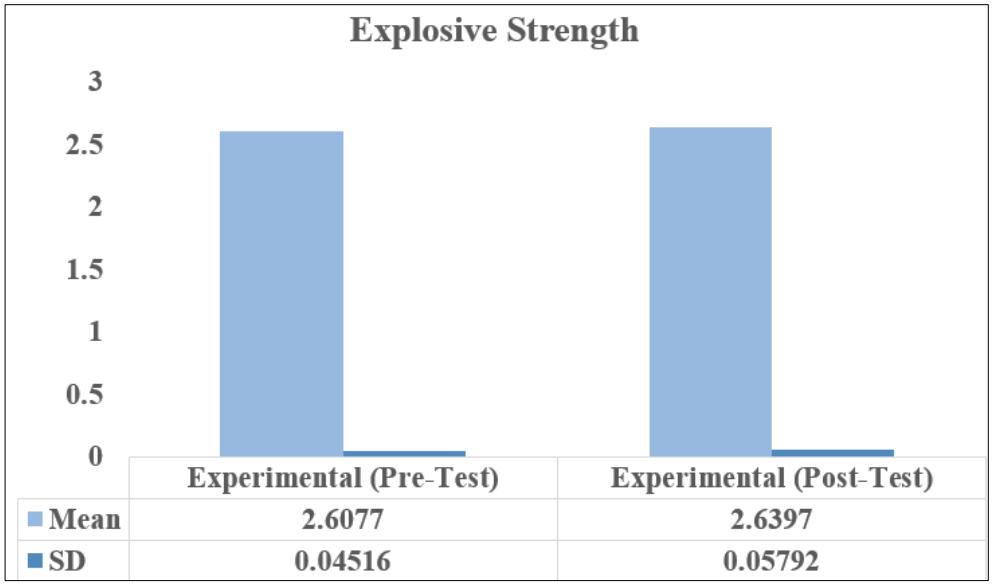

Fig 3: Mean and standard deviation comparison of experimental (pre-test) and experimental (post-test) on the variable, "Explosive Strength".

Table 3: Descriptive statistics and paired samples t-test result comparing control (pre-test) and control (post-test) on the variable, "Explosive Strength".

Explosive Strength		
	Control (Pre-Test)	**Control (Post-Test)**
Sample size	30	30
Arithmetic mean	2.5583	2.5607
95% CI for the mean	2.5451 to 2.5716	2.5450 to 2.5763
Variance	0.001256	0.001758
Standard deviation	0.03544	0.04193
Standard error of the mean	0.006470	0.007655
Mean difference	0.002333	
Standard deviation of differences	0.02459	
Standard error of mean difference	0.004490	
95% CI of difference	0.006849 to 0.01152	
Test statistic t	0.520	
Degrees of Freedom (DF)	29	
Two-tailed probability	P = 0.6072	

A paired samples t-test was conducted to compare control (pre-test) and control (post-test) on the variable, "Explosive Strength". There were no significant differences (P=0.6072) in scores for control (Pre-Test) (M=2.5583, SD=0.03544) and control (Post-Test) (M=2.5607, SD=0.04193).

The magnitude of the differences in the means (mean difference=0.002333, 95% CI of difference: 0.006849 to 0.01152) was very small.

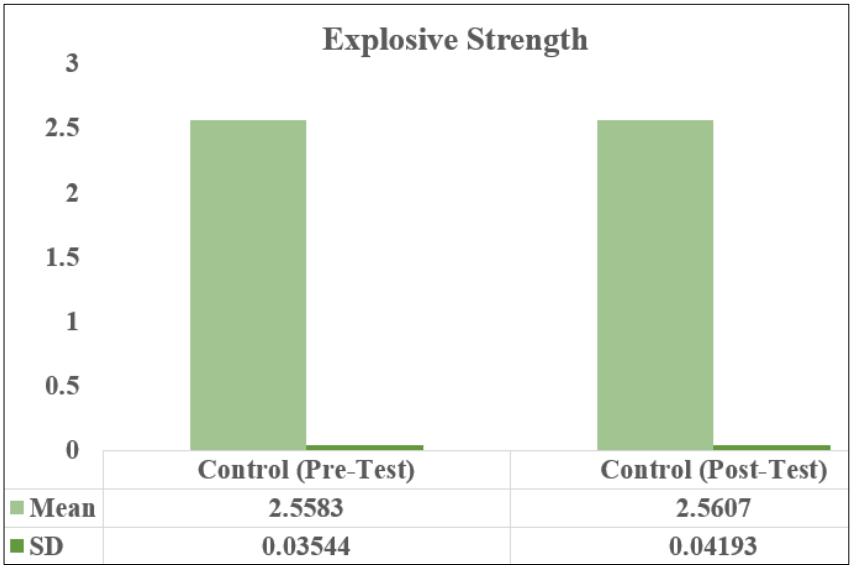

Fig 4: Mean and standard deviation comparison of control (pre-test) and control (post-test) on the variable, "Explosive Strength".

Conflict of interest

The authors declare no conflicts of interest.

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