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EFFECT OF FREQUENCY MODULATION IN RESISTANCE TRAINING ON MAXIMUM STRENGTH AMONG COLLEGE MEN STUDENTS

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ABSTRACT
The purpose of the study was to find out the effect of frequency modulation in resistance training on maximum strength among college men students. 45 men students were selected as respondents for the study and their age ranged between 18-21 years. The twelve week training program was conducted for the three groups: 3days in a week, 5days in a week named as experimental groups underwent resistance training program and control group did not underwent any training program. The selected dependent variables such as upper body maximum strength and lower body maximum strength were measured by 1RM bench press and 1RM leg press respectively before and after the training period. The collected data was analyzed by using (ANCOVA) analysis of covariance. The results of the study unfold that the maximum strength significantly improved in the two experimental groups compared to the control group. Specifically, within the treatment groups, the 3-day-a-week resistance training facilitated better improvement in maximum strength compared to 5-day-a-week resistance training after the 12-week training program.
Keywords: Resistance training, Frequency and Maximum Strength

INTRODUCTION
The National Strength and Conditioning Association assert that a large number of people in society are suffering from obesity and diabetes due to sedentary lifestyle. Human diseases namely coronary artery disease, cancer, hypertension and chronic low back pain are strongly associated with obesity and diabetes (Wilmore et al., 2008). Therefore, people are largely acquainted with personalized exercise programs to lead a healthy lifestyle (France, 2008). Fitness refers to a state of well-being of the human body and the mind. It is acquired through performing day-to-day activities without fatigue (Brown et al., 2006). Sports' training is a pedagogical process which relies scientific procedures, aimed at producing an athlete for extraordinary performance in competitions. Specifically, sport training is a scientific method employed to achieve the goal for a greater period of time (Freeman, 2013). There are various methods of training programs for the development of physical, physiological, biochemical, and hormonal changes and healthy posture. Training methods consist of strength training, high- and low-intensity interval training, speed training, fartlek training, circuit training, isotonic training, isometric training and isokinetic training.

Resistance training is also known as strength training or weight training. It is the capacity to overcome resistance or to perform against resistance and it is a product of voluntary muscle contractions caused by the muscles, bones, joints, heart, circulatory system, metabolism and nervous system (Hooper & Perring, 1999). Specifically, resistance training is part and parcel of all motor components, skills and tactics. It enhances the performance of athletes in terms of muscular mass, strength, endurance and tone (Singh, 1991). The workout for a particular muscle group that involves the number of training sessions in a week is called training frequency (Pfeiffer et al., 2014). The important factors of training frequency include training volume, intensity, selection of exercise, level of conditioning and recovery. The frequency of any workout strategy focuses on at least 48 to 72 hours of recovery time for each muscle group. In specific, the experienced is likely to split their body muscles for different days in a week: namely legs, abdominal muscles in one session; chest, shoulders and triceps in the subsequent session; back and biceps in the third session. The high frequency of exercises exhausts potential energy for the sedentary population. Further, there is a correlation between frequency and physical activity, which indicates that an individual must exercise on most number of days to obtain overall health benefits (Wilmore et al., 2008).

Maximum strength is the capacity to perform or to act against a greater amount of force. It is calculated by examining the maximum resistance to overcome the muscles which involves force application during contraction and relaxation of muscles. The maximum strength is a skill-related component and it is significant for sports like weightlifting, bodybuilding, throwers and jumpers. The scope of maximum strength relies on major sports that include explosive strength and strength endurance (Ivancevic et al., 2008).

METHODOLOGY

The purpose of the study was to find out the effect of frequency modulation in resistance training on maximum strength among college men students. 45 men students were selected as respondents for the study and their age ranged between 18-21 years. The twelve week training program was conducted for the three groups: 3days in a week, 5days in a week named as experimental groups underwent resistance training program and control group did not underwent any training program. The selected dependent variables such as upper body maximum strength and lower body maximum strength were measured by 1RM bench press and 1RM leg press respectively before and after the training period. The collected data was analyzed by using (ANCOVA) analysis of covariance.

ANALYSIS OF THE DATA AND RESULTS OF THE STUDY

TABLE 1
ANALYSIS OF COVARIANCE FOR 1RM BENCH PRESS OF THE 3DAYS/WEEK RESISTANCE TRAINING, 5 DAYS/WEEK RESISTANCE TRAINING AND CONTROL GROUPS

	3 days/week RT group	5 days/week RT group	Control Group	Source of variance	Sum of squares	df	Mean square	F ratio
Pre-test mean	33.47	33.33	32.67	B	5.51	2	2.76	0.06
SD	6.89	7.49	5.60	W	1950.40	42	46.44	
Post-test mean	44.13	39.20	33.53	B	844.04	2	422.02	11.72*
SD	5.50	6.00	6.46	W	1511.87	42	36.00	
Adjusted post-mean	43.91	39.07	34.00	B	753.37	2	376.70	29.05*
				W	531.60	41	12.97	

*Significant at 0.05 level.
The required table value at 0.05 level of significance for 2 & 42, 2 & 41 degrees of freedom is 3.22.

The above table shows that the pre-test means of the 3-day-a-week resistance training, 5-day-a-week resistance training and control groups: 33.47, 33.33 and 32.67, respectively. The F ratio is 0.06 for the pre-test mean, which is lesser than the required table value 3.22 for 2 & 42 degrees of freedom at 0.05 level of significance. Consequently, the statistical results establish the fact that there is insignificant change in 1RM bench press between the control and experimental groups before the training program.

Besides, the post-test means of the 3-day-a-week resistance training, 5-day-a- week resistance training and control groups are 44.13, 39.20 and 33.53, respectively. The F ratio 11.72 is greater than the required table value 3.22 at 0.05 level of significance. This analysis brings to light that there is a significant difference found in 1RM bench press between the control and experimental groups after the training program.

The adjusted post-test means of the 3-day-a-week resistance training, 5-day-a- week resistance training and control groups are 43.91, 39.07 and 34.00, respectively. The F ratio 29.05 is greater than the required table value 3.23 for 2 &

41 degrees of freedom at 0.05 level of significance. This analysis unveils that there is a significant change in 1RM bench press in the experimental training groups.

TABLE 2
SCHEFFE'S POST HOC TEST TO MEASURE ORDERED ADJUSTED 1RM BENCH PRESS MEANS BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS.

3 days/week RT group	5 days/week RT group	Control group	Mean difference	CD
43.91	39.07		4.84	3.34
43.91		34.00	9.91	
	39.07	34.00	5.07	

The above table shows the Scheffe's post hoc test results: the 3–day-a-week resistance training group (adj. mean = 43.91) significantly outperformed the 5-day-a- week training group (adj. mean = 39.07) in 1RM bench press with an adjusted mean difference of 4.84 (CD = 3.34). Further, the two experimental groups significantly performed better than the control group (adj. mean = 34.00) in 1RM bench press with adjusted mean differences of 9.91 and 5.07 (CD = 3.34), respectively.

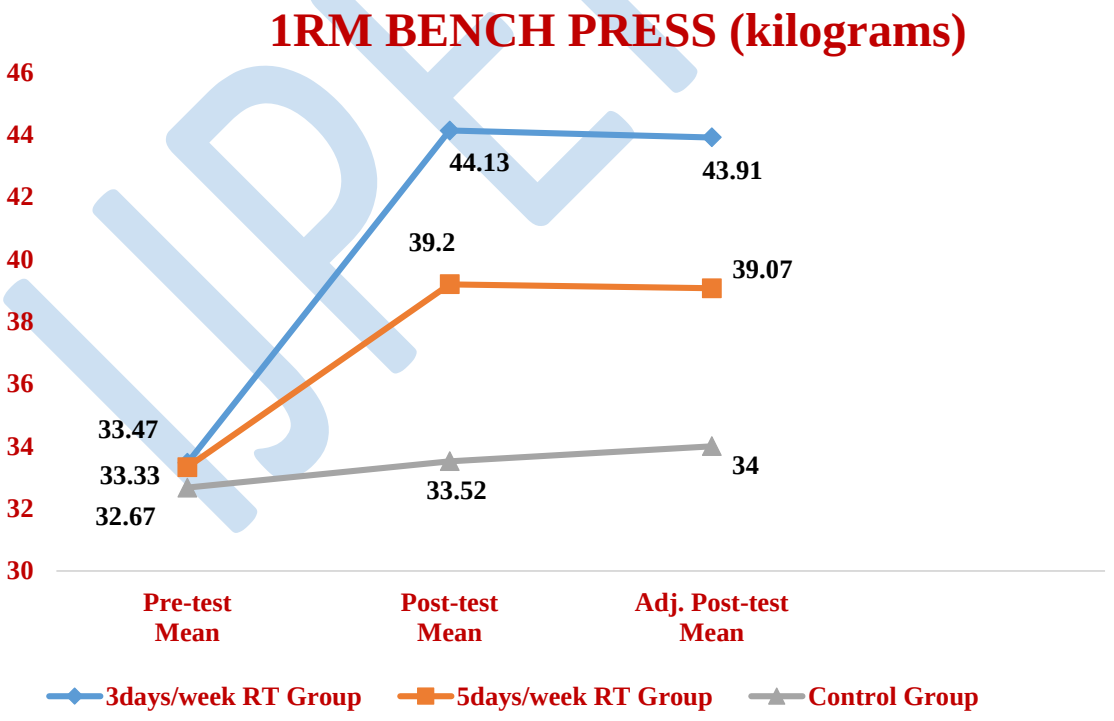

Figure 1 Line diagram showing the mean values of 1RM bench press of the 3 days/week resistance training, 5 days/week resistance training and control groups.

TABLE 4.3
ANALYSIS OF COVARIANCE FOR 1RM LEG PRESS OF THE 3 DAYS/WEEK RESISTANCE TRAINING, 5 DAYS/WEEK RESISTANCE TRAINING AND CONTROL GROUPS.

	3 days/week RT group	5 days/week RT group	Control group	Sum of squares	df	Mean Square	F ratio
Pre-test mean	50.00	49.33	49.00	7.78	2	3.89	0.062
SD	7.56	8.63	7.60	2653.33	42	63.21	
Post-test mean	61.67	57.00	50.00	1034.44	2	517.22	6.08*
SD	8.43	10.49	9.10	3573.33	42	85.10	
Adjusted	61.10	57.12	50.50	863.49	2	432.44	
Post- mean				733.50	41	17.90	24.13*

*Significant at 0.05 level.
The required table value at 0.05 level of significance for 2 & 42, 2 & 41 degrees of freedom is 3.22.

The above table shows that the pre-test means of the 3-day-a-week resistance training, 5-day-a-week resistance training and control groups are 50.00, 49.33 and 49.00, respectively. The obtained F ratio 0.06 is lesser than the required table value 3.22 for 2 & 42 degrees of freedom at 0.05 level of significance. This shows that there is no significant change in 1RM leg press between the control and experimental groups prior to the training program. The post-test means of the 3-day-a-week resistance training, 5-day-a-week resistance training and control groups are 61.67, 57.00 and 50.00, respectively. The F ratio 6.08 is greater than the required table value 3.22 at 0.05 level of significance. The adjusted post-test means of the 3-day-a-week resistance training, 5-day-a- week resistance training and control groups are 61.10, 57.12 and 50.50, respectively. The obtained F ratio 24.13 is greater than the required table value of 3.23 for 2 & 41 degrees of freedom at 0.05 level of significance. Therefore, there is a significant difference in 1RM leg press as a result of the training program.

TABLE 4.4
SCHEFFE'S POST HOC TEST TO MEASURE ORDERED ADJUSTED 1RM LEG PRESS MEANS BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS

3 days/week RT group	5 days/week RT group	Control group	Mean difference	CD
61.10	57.12		3.98	3.92
61.10		50.50	10.60	
	57.12	50.50	6.62	

The above table depicts the Scheffe's post hoc test results: the 3-day-a-week resistance training group (adj. mean = 61.10) significantly outperformed the 5-day-a- week training group (adj. mean = 57.12) in 1RM leg press with an adjusted mean difference of 3.98 (CD = 3.92). In addition, the two experimental groups are significant than the control group (adj. mean = 50.50) in 1RM leg press with adjusted mean differences of 10.60 and 6.62 (CD = 3.92), respectively.

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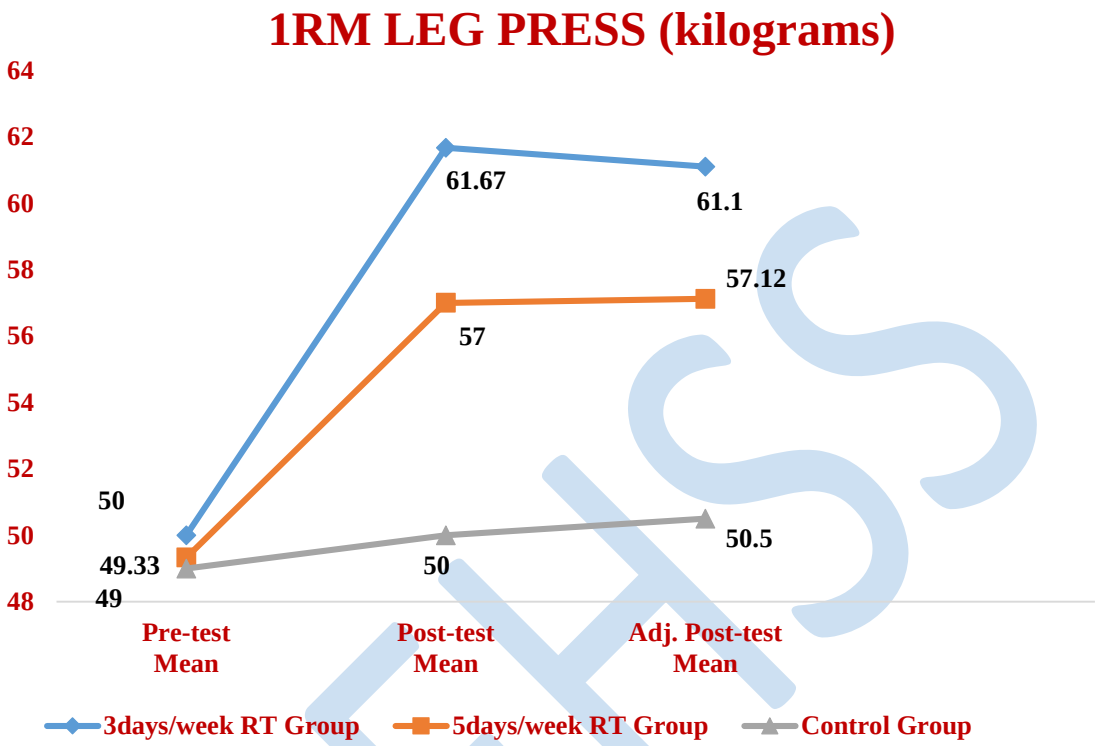

Figure 4.2 Line diagram showing the mean values of 1RM leg press of the 3 days/week resistance training, 5 days/week resistance training and control groups.

DISCUSSION

The results of the study unfold that the maximum strength significantly improved in the two experimental groups compared to the control group. Specifically, within the treatment groups, the 3-day-a-week resistance training facilitated better improvement in maximum strength compared to 5-day-a-week resistance training after the 12-week training program. This is due to the availability of the recovery period for 3-day-a-week resistance training, which facilitates muscular recuperations, whereas for the 5-day-a-week resistance training group, there was less difference in maximum strength due to acute fatigue. This finding corroborates with the earlier studies (Arazi & Asadi, 2011; Seenimurugan & Jeyaveerapandian, 2011; Candow & Burke, 2007; Carroll et al., 1998; Ramsay et al., 1990; Braith et al., 1989).

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