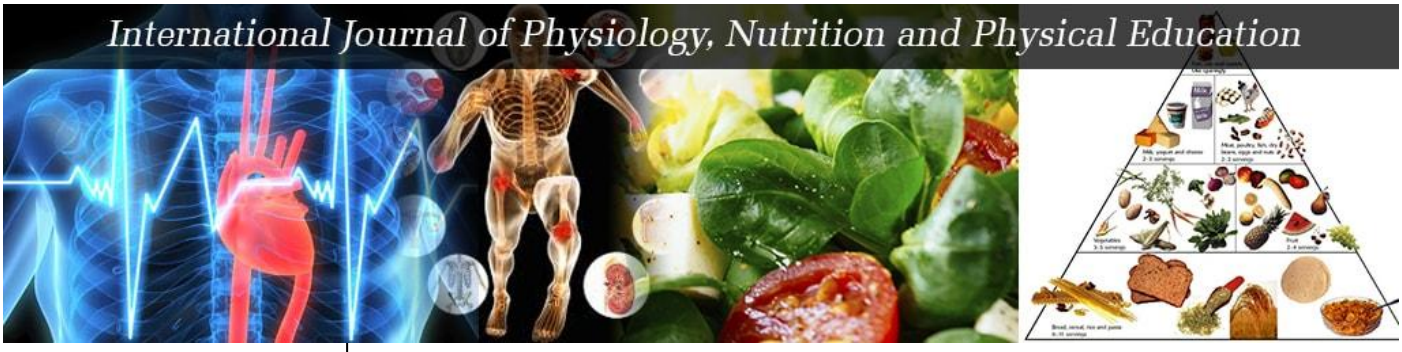

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Quantification of physiological responds to varied intensities of plyometric training among collage females

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Abstract
The purpose of the study was to quantify the effects of varied intensities of plyometric training on selected physiological variables such as resting heart rate and fat percentage among resident female students. To achieve the purpose of the study thirty (30) collage female students studying at National Institution of Technology, Calicut were selected as subjects by using random group design. Their age ranged from 18-20 years. The subject were divided into three groups of 10 each (n=10). Group -I underwent high intensity of plyomatric training, group –II underwent low intensity of plyometric training and group-III acted as a control group and did not undergo any training programme. The training was given for six weeks. The selected physiological variables were recorded in three groups at the start and after sixth week of training. The data collected from the experimental groups were statistically examined by applying analysis of covariance (ANCOVA). Results of the study revealed that varied intensity of plyometric training groups showed significant improvement on resting heart rate as compared to control group. Even though there was no significant difference was found between two groups on fat percentage due to the six weeks of plyometric training programme.

Keywords: Plyometric training, resting heart rate, fat percentage

Introduction
People have to develop physical fitness because it is an essential element for the smooth functioning of the human body and the system as a whole. Fitness is a basic necessity for the human being to live best and serve best. The people all over the world diverse of cast, colour, creed, race and religion are aware about importance of fitness in day-to-day life. The nation who keeps each their citizens healthy is the asset of the country and the weakness are the liability hence, it is the dependability of every country to give prime priority to attain the health and fitness of each citizen. "Plyometric exercise is a form of training which uses eccentric with concentric muscular contraction to improve maximal strength, speed and explosive power" (Gemvetta. 1998) [1]. Plyometric exercise is a form of training where both the contractile and elastic components are assisted by the strength reflex to generate muscular strength and speed (Dick, 1987) [2]. All human beings possess the basic urge to do some acceptable task to keep fit. But what prevent them from practicing it is the lack of motivation. Modern life is sadly a progressive stage of less moving and conditioned, obese and result in easy going sedentary life style. (Jordan, 1992) [5].

A renowned cardiac exercise physiologist said, 25 to 45% of one's fitness is genetically determined which leaves an estimated 60 -70% within our control through regular exercise and healthful diet. Inactivity contributes to the death of 4.5 million people a year in India (Claude bouchard, *at al*, 1992) [3]. The health and fitness of an individual depends upon the proper functioning of each organ and gland in the body. It is a sum of all the functions and organs to maintain it at a satisfactory level it is necessary to render sufficient exercise to each organ. Those persons, who undergo lot of bodily strain and muscular work in their daily life, for example, coolies or farm laborer, carpenter, black smith mesons and so on, do not need any physical exercise separately, as all the muscles of the body are already exercised fully in their daily work. But white collared people like teachers, doctors, advocates, clerks and others do not have to exert physically in their job. And thus they need to take regular exercise for maintaining the body and mind in a fit condition. Students' communities are also not an exemption from it.

Plyometric Training

Plyometric exercises are the rapid declaration and acceleration of muscles that create a stretch-shortening cycle. The exercises train the muscles, connective tissue and nervous system to effectively carry out the stretch-shorting cycle, as a result improving an athlete's performance. Plyometric drills can be a fundamental part of training for each and every in sport. Most competitive sports require a rapid deceleration of the body followed by almost immediate acceleration in the opposite direction.

Plyometric drills help develop rhythm, speed, power and even muscular endurance. Plyometric, used correctly and for a specific purpose, can be a tremendous asset to your individual athletes as well as to the general and specific conditioning of your entire sport program.

Exercise Intensity

The intensity of plyometric exercise varies greatly. Skipping exercise are classed as low intensity, while reactive drop jumps from 32 in (80cm) and above are the highest intensity of the plyometric exercises. Plyometric training should progress gradually from lower intensity to higher intensity drills, especially for individuals who lack a significant strength training background. Too great a load can reduce the speed and quality of movement negating the effects of plyometric.

Volume

Plyometric volume related to the number of repetitions per session. For lower body exercise a repetition is a ground contact.

Frequency

Typically, 2-3 sessions of plyometric can be in a week. Alternatively, recovery time between sessions can be used to prescribe frequency and is recommended at 48-72 hours.

It is not recommended that plyometric training be scheduled for the day after a heavy weight training session when muscles may still be store. This poses a planning problem for athletes that may need to strength train 3-4 times per week.

Rest Intervals

The effectiveness of a plyometric training session depends on maximal effort and a high speed of movement for each repetition. Reset intervals between repetitions and sets should be long enough to allow almost complete recovery (4). As much as 5-10 seconds may be required between depth jumps and a work to reset ratio of 1:10 is recommended. For example, if a set of bounds takes 30 seconds to complete, the rest interval between sets would be 300 seconds or 5 minutes. (Conroy & Theresa, 1994) [14].

There are lots of researches to explain the optimal guidelines for plyometric training. While many coaches use their experience to determine the quantity and intensity of session, several objectives guidelines have been proposed by bodies such as the national strength and conditional association and other experts in the field. Majority of today's youth are product of university education. They spent the best part of their lives in any one of the educational campuses. An educative mass –oriented fitness awareness inculcation programme, if included in the curriculum, can produce ideal national builders.

Methods

The female students from national institute of technology, Calicut were selected as subjects at random. The age of the subjects were ranged between 18- 20 years. They were divided in to three equal groups and each group consisted of 10 subjects. Group I and Group II underwent varied intensities of plyomatric training for three days per week for six weeks and group III acted as control group who did not participate any training apart from regular schedules.

Variables

The resting heart rate and fat percentage were selected as criterion variables. The plyomatric training was selected as in dependent variables. The selected criterion variables such as resting heart rate and fat percentage were measured by using radial wrist pulse test and skin fold measurement test respectively.

Training programme

During the training period, the experimental groups-I(n=10) & II(n=10) underwent varied intensities of plyometric training for three days per week (alternative days) for six weeks.every day the work out lasted for 30 to 45 minutes approximately including warming up and warming down periods. Subjects in group II as control were instructed not to participate in any strenuous physical exercise and specific training throughout the training programme. Each training session was conducted only in the morning time. The following plyometric training exercises are given in the training programme.

Table 1:

S. No	Polymeric Exercises	Low intensity group I	High intensity group II
1	Skipping	#5%4*20	#10%6*30
2	Hopping	#2%4*20	#5%6*30
3	Box jumping	#2%4*20	#5%6*30
4	Squat jump	#2%4*20	#5%6*30

#=minutes, %=repetition, &= sets, *=recovery period in seconds

Statistical procedures

All subjects of three groups were tested on selected dependent variables at prior to and immediately after the training programme. The analysis of covariance (ANCOVA) was used to analyze the significant difference if any, between the three groups on each selected criterion variables separately, all the case,.05 level of confidence was fixed to the significance, which was considered as an appropriate.

Physiological Variables

The Pre, Post and Adjusted Post Test data of the Control, Experimental groups I & II for Physiological variables Resting Heart Rate and Fat Percentage were subjected to Analysis of Covariance separately and it was presented in the TABLES No.2 to 4

Table 2: Analysis of Covariance for the Pre, Post and Adjusted Post Test Data on Resting Heart Rate of Control and Experimental Groups

Variables	Test	High intensity plyomatric training group	Low intensity plyomatric training group	Control group	F ratio
Resting heart rate	Pre-test	81.200	82.200	84.200	0.5294
	Post- test	77.400	80.600	85.200	3.4811*
	Adjusted	78.685	80.899	83.616	14.028*
Fat percentage	Pre-test	20.041	20.552	20.550	0.283
	Post- test	19.925	20.465	20.806	0.5730
	Adjusted	20.279	20.287	20.630	3.6792*

* Significant at 0.05 levels (The table value required for Significance at.05 levels with degrees of freedom 2 and 27 is 3.35 &2 and 26 is 3.37).

It is clear from the table -1 that there is no significant difference between experimental groups and control group on resting heart rate and fat percentage before commencement of training programme. However, there is a significant difference of resting heart rate (F= 3.4811, p< 3.35) and fat percentage (F= 3.6792, < 3.35) during the post test. there by it inferred that the polymeric training significantly improved the selected physiological variables in NIT female students.

Since, three groups compared, whenever obtained 'F' ratio for adjusted post-test was found to be significant, the. Scheffe's test to find out the paired mean differences and it was presented in Table -3.

Table 3: Scheffe's Test for the Differences between the Adjusted Post-Test Paired Means of Resting Heart Rate

Control Group	Experimental Group 'I'	Experimental Group 'II'	Mean Difference	Confidence interval value
83.616	78.685		4.931*	2.379
83.616		80.899	2.717*	2.379
	78.685	80.899	2.214	2.379

*Significant at 0.05 level of confidence.

Table 4: Scheffe's Test for the Differences between the Adjusted Post-Test Paired Means of Fat Percentage

Control Group	Experimental Group 'I'	Experimental Group 'II'	Mean Difference	Confidence interval value
20.630	20.279		0.351	0.385
20.630		20.287	0.343	0.385
	20.279	20.287	0.008	0.385

* Significant at 0.05 level of confidence.

TABLE (4) indicated that, there is no significant difference exists between the control group and experimental group I (mean difference = (0.351< 0.385), between the control group and experimental group II (mean difference = (0.343< 0.383) and between the experimental I and experimental group II (mean difference = (0.008<0.383).

Result and finding Physiological variables

The analysis reveals that the Quantification of varied intensity of Plyomatrics training showed significant improvement in a physiological variable of Resting Heart Rate when compared with control group**.** Hence, the Experimental groups showed noticeable improvement on Resting Heart rate apart, At the same time, when experimental groups were compared, the Fat Percentage has not shown any significance, which may be due to the short period of Plyometric training. Training has very pronounced effects on heart rate, even at rest. Highly trained athletes of either sex, resting heart rate may be as low as lower as 40 beats per minute. In contrast, resting heart rates for untrained but healthy individuals may be as high as 90 beats per minute. A relative slow heart rate, coupled with a relative large stroke volume indicates an efficient circulatory system, Fox et.al. (1982) [4].

The results of this study claim that training must fit in Intensity and the volume of training it gradually allowing the subjects to adjust effectively, especially the subjects who followed the polymeric training proto-cols. even though the fact that execution of polymeric training is not generally recommended on the continues days, the present study indicates that 6 weeks is an adequate period for the improvement of resting heart rate if the training protocols maintain the appropriate intensity and volume and the results of this study concern individuals relatively inexperienced in plyometric training. Today's girl students are tomorrow's corporate managers and home makers who can influence and motivate children more than men. A strong nation and positive minded citizen can be developed if women inspire their children. The women community on the campus needs to be subjected to research studies to make them aware of fitness and well-being.

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