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Effect of Ballistic Resistance and Plyometric Training on Reaction Time of Sprinters

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Abstract

The present study was conducted to determine the effects of Ballistic resistance and plyometric training on reaction time of noviced sprinters. The subjects for the study were selected on the basis of random group design. Thirty (N=30) male students were selected as subject for the present study from Lovely professional university (Punjab), INDIA. All the subjects ranged between the chronological age of 18-25 years. The selected subjects were further divided into three groups. Ballistic resistance training was assigned to group "A" Plyometric training as group "B" while group "C" acts as control. "Electronic Reaction timer" was used to measure reaction time. The subjects were subjected to the six week of ballistic resistance and plyometric training programme. To find out the effects of ballistic resistance and plyometric training programme on reaction time, analysis of covariance (Ancova) was employed. The results showed that the no significance F-ratio (=2.75) for the pre test means and significant F-ratio (=17.88) for post test means, since tab.0.05 (2, 27) (=3.35) required for significance F ratio cal. t (=3.58) which is significant as it is greater than the F value tab.05 (2, 26) (=3.37) required for significance that .05 level. For further analysis "Post-Hoc Test" (LSD Test) was applied. The obtained value showed significance difference for the plyometric training groups when compared with control group F-ratio (.63). The treatment of plyometric training for six weeks shown significant improvement in reaction time, since cal. t (=.63)> CD .05 (=.62).

Keywords: *Ballistic resistance training, Plyometric training, Reaction time,*

Introduction

Ballistic resistance training trains both the fast-twitch and the slow-twitch fiber. Second, ballistic weight training provides a highly effective cardiovascular workout. A ballistic lift requires full muscle utilization and this elevates the heart rate. By measuring the time of the lift and the rest period between lifts the lifter will keep his heart rate at an elevated rate throughout the workout. Ballistic lifting is an effective method for not only increasing muscle strength and speed, but also an effective means to gain flexibility and burn fat. A ballistic

lift is an athletic move that activates and trains the fast-twitch muscle fiber. In traditional weight training the lifter must hold the weight, slow down the weight, stop the weight and then return the weight to the starting position. These weight lifting motions require mostly slow-twitch fibers and take more than one second to complete. Ballistic training trains muscle to be fast. Fast-twitch muscle fiber is only activated for a short time before shutting off.

Plyometric is a method of developing explosive power. Previously referred to as jumping training the term plyometric first appeared in literature in the late 1960. Yuri verkhoshensky the father of plyometric. He was the discovered for Russian high jumpers and triple jumpers. Plyometric as a term was formed from the Greek root pleythein which loosely translated means to increase. An American coach by the name of Fred Wilt is believed to be the first person to use the term Plyometrics to describe the jump training that some U.S coaches were implementing with their athletes. The plyometric term as coined by an American track and field coach in 1975 Fred Wilt his thinking was to combine two Latin words 'Pilo' and 'Metric' which again loosely translated means more to measure. Plyometrics is basically working what is termed a "Stretch Reflex" of the muscle. Plyometrics can help maximize power in the stretching and shortening cycle of a muscle or muscle group. They also promote reflex power through a broader range of motion than most endurance athlete's use.

Methods

Subjects

The subjects for the present study were selected on the basis of random group design. Twenty (N=30) male students were selected as subject for the present study from Lovely Professional University, Phagwara, (Punjab), INDIA. All the subjects ranged between the chronological age of 17-22 years. The selected subjects were further divided into three groups. Ballistic resistance training was then assigned to group "A" Plyometric training as group "B" while group "C" acts as control. "Electronic Reaction timer" was used to measure reaction time. The subjects were subjected to the six week of ballistic and plyometric training programme. To find out the effects of ballistic training and plyometric training programme on reaction time of Lovely professional university, analysis of covariance was employed.

Reaction Time Test

Objective

The reaction time test measures the speed of reaction in response to a visual stimulus.

Required Resources

Electronic reaction timer supplied by Anand agencies, Poona

Test Procedure

There were four (4) wooden boards marked as A, B, C and D. Out of these A and B were the staring boards and C and D were the stepping boards. The subject stood on the starting board putting one foot on each board. After the onset of an auditory stimulus he lifts one of the legs which was pre-determined and which was told to the subjects from A and B and step on C and D.

The tester pressed one of the short keys giving the required stimulus (Auditory). Short key was a double key which give the stimulus and also started the chronoscope. As soon as the subject received a stimulus he lift his foot from the right or left A or B boards and steps on the left or right C or D boards, which stopped the chronoscope and the reaction time to the auditory stimulus was recorded. The time out the best of the three trials was recorded in seconds.

Six Week of Ballistic Resistance Training Programme

TRAINING WEEK	NAME OF EXERCISE	SETS	REPETITIONS	RECOVERY TIME	TRAINING INTENSITY
1-2 WEEK	Overhead shot throw Rebound Overhead Shot Throw Underarm Throw/Toss Rebound Throw/Toss	8	15 each set	40sec	LOW
3-4 WEEK	Overhead shot throw Rebound Overhead Shot Throw Underarm Throw/Toss Rebound Throw/Toss	8	15 each set	30sec	MEDIUM
5-6 WEEK	Overhead shot throw Rebound Overhead Shot Throw Underarm Throw/Toss Rebound Throw/Toss	8	15 each set	40sec	HIGH

Six Week of Plyometric Training Programme

TRAINING WEEK	NAME OF EXERCISE	SETS	REPETITIONS	RECOVERY TIME	
1-2 WEEK	Box to box jump Hurdle jump Medicine ball throw Hopping in stairs	8	15 each set	35sec	LOW

3-4 WEEK	Box to box jump Hurdle jump Medicine ball throw Hopping in stairs	8	15 each set	35sec	MEDIUM
5-6 WEEK	Box to box jump Hurdle jump Medicine ball throw Hopping in stairs	8	15 each set	35sec	HIGH





Finding

The study was conducted to find out the effect of ballistic training and plyometric training on reaction time of noviced sprinters. The result pertaining to significant difference, if any, between ballistic training, plyometric training and control groups were assessed by the analysis of covariance for the reaction time is presented in tables.

Table-1

Analysis of Covariance For the Three Experimental Groups and Control Group in Standing Broad Jump Performance

Source of variation	D.F	Sum of Square X	Sum of Squares Y	Sum of Squares x.y	Sum of Squares y.x	MSS y.x
Between groups (influence factor)	2	0.014	0.20	-0.04	3.19	1.59
Within groups (other fluctuations)	26	0.077	0.15	1.02	-13.23	-0.50
Total	28	0.092	0.35	0.97	-10.04	

The analysis of data in table 1 for two experimental and the control group on reaction time. Performance indicates no significance F-ratio of 2.75 for the pre test means and significant F-ratio of 17.88 for post test means respectively. There by indicating no significant difference in the initial means and post test means for the groups. F ratio for the adjusted post means indicate a value of 3.58 which is significant as it is greater than the F value of 3.37 required for significance that .05 level. This indicates that there is significance difference from pre to post means among the groups in reaction time. The paired adjusted final means following the post-hoc test analysis and the differences between the means among the four groups are presented in table.

Table -2

Paired Adjusted Final Means and Differences Between Means Among the Experimental Group and Control Group on Reaction Time

Ballistic Training	Plyometric Training	Control Group	Adjusted Mean Difference	CD at 5% level
0.01	.17		.16	.62
	.17	.64	.47	
0.01		.64	.63*	

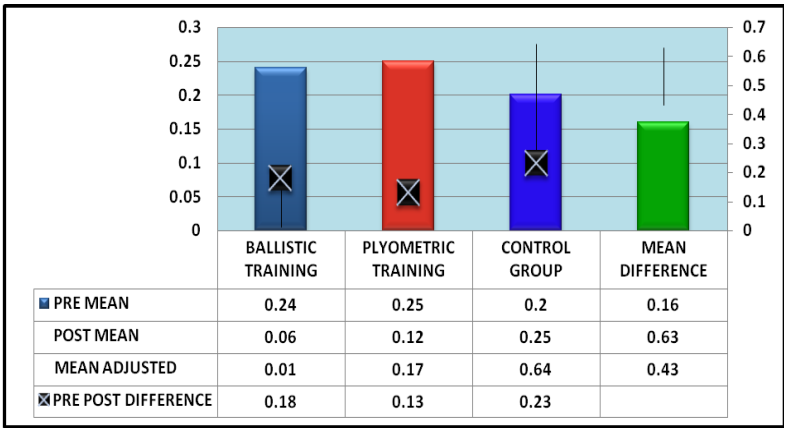
*indicate significant difference CD at 5% level

Table-2 shows that the differences between the paired adjusted final means among the ballistic training, plyometric training and control groups indicates significance difference for the plyometric training groups when compared with control group (.63). However the difference among ballistic training and control group is not significant as the mean difference values are lesser then the critical

difference value of 0.62 required for significance.

Figure-1

Mean, Paired Adjusted Mean, Mean Difference of Reaction Time of Experimental and Control Group



	BALLISTIC TRAINING	PLYOMETRIC TRAINING	CONTROL GROUP	MEAN DIFFERENCE
PRE MEAN	0.24	0.25	0.2	0.16
POST MEAN	0.06	0.12	0.25	0.63
MEAN ADJUSTED	0.01	0.17	0.64	0.43
PRE POST DIFFERENCE	0.18	0.13	0.23	

The graphical representation on pre and post test means paired adjusted means and mean difference of the experimental and control groups are shown in figure 1.

Discussion

The aim of the current study was to find out the effect of ballistic resistance and plyometric training on a 6-week training programme. From the results it is evident that the six week of plyometric training programme showed significant improvement in reaction time. The plyometric training programme groups were shown significant improvement in reaction time of noviced sprinter. This result is concurring with previous studies which found plyometric training to improve movement velocity capability. The findings is supported by the study conducted by McBride, J. M., T. Triplett-McBride, A. Davie, and R. U. Newton to evaluate the effect of an 8-week training program with heavy- vs. light-load jump squats on various physical performance measures and electromyography (EMG). This investigation indicates that training with light-load jumps squat results in increased movement velocity capabilities and that velocity-specific change in muscle activity may play a key role in this adaptation.

Our finding provides further support to the notion that plyometric training can demonstrate benefits in a short period of time. Indicating those twelve sessions of plyometric training is sufficed for initial improvement. There is a limited amount of information about the effects of resistance training on motor performance sculls in youth. Although it is attractive to assume that a stronger and more powerful adolescent will perform better on motor performance tests, the data is equivocal. Several studies involving youth have noted significant improvements in the long jump, vertical jump, sprint speed and agility run time following resistance training

(Falk & Mor, 1996; Weltman et al., 1986; Lillegard, Brown, Wilson, Henderson, & Lewis, 1997) Plyometric training alone, as has been shown by this study and others carried out by authors such as Blattner and Noble (1979) and Bosco (1982), can also have a significant effect in increasing hip and thigh power that is measured by the vertical jump. Bosco believes that this results from enhancing motor unit recruitment and improving the muscles' ability to store kinetic energy within the elastic components of the muscle (Bosco, et. al., 1982). This may enhance hip and thigh power by increasing the explosive capabilities of the athlete. The transfer of this explosiveness to activities other than the vertical jump needs further investigation

Conclusion

The results from our study are very encouraging and demonstrate the benefits plyometric training can have on reaction time. Not only can athletes use plyometrics to break the monotony of training, but they can also improve their speed and agility while working to become more agile. In addition, our results support that improvements in reaction time can occur in as little as 6 weeks of plyometric training which can be useful during the last preparatory phase before in-season competition for athletes.

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Comparision of Physical Fitness Components of Judo and Taekwondo Players

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Abstract

Physical fitness is the ability to carry out daily tasks with vigour andalertness; without undue fatigue. The purpose of this study was to comparethe physical fitness of judo and taekwondo players of Khanna City (Punjab). The research was a descriptive comparative method. A total of 70 Players (35 judo and 35 taekwondo Players) were selected purposively from the coachingcenters Khanna City. The criterion measures adopted for this study were Flexibility and muscular strength and Endurance. The data collection tools used in the study were sit & reach, Sit Ups.Data of Physical Fitness Components between boxing and wrestling players was compared by using independent Sample 't' test. The level of significance was kept at 0.05 level of significant to test the hypothesis. The statistical analysis of physical components revealed that in the parameters such as sit-upsand sit andreach, there was significant difference between judo and taekwondo players.The results also showed that all the physical fitness components the Muscular strength/Endurance and Flexibility taekwondo players were found tobebetter than judo players. Finally the researcher concluded that the taekwondo players were more fit as compare to judo Players.

Keywords: *Physical fitness, judoplayers,taekwondo Players.*

Introduction

Physical fitness is the capacity of heart, blood vessels, lungs and muscles to function at optimum efficiency. In previous years, fitness was defined as the capacity to carry out the day's activities undue fatigue. Physical fitness is now defined as the body's ability to function efficiently and effectively in work and leisure activities, to resist hypo kinetic diseases, and to meet the emergency situations (Corbin and Lindsey,1994). Fitness concepts in elementary physical education center on children's understanding of fitness as good health, and a working knowledge of activities that promote a healthy level of fitness. However, with increased leisure time, and changes in life styles wrought by the industrial

revolution, which took a large proportion of the population away from farm life and into more urban areas, this definition is no longer considered comprehensive enough.

The definition for physical fitness is now defined as the body's ability to function efficiently and effectively in work and leisure activities, not only at a set point in time, but at various ages and stages within a person's life cycle. The key is in finding optimum health within the limits of one's lifestyle, in order to be able to resist hypo kinetic diseases. The purpose of this study was to compare the physical fitness of judo and taekwondo players of Khanna City.

Method and Procedure

Sample: A total of 70 Players (35 judo and 35 taekwondo players) were selected purposively from the coaching centers of Khanna city (Punjab).

Method: The research was a descriptive comparative method The criterion measures adopted for this study were Flexibility and muscular strength and Endurance. The data collection tools used in the study were sit & reach, Sit Ups.

Analysis of Data: Data of Physical Fitness Components between boxing and wrestling players was compared by using independent Sample 't' test. The level of significance was kept at 0.05 level of significant to test the hypothesis.

Result

Table No.1.1

Descriptive Statistics of Sit-ups and Sit & Reach Judo and Taekwondo Players

Judo Players				Taekwondo Players				
Variables	N	Mean	Standard Deviation	St. Error Mean	N	Mean	Standard Deviation	St. Error Mean
Sit-ups	35	22.19	2.31	0.51	35	26.44	6.05	0.87
Sit & Reach	35	12.98	3.70	0.55	35	17.65	2.66	0.45

Table No.1.2

Independent Sample 't' test of Sit-ups, Sit & Reach and Speed

Physical Fitness-Variable	't' Value	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Sit- Ups	1.453	68	0.005	4.25000	1.1100
Sit &Reach	3.664	68	0.003	4.63000	0.65744

From the table no 1.2, the results of this study revealed that in all the selected physical fitness components such as Sit-ups, Sit & reach and Speed there is significant difference between judo and taekwondo players.

Conclusion

The researcher analyzed the collected data as per the objectives set for the research study. The statistical analysis of physical components revealed that in the parameters such as sit-ups and sit and reach there was significant difference between judo and taekwondo players. Thus the research hypothesis was accepted. The results of descriptive statistics have indicated that the mean scores in sit-ups, and sit and reach in case of judo players were found (22.19+2.31, 12.98+3.70 respectively while in case of taekwondo players the mean were found (26.44+6.05, 17.65+2.66 respectively. The results also showed that all the physical fitness components the Muscular strength/Endurance and Flexibility wrestling players were found to be better than judo players. The statistical analysis of physical components revealed that in the parameters such as sit-ups and sit and reach there was significant difference between judo and taekwondo players. In the present the results also showed that all the physical fitness components the Muscular strength and Endurance and Flexibility wrestling players were found to be better than judo players. Finally the researcher concluded that the taekwondo players were more fit as compare to judo players. This clearly shows that players of taekwondo are more fit as compare to players of judo.

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Comparison of Physical Fitness Between Adolescent Athletes and Non-Athletes

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Abstract

The purpose of this study was to compare the physical fitness components between adolescent athletes and non-athletes. The present study was conducted on a sample of sixty (N=60) adolescent, which includes thirty each, athletes (N1=30, mean ± SD: age 15.37± 1.10years, height 156.57± 1.10cm, weight 47.98± 1.35kg, BMI 19.56± 0.48) and non-athletes (N2=30, mean ± SD: age 15.37± 1.10years, height 156.80± 1.03 cm, weight 48.42± 1.62kg, BMI 19.70± 0.65) selected from different schools affiliated to Punjab School Education Board, Punjab, India. Height measurements were taken by using the standard anthropometric rod to the nearest 0.5 cm. The subject's weight was measured with portable weighing machine to the nearest 0.5 kg. 50 yard dash test was used to estimate speed. Sit-ups test was used to assess the muscular strength. 600 yards run or walk test was used to measure cardiovascular endurance. The Vertical jump test was used to assess explosive power of the legs. Shuttle run test was used to monitor the agility of the subjects. The independent samples t-test was applied to assess the differences between football and volleyball players. The results of present study indicated that athletes had significantly greater speed ($p<0.05$), strength ($p<0.05$), endurance ($p<0.05$), power ($p<0.05$) and agility ($p<0.05$) than non-athletes.

Keywords: *Athletes, non-athletes, speed, strength, endurance, power, agility.*

Introduction

Physical fitness is, in a very broad sense, determined by the individual's capacity for optional work and motor and sport performance (Astrand & Rodahl, 1986). Physical fitness is maintained by a healthy life style, including habitual physical activity (Das & Dhundasi, 2001). Physical fitness acquired in growing children provides healthy impact on cardio-respiratory system. Several factors like heredity, environment, diet, socioeconomic status and training are known to contribute to physical fitness of an individual (Khodnapur, 2012). Physical fitness can be thought of as an integrated measure of most, if not all, the body functions involved in the performance of daily physical activity or physical exercise

(Ortega et al., 2008). Physical fitness is recognized as an important component of health(Lamb et al., 1998; Twisk et al.,2002) and it may be important for the performance of functional activities and quality of life (Noreau & Shephard, 1995; Singh & Singh, 2012). Low physical fitness in children has been associated with impaired health indicators such as increased body fatness (Dencker et al., 2006), hypertension (Katzmarzyk et al., 2001; Ruiz et al., 2006) and low physical activity (Dencker et al., 2006). Physical fitness is measured by functional tests that are specific and usually normative-based, rather than criterion-based, thereby leaving unanswered as to how much of a specific fitness factor is required for a good quality of life (Chia et al., 2007). Athletes are commonly associated with a physically active lifestyle as compare to non-athletes, which is beneficial to physical fitness. Due to regular exercise, athletes tend to have an increase in physical fitness when compared to non-exercising individuals. Exercise is stressful condition which produces a marked change in body functions. Exercise and physical activity impact on wellness and fitness (Lee et al., 1995). Sedentary life styles could be associated with less efficient body functions. Therefore, the purpose of the study was to compare the physical fitness between adolescent athletes and non-athletes.

Materials and Methods

Subjects

The present study was conducted on a sample of sixty (N=60) adolescent, which includes thirty each, athletes (N1=30, mean ± SD: age 15.37± 1.10years, height 156.57± 1.10cm, weight 47.98± 1.35kg, BMI 19.56± 0.48) and non-athletes (N2=30, mean ± SD: age 15.37± 1.10years, height 156.80± 1.03 cm, weight 48.42± 1.62kg, BMI 19.70± 0.65) selected from different schools affiliated to Punjab School Education Board, Punjab, India. All the participants were informed about aim and methodology of the study and they volunteered to participate in this study. The purposive sampling method was used to select the subjects for the present study. The age of each subject was calculated from the date of birth as recorded in his school.

Methodology

Height measurements were taken by using the standard anthropometric rod (HG-72, Nexgen ergonomics, Canada) to the nearest 0.5 cm. Full attention was given to make sure that players' body was fully upright and their mandible was parallel to the ground. Taken values recorded in 'cm'. The subject's weight was measured with portable weighing machine to the nearest 0.5 kg. During measurements players were on bare feet and wearing underwear only. Measurements recorded in 'kg'. BMI was calculated by the formula of; Body Mass Index = Weight/Height^2.

Physical Fitness Tests

A 50 yard dash test (Johnson & Nelson, 1982).was used to estimate Speed. The time taken by the subjects to complete the test in sec was the net score of the

subjects. Sit-ups test (AAPHER, 1965) was used to assess the muscular strength. The score of the test is the number of correctly executed sit ups performed by the subjects in 60 seconds. 600 yards Run or Walk test (AAPHER, 1965) was used to measure cardiovascular endurance. The time taken to run 600 yards recorded in min. The Vertical jump test (Fleishman, 1964) was used to assess explosive power of the legs. Shuttle Run test (Johnson & Nelson, 1982) was used to monitor the agility of the subjects. The time taken by the subjects between the audible signal 'start' and the finishing of the run was recorded to be the score. The time was recorded correct in sec.

Statistical Analyses

Values are presented as mean values and SD. Independent samples t tests were used to test if population means estimated by two independent samples differed significantly. Data was analyzed using SPSS Version 16.0 (Statistical Package for the Social Sciences, version 16.0, SPSS Inc, Chicago, IL, USA).

Results

Table-2.
Demographic Characteristics of adolescent Athletes and Non-Athletes.

Sports Group	Age (yrs)		Height (cm)		Weight (Kg)		BMI	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Athletes	15.37	1.10	156.57	1.10	47.98	1.35	19.56	0.48
Non Athletes	15.37	1.10	156.80	1.03	48.42	1.62	19.70	0.65

Table-2: depicts the demographic characteristics of adolescent athletes and non- athletes. The mean age of athletes was 15.37 years and non-athletes were 15.37 years. The mean height of athletes was 156.57 cm and non-athletes were 156.80 cm. The mean weight of athletes was 47.98 kg and non-athletes were 48.42 kg. The mean BMI value of athletes was 19.56 and non-athletes were 19.70.

Table-3.
Physical Fitness Components of adolescent Athletes and Non-Athletes.

VARIABLES	Athletes (N1 = 30)		Non-Athletes (N2 = 30)		Mean Difference	SEDM	t-value	Sig.
	Mean	SD	Mean	SD				
Speed	7.88	0.45	8.56	0.21	0.68	0.09	7.54*	0.00
Strength	20.80	1.06	18.10	0.71	2.70	0.23	11.55*	0.00

Endurance	1.54	0.01	1.71	0.22	0.17	0.04	3.98*	0.00
Power	31.49	0.84	27.58	1.07	3.91	0.25	15.73*	0.00
Agility	13.57	0.20	13.89	0.48	0.32	0.09	3.31*	0.00

*Significant at 0.05 level $t_{.05}$ *(58) =1.671*

Table 3 presents the physical fitness characteristics of adolescent athletes and non- athletes. The results depicts that athletes had significantly greater speed ($p<0.05$), strength ($p<0.05$), endurance ($p<0.05$), power ($p<0.05$) and agility ($p<0.05$) than non-athletes.

Discussion

In the present study physical fitness components of the adolescent athletes and non- athletes have been evaluated and compared with each other. This study indicates the existence of physical fitness variables differences among the athletes and non- athletes. The demographic characteristics of athletes and non- athletes show that non-athletes were taller and heavier as compared to the athletes. The results of present study indicated that athletes had significantly greater physical fitness components i.e. speed, strength, endurance, power and agility than non-athletes. This is because of regular exercise which brings changes on the body. In a study by Pakkala and coworkers significantly higher values of cardiopulmonary efficiency in athletes were observed as compared to non-athletes (Pakkala et al., 2005). Ara et al.(2007) observed that physically active children had significantly higher values of physical fitness parameters than that of non-physically active children.

Conclusion

Significant differences were found between athletes and non-athletes with regard to selected physical fitness characteristics i.e. speed, strength, endurance, power and agility than non-athletes. The athletes had higher speed, strength, endurance, power and agility than non-athletes. According to the obtained results in this study it is concluded that further, athletes dad better physical fitness than non-athletes.

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Impact of Pranayamas on Stress of Males School Going Student

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Abstract

The aim of this study was to observe the impact of Pranayamas on stress of subjects with the age range 14 to 15 years. For this 30 male subjects were drawn from Beliatore high school, Beliatore, Dist: Bankura (W.B) by using simple random sampling. Pre post data were collected before and after intervention of Pranayama for 45 days using stress inventory for school students (SISS) by Seema Rani and Dr. Basant Bahadur Singh. Since calculated value of t (=6.57) is greater than tabulated $t_{0.05}$ *(29) (=2.045). It is concluded that Pranayama plays positive and significant role to decrease stress level of the subjects.*

Keywords: *Pranayama, Stress.*

Introduction

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tasmin-sati svasa-prasvasa-yor-gati-vicchedah prana-yamah,

– Patanjali Yoga Sutra II:49.

tasmin- in that.

sati- while being.

svasa- inhalation.

prasvasa- exhalation.

yoh (→r)- 6th, possessive case suffix-dual of the two.

gati- motion, here rhythmic regular movement.

vicchedah- cut, interruption, break, (is).

pranayama (h)- pranayama(is).

Two Sanskrit words are combined in the word 'Pranayama' Prana and Ayama. 'Prana' means life force i.e Breath. 'Ayama' means development or control. Therefore Pranayama is the control of breath .Breath is the life force that sustains life. Nobody can survive more than a few minutes without air. When the breath stops, life ends .In simple terms pranayama may be called the control of the breath. Its essence lies in the modification of our normal process of breathing.The practice of Pranayama and Meditation, and must be achieved before union can take place with the higher reality. The application is pranama is considered beneficial for health and cure of certain disease for stress management and for improving general efficiency of individual is different fields. pranayama is also a spiritual pursuit for many seekers of truth. In the modern world, western countries like America use pranayama as a tool for mental, physical and spiritual up liftmen.

Objectives: This study has aimed to study the impact of Pranayamas on stress level of the male subjects,

Hypothesis: Practice of Pranayamas causes significant decrease in stress level of the all subjects.

Methodology

Sampling

This study was conducted in 30 samples from Beliatore High School, Beliatore, Dist: Bankura (W.B).Samples were selected by applying the simple random sampling using lottery method. 30 were males of age range 14-15yrs.

Research design: pre-post single group

Symbolically, A Q_1 X Q_2

Where,

A= single group

Q = pre- test

X= Pranayama (45 min. for each morning and evening per day)

Q2= Post-test

Procedures

Using stress inventory for school students (SISS) by Seema Rani and Dr. Basant Bahadur Singh Firstly, by using SISS questioner of each subject was measured and post measurement of SISS questioner for the same subjects were taken after allowing practice of Nadisodhan Pranayama for 45 days. During the practice, each subject was allowed for inhalation (Puraka), retention (kumbhaka) and exhalation (Recaka) in equal ratio, thrice through left nostril and the same through right nostril and then inhalation through both nostrils and the exhalation through mouth which is supposed to be one round. Same procedure was suggested with

different deep feelings in Puraka, Kumbhaka and Recaka steps. The reference of this technique can be obtained from Super Science of Gayatri writen by Pandit Sriram Sharma Acaaya, founder of all worlds Gayatri Pariwara.

Results & Discussion

Table -1

Paired Sample Statistics

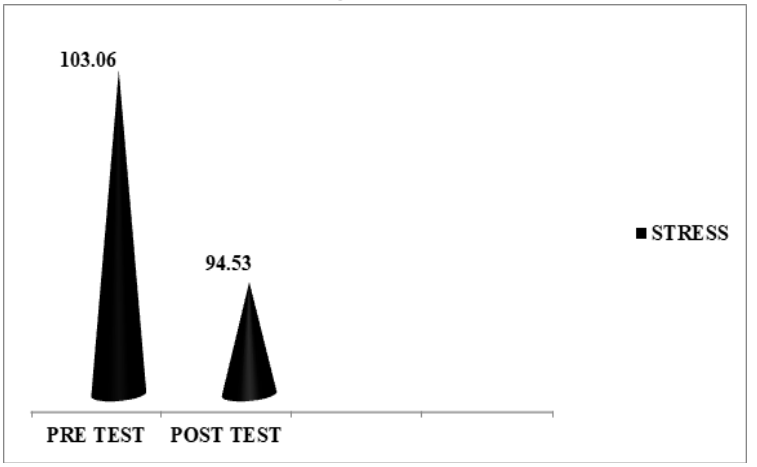
		Mean	N	S.D	S.E(Mean)
Pair 1	Pre Stress.	103.06	30	18.12	3.30
	Post Stress.	94.53	30	15.48	2.82

TABLE-2

Paired T-Test Table

	Paired Differences					t	df	Sig.(2-tailed)
	Mean	S.D	SE (Mean)	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Pre- Stress. Post- Stress.	8.53	7.10	1.29	5.87	11.18	6.57	29	0.000

Figure:-1



Graph for Total Subjects (Mean)

Interpretation of Findings

The following interpretation can be made on the basis of the results shown in the above output.

The values of the mean, standard deviation and standard error of the mean for the data on Haemoglobin in the pre and post testing are shown in the Table-1.

These values can be used for further analysis.

2. It can be seen from Table-2 that the value of t statistic is 6.57. This t value is significant as the p value is 0.000 which is less than 0.05.

For one - tail test, the value of tabulated t at 0.05 level of significance and 29 (N -1 = 29) df which is 2.045. Since calculated value of t (=6.57) is greater than tabulated $t_{0.05}$ (29) (=2.045), Hypothesis may be accepted and it may be concluded that Practice of Pranayama causes significant decrease in the stress level of the all subjects.

Discussion

The effectiveness of Pranayama programme may be due to the reason that Pranayama programme decrease the level of stress of individuals, as by practicing the Pranayama the arousal level of the individual is regulated which in return help us to decrease the stress level. Therefore, proposed hypothesis has been accepted in case of stress.

Conclusions

Pranayama decrease the Stress level of school going student.

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Resting Pulse Rate: Exploring The Effects of Aerobic Dance And Pranayama

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Abstract

The purpose of the present investigation was to study the effects of aerobic dance and pranayama on resting pulse rate of college students. The study was experimental in nature with pre-test and post-test on experiment groups and control group design. The sample comprised ninety (N=90) boy students of age ranged between 19 to 21 years, belonging to three different colleges of Kapurthala and Jalandhar district. The colleges were randomly assigned treatment. Further ninety (N=90) students were divided equally thirty (N=30) in experiment group-1& group-2 and control group. The resting pulse rate was measured as the heart beat per minute. For this, stopwatch 1/10th of a second was used to record the pulse rate of subjects. The number of heart beats per minutes was recorded as the score. The data was analyzed with the help of Analysis of Covariance through SPSS. The Scheffe's test was also applied to see the difference between adjusted post means of resting pulse rate among experimental groups and control group. The post test resting pulse rate significantly improved with mean values i.e. 68.83 and 68.81 respectively after experiment of the aerobic dance and pranayama programme of experimental groups. The resut of Scheffe's test reveals that aerobic group and control group; pranayama and control group differ significantly, whereas aerobic group and pranayama group found insignificant

Keywords: *Aerobic Dance, Pranayama, Pulse Rate, Analysis of Covariance*

Introduction

Resting pulse rate is known as individual's heart beat during rest in one minute. It has very close relation with individual health and fitness. Globally aerobic dance and pranayama are practiced to attain good health and fitness. Davis et al. (2006) defined that, "fitness is a general term referring to the ability of a person to perform a series of varied physical exercise". The components of fitness are determined by several variables including the individual's pattern of living habits,

diet, environment and heredity. Generally, fitness is operationalized in western societies with focus on two goals i.e. performance and health. Fitness is necessary for performance and optimal work in daily routine life. Health related fitness refers to those components of fitness which are affected favorably or unfavorably by habitual physical activity related to health status. One of the most important aspects of health related fitness is the cardiovascular endurance or aerobic capacity of an individual. Wiggins et al. (2005) stated that, "aerobic capacity is the ability of the cardiovascular system to take in and transport oxygen to the working muscles where it can be utilized and aerobic performance maintained". Aerobic fitness involves many important organs and tells much about the health in general. When aerobic fitness is high then physical and mental health enhances. Physical fitness prepares the body to perform strenuous activity without getting fatigue. Mental fitness prepares the mind to face tough tasks and challenges.

Aerobic dance is a form of rhythmic physical exercise which is generally practiced on music with planned pauses or continuously. Pranayama is an important part of yoga (Patil & Sawant, 2012). Yogic breathing techniques are termed as pranayama. Ankad et al. (2011) stated that the essence of the pranayama practice with slow and deep breathing is economical as it reduces dead space ventilation. Pranayama is a technique which helps to activate the quantity of prana (breath) in the body for a higher frequency. The science of pranayama is based on retention of prana or kumbhaka and the duration of breath retention has to be increased. When breath retention is held for a prolonged period, mental agitation is curtailed. Inhalation and exhalation are methods of inducing retention. Retention is most important because it allows a longer period for the assimilation of prana and allows more time for the exchange of gases i.e., oxygen and carbon dioxide in the cells. Breath and consciousness are essentially linked and can be separated by scientific yogic technique of learning to retain the breath. Chaitow et al. (2014) mentioned that yoga techniques including pranayama have several beneficial effects on lung capacity. Thus, aerobic dance and pranayama are kind of exercises based on how oxygen is utilized by the body. It would be useful to study the effects of aerobic dance and pranayama programme on the normal functioning of the cardiovascular system. This may contribute to attain better fitness and health. Previously studies have been done in which effect of either aerobic dance or pranayama on resting pulse rate studied (Shiotani et al., 2009; Kumar, 2010 and Khetmalis, 2012). However, the present investigation was an attempt to study and compare the effects of aerobic dance and pranayama on pulse rate of college level boy students.

Methodology

Sample: The sample comprised ninety (N=90) boys selected from Ramgarhia College, Phagwara; Guru Nanak College, Phagwara and Lyallpur Khalsa College, Jalandhar. The subjects were divided into three groups and each group consisted of thirty (N=30) subjects from each college respectively. Further, selected subjects

were divided into experimental group-1, experimental group -2 and control group. The participants had no previous history of participation in any sports and games. The age group of the subjects ranged between 19 to 21 years.

Tool: The resting pulse rate was dependent variable in the study. The stopwatch 1/10th of a second was used to record the heart beat of subjects. The number of heart beats per minutes was recorded as the score. The pulse rate of all groups was recorded in sitting position in morning time before aerobic dance and pranayama practise. Sufficient rest was given to subjects before recording the pulse rate. To record the pulse rate of subjects' finger tips were placed on the radical artery at wrist in such manner that palpation can be recorded for one minute.

Procedure: The two experimental groups were given different training programmes, namely aerobic dance and pranayama. The third group acted as control group which did not undergo any physical training. The data on the selected variables were collected before and after the training period of eight weeks. Group 1 & 2 were given aerobic dance and pranayama training respectively by researchers himself for eight weeks. Six days in week were experiment days and sunday was complete rest day. Every morning from 7 am to 8 am. (One hour) for aerobic dance and pranayama including warming up and cooling down given under special instructions to experiment group 1 & 2.

Statistical Analysis: Mean and S.D. were calculated and Analysis of Covariance was applied to find out the difference among experiment and control groups through SPSS. Further Scheffe's test was applied to see the difference between adjusted post test mean of resting pulse rate. The level of significance was set at 0.05.

Results and Discussion

The influence of independent variables (aerobic dance and pranayama) on criterion variable (resting pulse rate) was determined by subjecting the collected data to the Analysis of Covariance and presented below in Table 1

Table – 1

Analysis of covariance on resting pulse rate of aerobic dance, pranayama and control groups

test	Aerobic Dance Group	Pranayama Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained 'F' value
Pre-test								
Mean	81.3	80.03	80.7	Between	25.356	2	12.678	0.13
S.D.	11.37	10.12	7.78	Within	8471.93	87	97.379	
Post-test								
Mean	69.3	68.33	81	Between	2729.76	2	1364.88	23.04*
S.D.	8.5	8.35	7.23	Within	5153.53	87	59.24	

Adjusted Post-test								
Mean	68.83	68.81	80.99	Between	2697.63	2	1348.82	114.9*
				Within	1009.56	86	11.74	

* Significant at 0.05 level of confidence.

(The table values required for significance at 0.05 level of confidence for 2 and 87, 2 and 86 are 3.114 and 3.115 respectively).

Table-1 shows that the pre-test Mean and S.D. values on resting pulse rate for aerobic dance, pranayama and control groups were 81.3, 11.37, 80.03, 10.12 and 80.7, 7.78 respectively. The obtained 'F' ratio value of 0.13 for pre-test score of aerobic dance, pranayama and control groups on resting pulse rate was less than the required table value of 3.114 for significance with df 2 and 87 at .05 level of confidence.

The post-test mean values of resting pulse rate for aerobic dance, pranayama and control groups were 69.30, 68.33, and 81.00 respectively. The obtained 'F' value of 23.04 for post-test scores of aerobic dance, pranayama and control groups was more than the required table value of 3.114 for significance with df 2/87 at .05 level of confidence.

The adjusted post-test mean values of resting pulse rate for aerobic dance, pranayama and control groups were 68.83, 68.81 and 80.99 respectively. The obtained 'F' value of 114.90 for adjusted post-test scores of aerobic dance, pranayama and control groups were more than the required table value of 3.115 for significance with df 2/86 at .05 level of confidence.

The result of this study showed that there was a significant difference between aerobic dance, pranayama and control groups on resting pulse rate. Further to determine which of the paired means had a significant difference that Scheffé's test was applied and the result presented in Table, 2.

Table – 2

Scheffĕ s test for the difference between the adjusted post-test mean of resting pulse rate

Adjusted Post Test Means			Mean Difference
Aerobic Dance Group	Pranayama Group	Control Group	
68.83	68.81		0.02
	68.81	80.99	12.18*
68.83		80.99	12.16*

* Significant at .05 level of confidence.

Table-2 shows that the adjusted post-test mean difference in resting pulse rate between aerobic dance, pranayama and control group are 0.02, 12.18 and 12.16 respectively. Since the adjusted post-test mean difference between aerobic dance and pranayama is not significant. The adjusted post-test means difference between

aerobic dance and control group; pranayama and control group, were significant at 0.05 level of confidence.

Discussion

The post-test result showed that significant difference found among aerobic dance, pranayama and control groups in relation to their resting pulse rate. The adjusted post-test mean difference in resting pulse rate among aerobic dance group and pranayama group showed that both experimental groups improved in resting pulse rate as compare to control group. Further Scheffe's post-hoc test reveals that significance difference found between aerobic dance group and control group, pranayama group and control group, whereas aerobic dance group and pranayama group did not find significant difference. Aerobic dance and pranayama training help to improve fitness and health benefits. Chakraborty (1983) stated that dance offer a wide range of rhythmic movements i.e. bending, jumping squatting and swinging and results of study determined which helps to improve physiological aspects of individuals. Shenbagavalli and Mary (2008) indicated that aerobic training helps the subject to decrease the weight and BMI. They concluded that mild aerobic training can be adopted by obese men to decrease the magnitude of obesity. Kaul (1984) concluded that pranayama is a special form of exercise which helps to improve fitness. It also corrects disorder of circulatory and respiratory system. Kumar and Elangovan (2011) concluded that experimental group has achieved significant improvement on selected motor ability components of speed, agility and leg explosive power. Kumar, et al. (2008) find out that yoga therapy has a positive effect on reducing body weight, total cholesterol, LDL and HDL in blood of women. The results of study revealed a great potential of yoga for healthier living. Mishra et al. (2011) carried out research on school level boys and concluded that programme of yoga is beneficial for students to develop better lung functioning. Auvai (2013) concluded that yoga training significantly decreased blood pressure and pulse rate of engineering college students. The results of above quoted studies support the results of present investigation that resting pulse rate indicates the status of cardiovascular system of individuals. Both aerobic dance and pranayama reduces the resting pulse rate of individual which indicates that both training programmes help to improve good health of students.

Conclusion

The resting pulse rate was significantly improved after the aerobic dance and pranayama when compared with the control group. Whereas aerobic dance and pranayama group did not differ significantly in improving resting pulse rate. The study has implications for college stakeholders in general for good health. Better results can be obtained by following training regimen based upon either aerobic dance as well as pranayama.

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Effect of Olympic Lift Training On The Sprinting Ability of 100 Meters Sprinters

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Abstract

The purpose of the present study was to assess the effect of intensity manipulation of Olympic lift training on the sprinting ability of 100 meters sprinters. The subjects were 30 male elite sprinters of 18 to 25 years of age group from Lakshmibai National Institute of Physical Education, NERC. They were assigned into 2 groups: A (Intensity manipulation of Olympic lift training; n=15) and B (control; n=15). The training was given for a period of 6 weeks. The experimental groups were trained thrice a week, while the control group continued with their daily routine work. The performances of sprinting ability of the subjects were taken by the Smart Block. The different sprinting ability- Run time, Raw time, Reaction time, Peak force (R), Peak force (L) Push time and Timed runs were measured with the use of a smart block The between-group differences were assessed using the student's t-test for dependent data. The level of p≤0.05 was considered significant. Significant between-group differences were found for Run time (t=3.00), Raw time (t=3.03*), Reaction time (t=5.84*), Peak force (R) (t=4.40*), Peak force (L) (t=3.82*), Push time (t=2.48*), and Timed runs (t=2.93*), since the computed value of t for all the dimensions were greater than the tabulated t.05 (14) =2.145. The result was found that the sprinters significant difference in their sprinting ability components*

Keywords: *Intensity Manipulation, Olympic Lift Training, Sprinting Ability, Sprinters, Smart Block, University Athletes*

Introduction

Today the sports persons are trained scientifically with the latest training methods and sophisticated instruments for higher performance improvement in different sphere of sports. Training is not a recent discovery. In ancient times, people systematically trained for military and Olympic endeavors. Today athletes prepare themselves for a goal through training (Tudor, 1999). In the recent years greater stress has been laid on the quality rather than the quantity of

training. The sports scientists and experts of sports want their sportsman to extract maximum achievement from their training procedure without causing too much strain on them (Asha, 1980). Over the years this form of training has been employed extensively to improve many power oriented movements in a variety of sports. There are many variations on the theme of power training. Some of these training principles include plyometrics, assisted and resisted training and speed and acceleration drills. A popular method used to increase athletic power is Olympic lifting (ie power cleans, push presses, snatches, jump jerks and their variations) conducted in the weight room. This has traditionally been seen as an effective way of producing general explosive ability. However, considering motor skill and neurological aspects of movement, the logic of employing Olympic Lifts in power training becomes unclear. Therefore, the interpretation and application of Olympic lifting to the development of power will be considered (Takano, 1992).

Smart block will increase the athlete personal best. Smart block help to customized start optimized each athlete the unique ability. Smart block is a brilliant invention to uses panel technology smart block uses the audible "On your marks" at audible set and audible gun start smart block store performance status for each run. Smart block help your athlete achieve faster reaction time.

Methods

Subjects: A total thirty (15 experimental and 15 control) athletes of Sports Authority of India, Guwahati has been selected for this study. Their mean height, weight, and age were 1.87±0.04m, 76.5± 5.2kg, 23.5± 0.4 years. The purposive sampling technique was used to attain the objectives of the study. All the subjects, after having been informed about the objective and protocol of the study, gave their consent and volunteered to participate in this study. They were further divided into two groups N = 15 each (i.e., N1=15; Experimental and N2=15; and Control). The study was further delimited to selected sprinting ability components i.e., (Run time, Raw time, Reaction time, Peak force (R), Peak force (L) Push time and Timed runs).

The Instant Feedback App provides the ease-of-use and actionable, measureable data that coaches need to make the effective adjustments necessary to improve the performance of their athletes. The screenshot of the Instant Feedback app, with accompanying individual screenshots explaining the type of data that is captured. The ones measured were as follows:

- **Run Time:** Run time gives time runner an indication of whether their efforts/ changes resulted in a faster time. The score is recorded to the nearest 1/10th of a second.
- **Raw Time**: Raw Time shows how fast the athlete ran once they started moving. This shows the real effort of the run and disregards reaction time.
- **Reaction Time:** Reaction Time the time from the gun sounds to when the

athlete pushes on the pedals.

- **Peak Force (R):** Peak Force is the highest force generated from pedals during the drive off the blocks. This is as (R) for right pedal. The score is recorded to the pounds (lbs).
- **Peak Force (L):** Peak Force is the highest force generated from pedals during the drive off the blocks. This is as (L) for left pedal. The score is recorded to the pounds (lbs).
- **Push Time:** Push time shows how long an athlete pushed on the pedals.
- **Timed Runs:** Timed Runs Eye-Beams can be set at a particular distance to time a run.

Six Week of Olympic Lift Training Programme: Subjects were trained thrice a week i.e. on Monday, Wednesday and Friday. The subjects performed Power Clean, Snatch, Push Press, Push jerk and Split jerk. 10-15 repetitions in each of the 3 sets, with 50% weight of 1 repetition maximum and with 3 min recovery period in between each set. Finally for last three weeks the exercises were performed with 60% weight of 1 R.M., 10-12 repetitions in each of the 3 sets with 2 min recovery period in between sets.

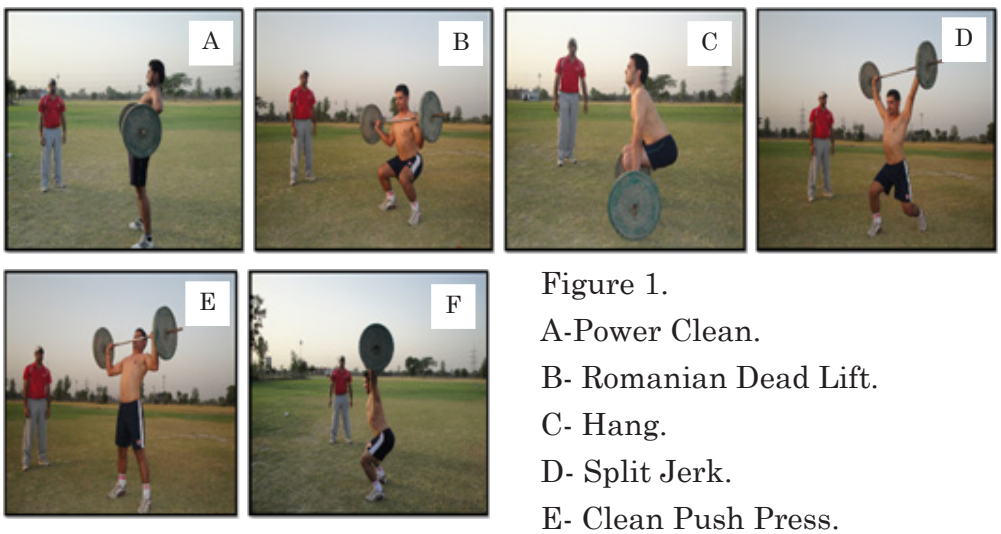


Figure 1.
A-Power Clean.
B- Romanian Dead Lift.
C- Hang.
D- Split Jerk.
E- Clean Push Press.

Data Analysis

The Instant Feedback App provides the ease-of-use and actionable, measureable data that coaches need to make the effective adjustments necessary to improve the performance of their athletes. Student's t-test was used to assess the between group differences. The level of $p \leq 0.05$ was considered significant.

Results

The study was conducted to assess the effects of intensity manipulation of Olympic lift training on Sprinting ability of 100 meters Sprinters. The statistical

analysis of data collected on thirty (N=30) subjects. The finding have shown the significant value of F- ratio's for selected variables in the experimental training group as compared with the control group. No significant changes over that 4-week period were noted in the control group. The graphical representation of responses has been exhibited in Fig.2.

The hypothesis was rejected because of significant differences were obtained in the sprinting ability of sprinters. The results pertaining to significant difference, if any, between experimental and control groups were assessed by "t" test and are presented in following tables:

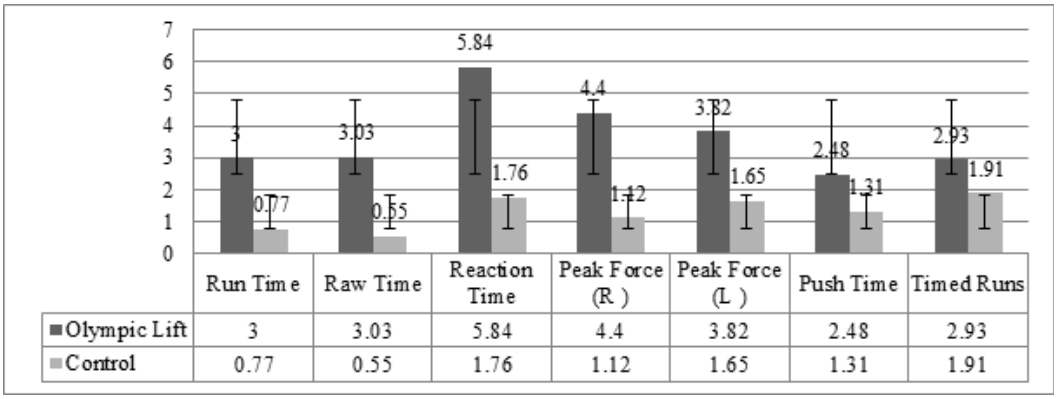
Table -1.

Sprinting ability of Experimental Group Paired Samples t-Test

Variables	Olympic Lift			Control Group		
	Pre	Post	t-value	Pre	Post	t-value
Run time	2.52	2.51	3.00*	2.53	2.53	0.77
Raw time	0.13	0.12	3.03*	0.13	0.13	0.55
Reaction time	2.40	2.29	5.84*	2.40	2.38	1.76
Peak force (R)	27.46	23.8	4.40*	27.13	28.53	1.12
Peak force (L)	52.26	59.2	3.82*	52.4	56.26	1.65
Push time	0.15	0.17	2.48*	0.148	0.159	1.31
Timed runs	0.16	0.19	2.93*	0.167	0.186	1.91

Figure-2.

Performance parameter of sprinting ability of sprinters before and after training



Significant between-group differences were found for Run time (t=3.00*), Raw time (t=3.03*), Reaction time (t=5.84*), Peak force (R) (t=4.40*), Peak force (L) (t=3.82*), Push time (t=2.48*), and Timed runs (t=2.93*), since the computed value of t for all the dimensions were greater than the tabulated t.05 (14) =2.145. Thus it is concluded that the sprinting ability components of sprinters found to be

statistically significant.

Discussion

Weight training depends on the individual, though considers it an important part of training programme. If everything else is equal among sprinters, the strongest sprinter will be the winner. Be consistent in the way you set the blocks. Put your strong leg in front. Your starting position should be comfortable, balance. For better performance in sprinting emphasize should be as relaxed as possible while running. Keep mouth open slightly. Relax jaw and entire face, even eyes. Don't grit teeth. Proper running form helps to run efficiently and positions to move as quickly and powerfully as one can. The angle of your body to the ground should be slightly forward, so that pushing off the ground while running. The body should be straight but leaning slightly forward. Finally proper Run time, Raw time, Reaction time, Peak force (R), Peak force (L) Push time and Timed runs is important to running best. All the energy should be used to go forward. About two-third of the race is acceleration. Then enter the stage where sprinter try to maintain speed. Many races won and lost in the last 10 to 15 meters where the sprinter slowing down, trained sprinters just slowing down less than everyone else. How to become a better Sprinter, Carl Lewis and Tom Tellez. The factors that sprinters should look for setting up the starting block, the optimal 'set' position for an athlete, and what an athlete should do during the acceleration phase of the sprint to maximize performance. The present study showed that the between-group differences were found for Run time (t=3.00*), Raw time (t=3.03*), Reaction time (t=5.84*), Peak force (R) (t=4.40*), Peak force (L) (t=3.82*), Push time (t=2.48*), and Timed runs (t=2.93*), since the computed value of t for all the dimensions were greater than the tabulated t.05 (14) =2.145.

Conclusion

In conclusion, the present study suggests that 6-week intensity manipulation of Olympic lift training had significant effect on sprinting ability of sprinters. These data provide more scientific evidence to support the beneficial effect of intensity manipulation of Olympic lift training on sprinting ability and thus, such training may be recommended to improve physical and physiological based performance.

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Comparison of the Relative Strength Among the Different Weight Categories of Men Weightlifters of Summer Olympics Games London 2012

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Abstract

Background: *Today is an era of minimum input and maximum output and for this; every possible work is being done to increase efficiency. Every perspective angle is being thoroughly scrutinized by researchers and scientists together, so that sportsman can get maximum mechanical advantage to improve their performance, clear insight of sports during Greek period was reflected in the epic period of Homer. Games were the part of the daily life of the people or any important event. Strength is also one of key to success in modern games and sports. Such as a statement may sound extreme but nevertheless it is true strength, however is the key element because it is more improved than other elements? It is in fact the only element that can only be improved with one hundred percent success. Relative strength formulas are commonly used to determine the overall champion across all weight classes and in open meets, but are also invaluable tools for comparing the progress of a single lifter whose weight fluctuates over time. The analysis and research of the important factors to reach the high level of sport that gives us a real indication of the level of development and delays in sports, if he supported the correct analysis in scientific bases. In the Olympics the athletes compete in several events, including weightlifting, which real heavily on strength, but as the result of the athlete achieved in strength all linked weightlifting law which requires the athlete to compete in the category of grains and specific power is thus here called relative strength. There tore the importance of research in the analysis of the results of relative strength of men weightlifting in Olympic Games was in London 2012.*

Keywords: *Relative strength, Body weight, Lifting score, Weightlifters*

Introduction

Every perspective angle is being thoroughly scrutinized by researchers and scientists together, so that sportsman can get maximum mechanical advantage to improve their performance, clear insight of sports during Greek period was reflected in the epic period of Homer. Games were the part of the daily life of the people or any important event.[1] Sports can improve the components of fitness namely: Strength, speed, endurance, flexibility and suppleness. Strength, the ability to exert muscular force is a component of physical fitness and has been of interest since antiquity and many account of super human quality to lift stupendous weight have been recorded. The scientific principles of increasing the load of resistance against which muscles work that strength increases has been called progressive exercise and has been employed extensively in modern times by individuals interested in strength development and athletic performance.[2] Research indicates that for untrained individual not engaged in heavy manual labor or exercise, maximum muscles strength is reached between the ages of eighteen and twenty, after which it decreases gradually. With increased age and disuse of muscle there can be marked reduction in muscular strength.[3] Strength is also one of key to success in modern games and sports. Such as a statement may sound extreme but nevertheless it is true strength, however is the key element because it is more improved than other elements? It is in fact the only element that can only be improved with one hundred percent success.[4] Strength training is not only limited to competitive sports, but also training for prevention and rehabilitation, as well as strength training as a leisure time activity in gym is now quite common, strength training was, and still is a major part of athletic training with the aim to improve performance.[5] Power lifting consists of three separate lifts; the squat, bench press and dead lift. In competitions people are grouped into weight classes where they compete against people of similar weight. Each lifter is allowed 3 attempts in each lift to lift the most weight they can. In order for a lift to be considered "good" at least two of three judges must agree that it was "good" lift, meeting all the rules of the power lifting competition for that lift.[6]

Methods

The population of the research has been chosen from the athletes participated in the Summer Olympics games of London /2012 in weightlifting for men, totaling (60) players. Weightlifters were divided into three groups of twenty (20) each in different weight categories. Group – I which covering the light weightlifters of second and third weight categories. Group-II which covering the middle weightlifters of fourth and fifth weight categories. Group-III which covering the heavyweight lifters of sixth and seventh weight categories. The reliability of data was ensured by establishing the instrument reliability and testers competence. The sum of the best 3 lift of respective events was considered as the scores of the lifters.The procedure for administration of the test only six (6) categories of

actual eight (08) body weight categories was taken by eliminating the first and last categories i.e. up to 56 kilograms and + 105 kilogram category for relative strength of weightlifters. The score or performance achieved in the weight lifting namely: Snatch, Clean and Jerk lift by the subjects can be divided with the body weight. The relative strength was recorded in kilograms. The scores or performance of the lifters were analyzed by calculating the means and the data were subject to one way analysis of variance (ANOVA) in order to find out the significance difference in the means. It was assess by conducting the test in Olympic arena by skillful and specialized experts with use of highly technological instruments.

Results

Findings pertaining to relative strength of the different weight categories of Olympics weightlifters 60 subjects were divided into three groups of 20 each. The sum of the best 3 lifts of respective events was considered as the scores of the lifters. The obtained value of 'F' ratio that is 64.93 was greater that the tabulated value of 3.17 for the selected degree of freedom and level of significance which indicates that the subjects of the entire group differ significantly in relative strength. To further analyses which group is better! Pair wise mean comparison analysis was done by using Post Hoc Test. After applying the Post Hoc Test it was found that there was significant difference in the entire three groups in their relative strength. However group I had higher relative strength. The analysis of data reveals that there is a significant difference in relative strength of various categories of lifters was found at the selected level of significance which establishes that various categories of lifters possesses different level of relative strength. After applying the Post Hoc Test it was found that there was significance difference in groups I (4.852), Group II (4.432) and Group III (4.040) in their relative strength. However group I had higher relative strength. This may be due to the different nature training and pre-requisite components for lifters. Such results may be due to small size of sample and factors such as different body types, difference in the body compositions etc.

Table-1

Analysis of Variance (Anova) For The Data of Relative Strength of Various Different Categories of Weight Lifters

ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Groups	6.590515	2	3.295257	64.93051	2.015	3.158843
Within Groups	2.89278	57	0.050751			
Total	9.483295	59				

Table-2

Post Hoc Test For The Comparison of Relative Strength Among The Different Weight Catogaries of Weight Lifters

Post hoc Test

LW	MW	HW	CD at 5% Level
4.852	4.432		0.42
4.852		4.040	0.81
	4.432	4.040	0.39

LW: Light Weight, MW=Middle Weight, HW=Heavy Weight

The significant differences in relative strength of different weight categories of power lifters were probably due to the different nature of training and pre-requisite components for athletes. Such results may be due to small size of sample and other factors such as different body type, difference in the body composition etc.

Conclusions

The purpose of the study was to compare the relative strength among the different weight categories of men weightlifters of Summer Olympics in 2012. The population of the research has been chosen from the athletes participated in the Summer Olympics games of London /2012 in weightlifting for men, totaling (60) players. Weightlifters were divided into three groups of twenty (20) each in different weight categories was selected. Group – I which covering the light weightlifters of second and third weight categories. Group-II which covering the middle weightlifters of fourth and fifth weight categories. Group-III which covering the heavy weight lifters of sixth and seventh weight categories. Their relative strength was recorded in kilograms. The scores or performance of the lifters were analyzed by calculating the means and the data were subject to one way analysis of variance in order to find out the significance difference in the means.The relative strength of Olympics weightlifters can be obtained by dividing recorded performance or score with body weight of the subjects. To see the significant difference of relative strength among the different weight categories of Olympics weightlifters the analysis of variance "F-ratio" was applied at.05 level of significance. For further analysis "Post-Hoc Test" (LSD Test) was applied. The results have shown that the lifters participated in various categories differ significantly in their relative strength. The selected level of significance was 0.05. After applying the Post Hoc Test it was found that there was significance difference in groups I (4.852), Group II (4.432) and Group III (4.040) in their relative strength. However group I had higher relative strength.

After applying the Post Hoc Test it was observed that there were significant difference in relative strength, however group I (4.852) had highest relative

strength as its mean value is highest among all group. The analysis of data reveals that there is a significant difference in the entire three groups in their relative strength, however group I had shown highest relative strength as its mean value is highest among all groups.

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Comparative Study of Injuries Among Boys Andgirlsinathletics

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Abstract

Injuries cannot be eliminated from sports or physical activities, but can be minimized, if we can have approximate data of the types of injury (soft tissue and hard tissue) that takes place among boys and girls. Study can act as a boon to the Coaches and Physical educationist, data pertaining to injuries can help in planning training schedule accordingly and can have regular checks on the particular domain. By keeping these facts in mind present study has been conducted. Data has been collected from the state of Punjab i.e. one hundred and thirty eight (138 samples

= 70 boys and 68 girls) subjects between the age group of 16-18 years from the different athletics centre, running in different parts of Punjab. Interview, and observation method was used to collect data for this study. Help of the physiotherapist was also taken to collect the data. After the analysis it was concluded that amongst boys 51.56% of the injuries were soft tissue injury and 48.44% of the injuries were hard tissues injuries, whereas amongst girls 47.89% were soft tissue injuries and 52.11% were hard tissues injuries. After studying the results it is recommended that coaches and physical educationist should design training schedule by keeping in mind the percentage of injuries that boys and girls are prone to, as mentioned in the study.

Keywords: *???*

Introduction

It is inevitable that injuries can be alienated from physical activity and athletics. The risk of injury is much higher in some sports, such as those requiring contact or collision, but is inherent to all athletic activity. Although the majority of athletic injuries are relatively minor, the potential for serious and possible life-threatening injuries is constantly present. The incidence of serious and life-threatening conditions associated with athletic activity has decreased over the

last several years as a result of the decreased delineation in many sports and vast improvements and increased sophistication in all facets of sports medicine and athletic training. Inspite of this increased sophistication, there has been an overall increase in the number of athletics injuries; this is primarily the result of an increase in the number of participants, the intensity of modern training techniques and the expansion of athletic activities. Today a wider selection of athletic activities, physical fitness programs and sports are available to a larger cross-section of the population than ever before. Interest in physical activities and athletics continues to increase the level of participation is no longer limited to high school, college or professional institutes. A greater number of organized athletic programs are available to children in junior high school and upper elementary grades. The number of participants in all areas continues to increase dramatically. People than ever before are participating in life- time activities such as walking, jogging, swimming, golf and tennis. Whatever may be the reason for the dramatic increase in the number of participants and activities available, injuries are reality at every level of participation and in every type of program. Participants in all forms of athletic activity are subjected to many stresses and forces that can result in injury. There are few related studies to the topics are Ghose Aloke (1972) reported that picking up the right participant for the particular sports with requisite physical and mental fitness will avoid much complication. Muckle et al. (1975) the position played by the athletes is also an extrinsic risk factor that can contribute to an injuries. Brukner and Khan (2001) have reported that excessive training volume and intensity, sudden changes in the type of training, excessive fatigues, inadequate recovery, and faulty technique are all training errors can overuse injuries in athletes. Kumar B. (2007) participation in sports and recreational activities have increased injuries in recent time and athletes sport gaining immense popularity between the young players. So in order to minimize the injuries it is important that one should know the type of injury his athletes are more prone.At this stage it is essential to know which type of injuries (soft tissue and hard tissue) that boys and girls are more prone.

Procedure and Methododlogy Convenience sampling method was used to select one hundred and thirty eight (138= 70 boys and 68 girls) subjects from different Athletics training center of Punjab, between the age group of 16-18 years. Interview, and observation method was used to collect data for this study. Help of the physiotherapist was also taken to collect the data. Terms which were used are injury and athletics which are defined as: Injury: Injury can be defined as the d amag e or rupture of the t i s s ue. (Corrigan A. B. Sport's injuries, Hosp. Med.2,1328 1968). Athletics: Sports that involves running, jumping and throwing is known as athletics.

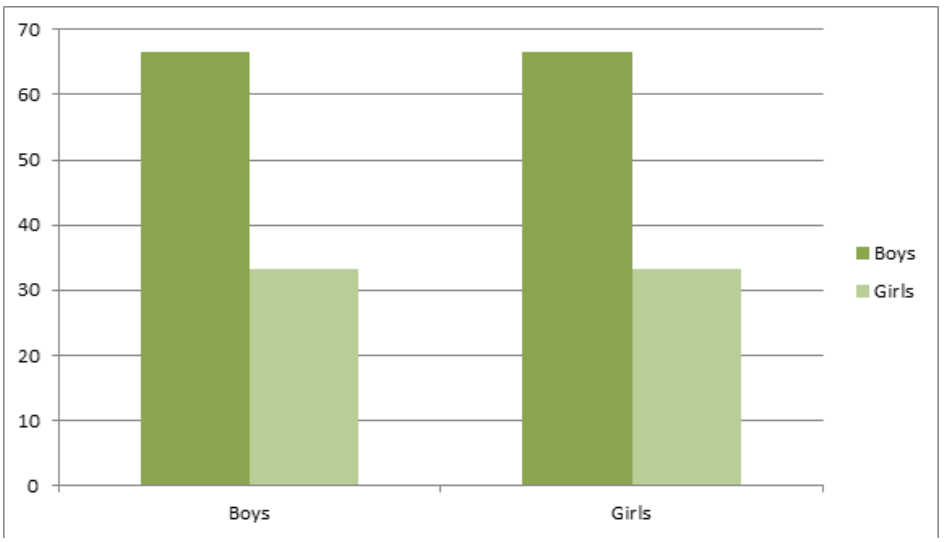
Table-1

Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in 100 Meters

Category	Muscle Injury in Percentage	Bone Injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	66.66	33.33	6
Girls	66.66	33.33	3

Figure-1

Showing the percentage of soft and hard tissue injuries in 100 meters



Soft tissue Hinajurdryt issue injury

Above table 1 and figure 1 are showing, that in 100meters number of muscle injuries among boys and girls are four and two respectively, whereas both the categories have 66.66 percentage of muscle injuries, when bone injuries are considered two boys and one girl were found injured and their percentage is same i.e.33.33 percent.

Table-2

Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in 200 Meters

Category	Muscle Injury in Percentage	Bone Injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	62.5	37.5	8
Girls	50	50	4

Injuries in percentage

Figure-2

Showing the Percentage of Soft and Hard Tissue Injuries in 200 Meters

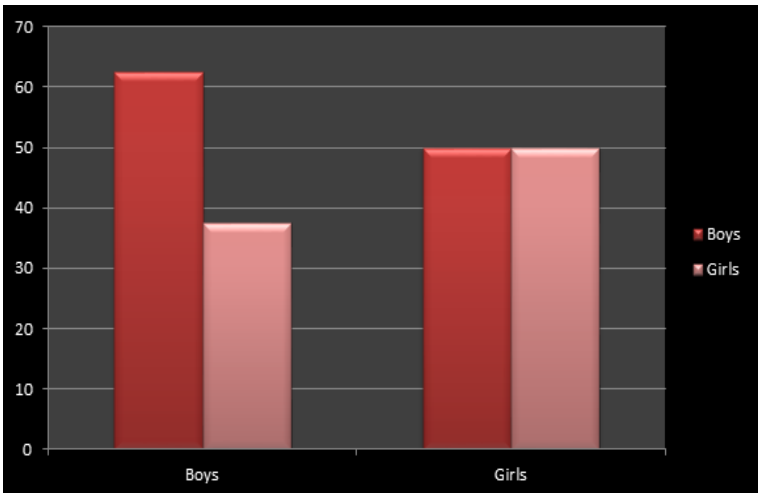


Table 2 and figure 2 indicates that in 200meters five boys and two girls have suffered from muscle injuries, in percentage the value is 62.5 and 50 and bone injuries among boys and girls are three and two respectively, i.e. 37.5 and 50 percentage respectively.

Table -3

Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in 400 Meters

Category	Muscle Injury in Percentage	Bone Injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	60	40	5
Girls	50	50	6

Injures in percentage

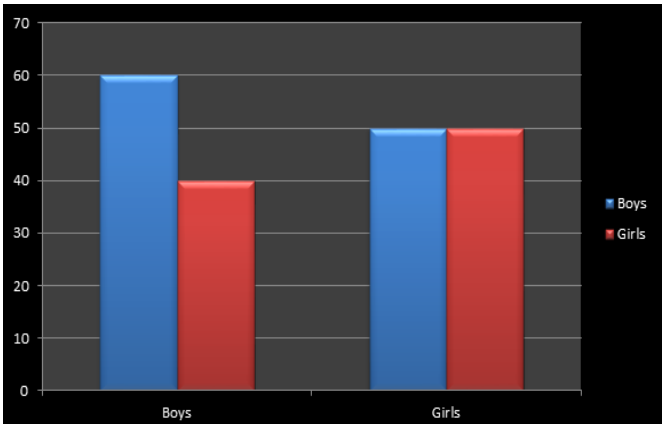
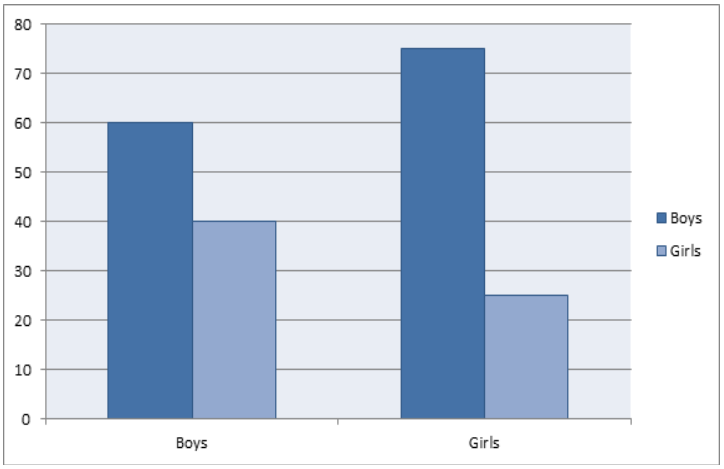


Table 3 and figure 3 indicates that in 400 meters three boys and three girls have suffered from muscle injuries, in percentage the value is 60 and 50 and bone injuries among boys and girls are two and three respectively, i.e. 40 and 50 percentage respectively .

Table-4
Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in 800 Meters

Category	Muscle Injury in Percentage	Bone Injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	60	40	10
Girls	75	25	8



Injuries in percentage

The perusal of table 4 and figure 4 indicates that in 800 meters six boys and six girls have suffered from muscle injuries, in percentage the value is 60 and 75 and bone injuries among boys and girls are four and two respectively, i.e. 40 and 25 percentage respectively.

Table-5
Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in 1500 Meters

Category	Muscle Injury in Percentage	Bone Injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	66.66	33.33	3
Girls	50	50	2

Injuries in percentage

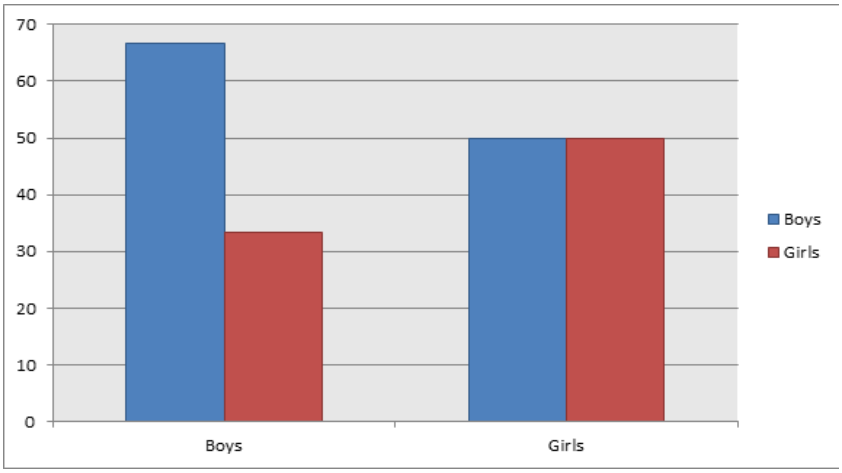


Table 5 and figure 5 indicates that in 1500meters two boys and one girl have suffered from muscle injuries, in percentage the value is 66.66 and 50 and bone injuries among boys and girls are one and one respectively, i.e. 33.33 and 50 percentage respectively .

Table-6

Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in High Jump

Category	Muscle Injury in Percentage	Bone Injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	25	75	4
Girls	40	60	5

Injuries in percentage

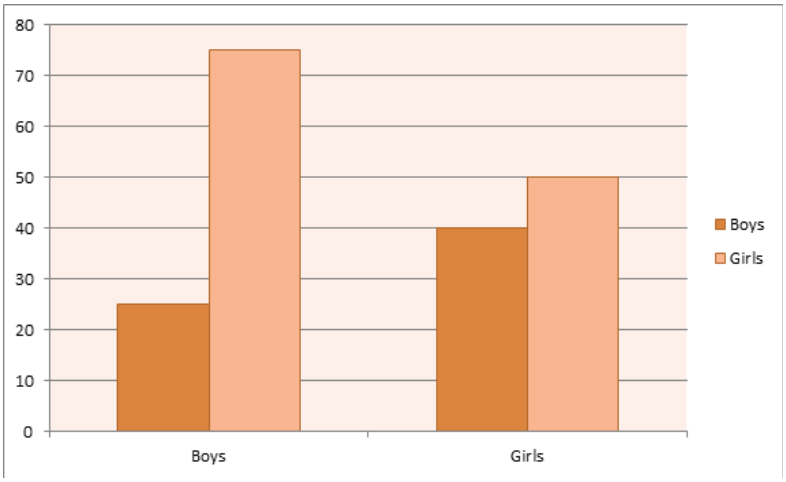


Table 6 and figure 6 indicates that in high jump one boy and two girls have suffered from muscle injuries, in percentage the value is 25 and 40 and bone injuries among boys and girls are three each, i.e. 75 and 60 percentage .

Table-7

Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in Long Jump

Category	Muscle Injury in Percentage	Bone Injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	33.33	66.66	9
Girls	42.8	57.14	7

Injuries in percentage

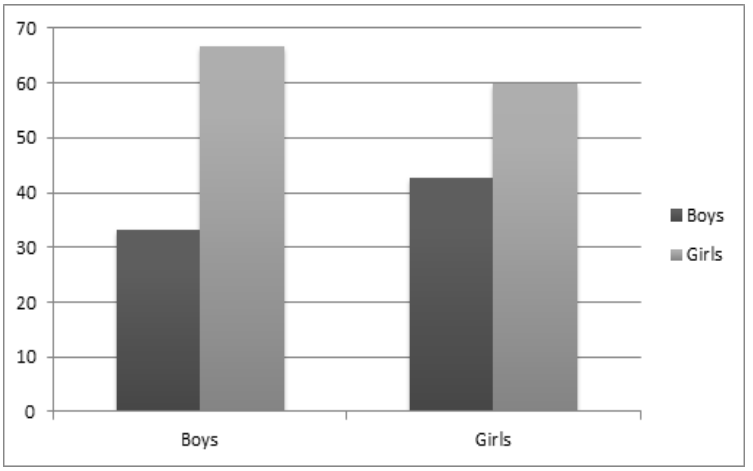


Table 7 and figure 7 indicates that in long jump three boys and three girls have suffered from muscle injuries, in percentage the value is 33.33 and 42.8 and bone injuries among boys and girls are six and four respectively, i.e. 66.66 and 57.14 percentage.

Table-8

Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in Triple Jump

Category	Muscle Injury in Percentage	Bone injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	57.14	42.8	7
Girls	46.15	53.84	13

Injuries in percentage

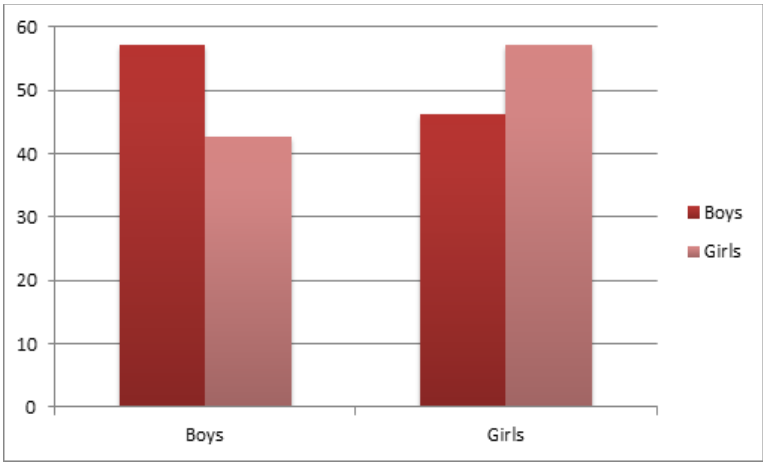


Table 9 and figure 9 indicates that in triple jump four boys and six girls have suffered from muscle injuries, in percentage the value is 57.14 and 46.15 and bone injuries among boys and girls are three and seven respectively, i.e.42.8 and 53.84 percentage respectively.

Table-9
Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in Discus Throw

Category	Muscle Injury in Percentage	Bone Injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	25	75	8
Girls	22.22	77.77	9

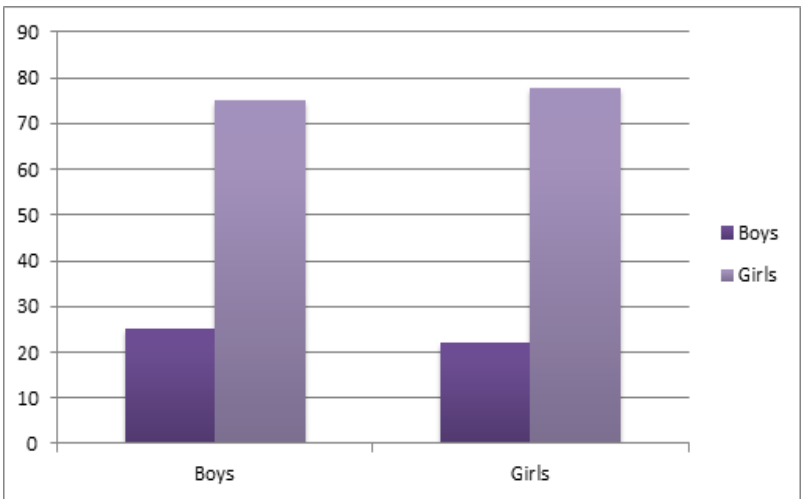


Table 9 and figure 9 shows that in discus throw two boys and two girls have suffered from muscle injuries, in percentage the value is 25 and 22.22 and bone injuries among boys and girls are six and seven respectively, while 75 and 77.77 respectively percentage.

Table-10
Showing the Number and Percentage of Soft and Hard Tissue Injuries Among Boys and Girls in Shot Put

Category	Muscle Injury in Percentage	Bone Injury in Percentage	Total no. of Muscle and Bone Injuries
Boys	60	40	10
Girls	36.36	63.63	11

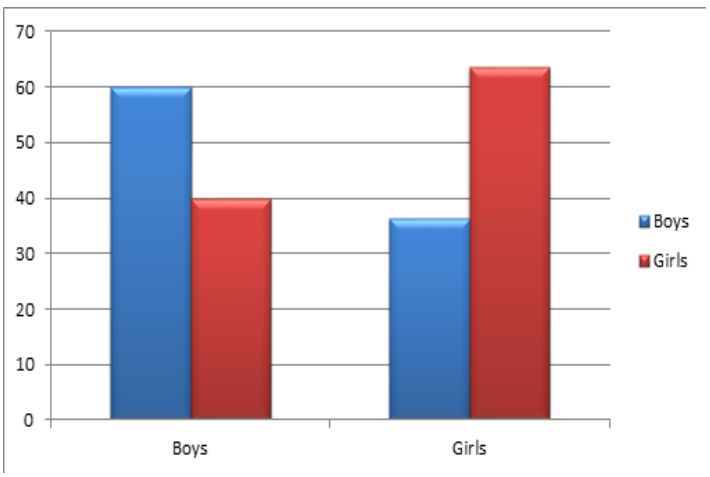


Table 10 and figure 10 indicates that in shot put six boy and four girls have suffered from muscle injuries, in percentage the value is 60 and 36.36.and bone injuries among boys and girls are four and seven respectively, i.e. 40 and 63.63 respectively percentage.

Conclusions

In 100meters sprint number of muscle injuries among boys and girls are four and two respectively, whereas both the categories have 66.66 percent of injuries, when bone injuries are considered two boys and one girl were found injured and their percentage is same i.e.33.33%. In 200meters sprint five boys and two girls have suffered from muscle injuries, in percentage the value is 62.5 and 50. And bone injuries among boys and girls are three and two respectively, while 37.5 and 50 respectively are their percentage. In 400meters sprint three boys and three girls have suffered from muscle injuries, in percentage the value is 60 and 50. And bone injuries among boys and girls are two and three respectively, while 40 and 50 respectively are their percentage. In 800 meters race six boys and six

girls have suffered from muscle injuries, in percentage the value is 60 and 75. And bone injuries among boys and girls are four and two respectively, while 40 and 25 respectively are their percentage. In 1500meters two boys and one girl have suffered from muscle injuries, in percentage the value is 66.66 and 50. And bone injuries among boys and girls are one and one respectively, while 33.33 and 50 respectively are their percentage. Thirty six boys (50.42%) have suffered from muscle injuries and thirty four (48.51%) have suffered from bone injuries And in girls category thirty one (45.58%) have suffered from the muscle injuries and thirty seven (54.41%) with bone injuries. Conclusion can be drawn that males (boys) are more prone to muscle injuries and females (girls) are more prone to bone injuries.

In high jump event one boy and two girls was suffering from muscle injuries, in percentage the value is 25 and 40. And bone injuries among boys and girls are three each, while 75 and 60 respectively are their percentage. In long jump three boys and three girls have suffered from muscle injuries, in percentage the value is 33.33 and 42.8. And bone injuries among boys and girls are six and four respectively, while 66.66 and 57.14 respectively are their percentage. In triple jump event four boys and six girls have suffered from muscle injuries, in percentage the value is 57.14 and 46.15. And bone injuries among boys and girls are three and seven respectively, while 42.8 and 53.84 respectively are their percentage. In discus throw event two boys and two girls have suffered from muscle injuries, in percentage the value is 25 and 22.22. And bone injuries among boys and girls are six and seven respectively, while 75 and 77.77 respectively are their percentage. In shot put event six boy and four girls have suffered from muscle injuries, in percentage the value is 60 and 36.36. And bone injuries among boys and girls are four and seven respectively, while 40 and 63.63 respectively are their percentage. It is recommended that coaches and physical educationist should design training schedule by keeping in mind the percentage of injuries that boys and girls are prone to, as mentioned in the study, so that injuries can be minimized among young athletes by using proper equipment, modern and first aid measures. This in turn will help in enhancing the performance in various track and field events.

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