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Contents

Editor's Page

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Editor-in-Chief: Prof. (Dr.) S.K. Verma

I am glad that the Volume 5, No. 2 issue of **Journal of Exercise Science and Physiotherapy** ***(JESP)*** is out for the readers. This issue of JESP contains thirteen research papers on diverse important aspects of exercise science. **Parvatikar and Mukkannavar from Dharwad** carried out a comparative Study of Grip Strength in Different Positions of Shoulder and Elbow with Wrist in Neutral and Extension Positions and interestingly observed that various joint positions can affect grip strength, especially elbow and shoulder joints with respect to wrist positions. Through the results of their study, they emphasize that the findings are valuable in evaluation and rehabilitation training of hand injured athletes or patients. **Poonam et al from Dehradun** reported that out of leg and limb lengths, leg length is significantly more related with H-latency than the limb length. **Kulandaivelan et al** from Hissar, tested the effectiveness of Russian current stimulation as a recovery modality following exhaustive exercise on heart rate, temperature, blood lactate and blood pressure and compared it with other traditional modes of recovery. They concluded that electrical stimulation causes increment in heart rate, blood lactate and blood pressure, decrement in oral temperature when compared to the active and passive modes of recovery as well as with in different intervals. They are of the view that electrical stimulation stresses cardio-vascular system without reducing the lactate and concluded that electrical stimulation may not be a useful tool in recovery after exhausted exercise. **Shenbagavalli & Sam Christa Doss** from Karaikudi reported the effect of Packages of Training on Functions of Haemoglobin Concentration and Mean Arterial Pressure among School Boys. They found that that the haemoglobin concentration was increased due to the treatment of ten weeks of Run & Walk and Interval training. **Rathee** from USA report better overall self perception in sportspersons than non-sportspersons. **Singh et al** from Ludhiana reported that school national level athletes were found significantly better on perceived physical ability, confidence in physical presentation and self-efficacy total as compared to School district level athletes. Training Programme on Leadership Quality of trainee females and reported that organised Physical Education programme in which the subjects had participated, significantly improved their physical fitness and psychological qualities but failed to develop desirable leadership qualities up to the best possible level. **Singh & Thukral** reported a negative and significant relationship between anxiety and achievement. They further report significant differences between boys and girls, rural and urban students on the basis of their anxiety. **Kadam and coworkers** compared the Emotional Health of the volleyball players of India and Brazil. They concluded that Indian players tend to be Dominant, assertive, aggressive, stubborn, competitive, bossy, dominant, and Enthusiastic, spontaneous, heedless, expressive, cheerful, surgency as well as Tender-minded, sensitive, over-protected, intuitive, apprehensive, self blamed, guilt-prone, insecure and worrying.

Mukhopadhyay and Uppal from West Bengal reported that 12 weeks interval training is effective for significant reducing left ventricular end systolic diameter and left ventricular end systolic volumes in adolescent boys. **Sibby et al from Mangalore** compared the effectiveness of Integrated Neuromuscular Inhibitory Technique (INIT) and, Laser with stretching in reducing pain, improving ROM and functional activities of subjects with neck pain due to upper trapezius trigger points. Their study concluded that both INIT and Laser with stretching are equally effective in managing subjects with neck pain due to upper trapezius trigger point. **Mozhi et al** from Patiala concluded that neurogenic therapy is beneficial for improving pain and functional mobility. Health fitness is a significantly scrutinized subject in the United States, and it is practical to compare this issue among young children and teenagers of the world. **Vaid et al from USA** compared the BMI of Indian Punjabi children with the age peers in USA. They concluded that Punjabi boys are not being confronted with the obesity problems**. Sakthivelavan & Sumathilatha from Tamilnadu** reported significantly greater functional capacity in endurance trained than the resistance trained athletes and ascribed the differences to the variations in adaptations that happen in them due to different types of training protocols. They further report that The levels of aerobic capacity reported from athletes abroad are higher compared to Indian athletes and are of the view that this could be a potential area of improvement for their much awaited superior performance.

S.K. Verma

Comparative Study of Grip Strength in Different Positions of Shoulder and Elbow with Wrist in Neutral and Extension Positions

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Abstract

This study investigated the effect of shoulder, elbow positions with respect to wrist positioned in neutral and in extension in 25 males and 25 females. A hydraulic dynamometer was used to measure the grip strength in six testing positions with respect to wrist positioned in neutral and in extension. The six grip strength tests consisted of three positions in which the elbow was maintained in full extension with varying degrees of shoulder flexion (0^0, 90^0 and 180^0) and other three positions where the elbow was maintained in 90^0 flexion combined with varying degrees of shoulder flexion (0^0, 90^0 and 180^0). Only the dominant hand was tested. The highest mean grip strength score was recorded when the shoulder was positioned in 180^0 of flexion with elbow in complete extension with respect to wrist being positioned in neutral (30.20 ± 8.74) and wrist in extension (25.44 ± 7.51), while the lowest mean grip strength score was recorded when shoulder was positioned in 180^0 flexion with elbow 900 flexion with respect to wrist being positioned in neutral (21.92 ± 7.45) and wrist in extension (19.40 ± 6.21). Finally grip strength differed significantly for both sexes and study showed males have greater grip strength than females with respect to wrist being positioned in neutral and in extension. In essence, our study affirms that various joint positions can affect grip strength, especially elbow and shoulder joints with respect to wrist positions (neutral and extension). Clinically useful information may be derived from these findings and are valuable in evaluation and rehabilitation training of hand injured patients

Key Words: Grip Strength, Hand Strength Testing, Shoulder Position, Elbow Position, Wrist Position

Introduction

Grip strength is frequently evaluated in clinical settings as an indicator of disease activity (*Rhind et al, 1980*). It is evaluated as a component of hand function. In addition to being an economical measure that is easy to administer, it is one of the best indicators of the overall strength of the limb (*Rice et al, 1989*). Grip strength is the integrated performances of muscles that can be produced in one muscular contraction (*Nwuga, 1975*). It is widely accepted that grip strength provides an objective index of the functional integrity of the upper extremity (*Myers et al, 1973; Mayers et al, 1982*).

To obtain an objective assessment of hand function there is a need for a standardized measure of hand strength. American society of hand therapist suggested a standardized testing protocol for handgrip strength in which subject is seated with the shoulder adducted and neutrally rotated, the elbow flexed at 90° and forearm in neutral and the wrist between 0 and 30 degrees extension and between 0 degrees and 15 degrees ulnar deviation (*Fess & Moran, 1981*). However, there may be clients who are unable to assume or hold this standardized testing position. Standardized grip strength testing procedures have been recommended to provide even greater objectivity of measurement. In a clinical setting, however, there are a number of reasons why it may be impossible to follow standardized testing procedures, such as patient's inability to tolerate an upright position or the presence of contractures in upper extremity joints.

Alternative testing position may be useful, however, in identifying positions, which maximize biomechanical abilities and may assist in the design of environment and tools (*Richards et al, 1996*). Various reports have discussed the effect of testing posture and joint position on grip strength. Standing has been found to result in higher grip strengths than when sitting when using the same instrument. Differences of up to 2lb/in (140gm/cm) have been reported (*Balogun et al, 1991; Amosun et al, 1995*). Teraoka examined the effect of three body positions on grip strength: standing, sitting, and supine, with the elbow joint held in full extension in each test position. He found that grip strength was strongest with the subject in the standing position (*Teraoka, 1979*).

One study has directly examined the influence of the shoulder position on grip strength. *Su et al (1994)* compared the strength of the grip while the shoulder was in 0°, 90° and 180° of flexion. They found that the strongest grips were obtained while the shoulder was in 180° of flexion and the elbow extended. The weakest grips were found while the shoulder was in 0° and the elbow in 90° of flexion. In this study only the dominant hand was tested.

Studies on the effect of elbow position on grip strength remain controversial. *Mathiowetz et al (1985)* tested the grip strength of 29 female college students with the elbow joint flexed at 90° in one test and fully extended in another. Significantly higher grip strength was obtained in the 90° elbow flexed position than in the fully extended position. *Balogun et al (1991)* tested the grip strength of 61 college students in four positions: (i) sitting with elbow in 90° flexion; (ii) sitting with elbow in full extension; (iii) standing with elbow in 90° flexion; and (iv) standing with elbow in full extension. Lowest scores were recorded when the measurement was taken while the subject was sitting with the elbow joint in 90° flexion.

Wrist position is another variable that affects grip strength performance (*Kraft & Detels, 1972*; *Pryce, 1980*; *O'Driscoll et al, 1992*). Pryce found no significant difference in grip strength with test angles of (a) 0^0 and 15^0 ulnar deviation, (b) 0^0 and 15^0 wrist extension and (c) any combinations of these positions. *Kraft and Detels (1992)* found significant differences with wrist positioned at 0^0, 15^0 and 30^0 extensions. Both studies found grip strength to be significantly less than 15^0 of palmar flexion. Recently *O'Driscoll et al (1992)* investigated the relationship between the optimum wrist position and maximal grip strength in 20 healthy subjects. An electro-goniometer recorded the wrist position naturally assumed by the subjects during their maximal unconstrained grip. Maximal grip strength was consistently obtained for the dominant wrist in 35 ± 2^0 of extension and 7 ± 2^0 of ulnar deviation. Grip strength was significantly less in any positions of deviation from this natural or self-selected position. This finding was at variance with the finding of *Pryce (1980)* and *Kraft and Detels (1972).*

The position given by American society of Hand therapists (ASHT) accommodates range of wrist positions (0-30^0 wrist extension, 0-15^0 ulnar deviation) enabling the subjects to self-select a position of wrist comfort *(Fess & Moran, 1981).* And therefore, alternative testing positions may be useful, however in identifying positions which maximizes biomechanical abilities and may assist activities of daily living. The main objective of the current study is to establish the variation in grip strength in different positions of shoulder (0^0, 90^0 and 180^0 flexion) and elbow (90^0 flexion, 0^0 extension) with wrist in neutral and extension.

Material and Methods

A convenience sample of fifty healthy subjects from the student population of Padmashree Institute of Physiotherapy, Bangalore (25 males, 25 females) in age group of 18-25 years participated in the study. Subjects signed informed consent forms after being provided with a brief description of the study. The exclusion criteria for this study included any previous history of upper extremity abnormalities, inflammatory joint diseases, neurological disorder or injury to upper limb and other health conditions.

A standard adjustable hydraulic hand dynamometer which was manufactured in USA (Fabrication Enterprises Inc) was used for measuring grip strength. The device was set at second handle position (of the five positions available) and same dynamometer was used throughout the study.

All the subjects reported themselves to be in good health. By self report, majority of subjects were right hand dominant. Prior to the procedure subjects who met the inclusion criteria were assessed and evaluated thoroughly. Each subject's name, gender, age and BMI were recorded. Subjects in the standing position were instructed to adduct and neutrally rotate their shoulders while holding their forearm and wrist joints neutral for one set of six testing positions and also wrist in extension, while subjects were able to self-select their wrist position during testing in another set of the six testing positions:

1. 0° of shoulder flexion with elbow fully extended
2. 0° of shoulder flexion with elbow flexed to 90°.
3. 90° of shoulder flexion with elbow fully extended.
4. 90° of shoulder flexion with elbow flexed at 90°.
5. 180° of shoulder flexion with elbow fully extended.
6. 180° of shoulder flexion with elbow flexed at 90°.

Prior to the commencement of data collection, a practice trial was given to familiarize the subjects with the dynamometer. Before testing, the examiner demonstrated how to hold the handle of the dynamometer. The same instructions were given for each trial. After the subject was positioned with the dynamometer, the examiner instructed the subject to "squeeze as hard as possible … harder … harder. Relax". To control for the effects of fatigue, subjects were asked to rest for 2 minutes. For dominant hand, three trials were performed in each position. Mean of 3 trials were recorded for calculation purpose.

Data were computed with repeated measures of analysis of variance procedure (ANOVA) to determine the effects of gender and positions on grip strength, followed by use of the Newman Keul's post hoc test. In addition, multivariate analysis of variance procedure (MANOVA) was used to determine the effects of gender and all six different positions with respect to wrist positions (wrist in neutral and wrist in extension). In the above statistical analysis, a value equal to or less than 0.05 was considered evidence of statistically significant finding. These methods were applied to determine any significant grip strength differences among the total sample and different sexes for all the six hand strength tests and to identify specific group differences (positions of wrist in neutral or wrist in extension) between the six positions.

Results

Table 1 shows, the physical characteristics of the study population are summarized.

Table 1: Physical characteristics of the study population.

Measure		N	Mean	SD
Age, yr	Male	25	20.56	1.04
	Female	25	20.28	4.13
Height, cm	Male	25	171.50	7.37
	Female	25	157.99	4.85
Weight, kg	Male	25	62.45	7.30
	Female	25	50.80	6.18
Body Mass Index	Male	25	21.23	2.05
	Female	25	20.34	2.36

Table 2 & figure 1 shows means and standard deviations of grip strength scores for all six positions with respect to wrist position (neutral and extension). The highest mean grip strength was recorded; when the shoulder was positioned in 180^0 of flexion with elbow in complete extension with respect to wrist in neutral and in extension positions. While the lowest mean grip strength score was recorded when shoulder was positioned 180^0 of flexion with elbow in 90° flexion with respect to wrist in neutral and in extension positions. Also the mean grip strength scores were observed to be higher in all the six positions in neutral than the wrist positioned in extension.

TABLE 2: Means and Standard deviation of grip strength scores for all six positions with respect to wrist in neutral and in extension position.

	WRIST IN NEUTRAL (N=50)		WRIST IN EXTENSION (N=50)	
	Mean	±SD	Mean	±SD
PS 1	28.32	8.76	24.76	8.07
PS 2	25.84	8.89	23.56	7.44
PS 3	26.20	8.68	23.72	8.02
PS 4	25.06	8.39	22.16	6.78
PS 5	30.20	8.74	25.44	7.51
PS 6	21.92	7.45	19.40	6.21

PS 1: 0 degrees Shoulder flexion with Elbow in complete extension.
PS 2: 0 degrees Shoulder flexion with Elbow 90 degrees flexion.
PS 3: 90 degrees Shoulder flexion with Elbow in complete extension
PS 4: 90 degrees Shoulder flexion with Elbow 90 degrees flexion.
PS 5: 180 degrees Shoulder flexion with Elbow in complete extension
PS 6: 180 degrees Shoulder flexion with Elbow 90 degrees flexion.

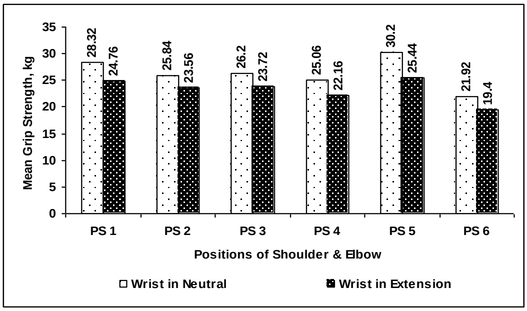

Figure 1: Comparisons of Mean grip strength for all six positions with respect to wrist in neutral and in extension positions.

Table 3 shows the means and standard deviation of grip strength scores for all six positions for different gender. The highest mean grip in females and males were recorded when the shoulder was positioned in 180^0 of flexion with elbow in complete extension with respect to wrist positioned in neutral. While the lowest mean grip strength scores in females and males was recorded when shoulder was positioned 180^0 of flexion with elbow in 90^0 flexion with respect to wrist being positioned in extension.

TABLE 3: Means and Standard deviation of grip strength scores for all six positions for different gender.

	WRIST IN NEUTRAL		WRIST IN EXTENSION	
	Males (N=25) Mean±SD	Females (N=25) Mean±SD	Males (N=25) Mean±SD	Females (N=25) Mean±SD
PS 1	36.00±4.58	20.64±3.59	31.84±4.16	17.68±3.35
PS 2	33.08±5.10	18.00±4.09	29.54±4.64	17.08±3.23
PS 3	33.31±5.18	18.50±3.50	30.15±4.16	16.75±3.86
PS 4	1.27±6.33	18.33±3.94	27.38±4.96	16.50±3.65
PS 5	37.15±5.75	22.67±3.62	31.38±4.92	19.00±3.23
PS 6	26.92±6.48	16.50±3.69	23.85±4.70	14.58±3.41

TABLE 4: Repeated measures of ANOVA determining grip strength differences in all the six positions with respect to wrist position.

Position of wrist	Source	D.F	S.S	M.S.S	F-value	P-value
Wrist in Neutral	Gender	1	14364.3	14364.3	621.9	0.00
	All six positions	5	2033.0	406.6	17.6	0.00
Wrist in extension	Gender	1	10951.3	10951.3	655.1	0.00
	All six positions	5	1180.8	236.2	14.1	0.00

[p<0.05, indicates significant finding]

Table 4 shows the repeated measures of ANOVA determining grip strength differences in all the six positions with respect to wrist position. The results of ANOVA findings indicated significant overall difference ($p<0.05$) in grip strength across six testing positions for the total sample with respect to wrist position (neutral and extension).

Consequently, The Newman Keuls post hoc analysis was done which indicated statistically significant differences existed across the six testing positions for the total sample and for both sexes with respect to wrist positions (wrist in neutral and wrist in extension position). The differences in mean grip strength scores for all six testing positions as well as for gender (male and female) with respect to wrist positions (neutral and extension) is evident from Tables 2 & 3).

TABLE 5: Summary of the MANOVA for the effects of different positions and gender with respect to wrist positions. (Wrist Positions*: Wrist in neutral, Wrist in extension)

Positions	Source	D.F	S.S	M.S.S	F-value	P-value
PS 1	Gender	1	5446.44	5446.44	348.91	0.000
	Wrist Positions*	1	316.840	316.84	20.30	0.000
PS 2	Gender	1	4928.04	4928.04	293.22	0.000
	Wrist Positions*	1	129.96	129.96	7.733	0.006
PS 3	Gender	1	5069.44	5069.44	276.57	0.000
	Wrist Positions*	1	153.76	153.76	8.39	0.005
PS 4	Gender	1	3660.25	3660.25	174.37	0.000
	Wrist Positions*	1	210.25	210.25	10.016	0.002
PS 5	Gender	1	4596.84	4596.84	235.86	0.000
	Wrist Positions*	1	566.44	566.44	29.06	0.000
PS 6	Gender	1	2601.00	2601.00	125.03	0.000
	Wrist Positions*	1	158.76	158.76	7.63	0.007

Table 5 shows, the summary of the MANOVA for the effects of different positions and gender, where the findings indicated significant overall difference ($p<0.05$) in grip strength across the six testing positions for the total sample and for both sexes with respect to the different wrist positions.

Discussion

Measurement of grip strength is an important component for hand rehabilitation. It assesses the client's initial limitation and provides a quick reassessment of client's progress throughout the treatment. This study has investigated comparative study of grip strength at different positions of shoulder and elbow with wrist in neutral and extension positions. The results reveal that the highest mean grip strength was recorded; when the shoulder was positioned in 180^0 of flexion with elbow in complete extension with respect to wrist positions (neutral and extension). While the lowest mean grip strength score was recorded when shoulder was positioned 180^0 of flexion with elbow in 90° flexion with respect to wrist positions. Grip strength decreased as shoulder was positioned in 0^0 flexion (Table no.2). These findings indicated that shoulder angle does affect grip strength performance and are similar to the results reported by *Kattel et al (1996).* He reported the effect of upper extremity posture of maximum grip strength revealed that the shoulder joint angle has influence on grip strength performance. It may be speculated that the synergistic muscles of the back and shoulder may be able to act to their best advantage, when the shoulder is elevated at 180^0 shoulder flexion during grip. This overhead position appears to allow those proximal muscles involved to be stretched beyond their normal resting length, which would theoretically increase their efficiency for optimum exertion according to the principle of length-tension relationship (*Lehmkuhl & Smith, 1985; Carlstedt et al, 1989*).

The mean grip strength scores were higher for all the six positions when wrist was positioned in neutral than in extension position (Table 2). This may be explained on the basis of the length–tension relationship of active contractile elements within a muscle (*Loren et al, 1996*). It may be that when the wrist is positioned at neutral with slight ulnar deviation the muscular compartments for individual fingers attain optimal length for maximum active force production. As the wrist moves in full extension the associated muscle compartment length for each finger exceeds the optimal range leading to decrease in grip force. This can occur can occur when musculo-tendinous units such as the extrinsic finger flexors (digitorum superficialis, flexor digitorum profundus) that are primarily responsible for powerful finger force production cross more than one joint. According to *Li (2002)* when an external force is applied at a distal phalanx during gripping, the profundus is the only flexor that balances the external extension torque at the distal interphalangeal joint and the torque balance at the proximal inter-phalangeal and metacarpophalangeal joints is progressively assisted by the flexor digitorium superficialis and intrinsic muscles. The flexor digitorum profundus originates outside the hand, inserts into the distal phalanx, and crosses many joints like the wrist, the metacarpophalangeal, proximal inter-phalangeal, and distal inter-phalangeal joints leading to increase in the length of its elements beyond optimum levels. Therefore, decreased grip force at a deviated wrist position may be primarily caused by the weakened force production capability of the flexor digitorum profundus.

In our study results were further analyzed in males and females in all six positions. Results showed existence of differences in the grip strength among males and females (Table No.3) with males exhibiting greater grip strengths than their female counterparts. Various authors have reported similar results (*Agnew & Mass, 1982; Crosby et al, 1994*). *Balogun et al (1991)* attributed the differences in strength between the genders to their physical characteristics rather than to the biological differences. Study conducted by *Su et al (1994)* reported that the highest mean grip strength was found when shoulder was positioned in 180^0 of flexion with elbow in full extension where as the position of 90^0 elbow flexion with shoulder in 0^0 flexion had the lowest grip strength scores. He also showed grip strength differed significantly for both sexes and for each age group. Though the results of our study was found to be similar to the study conducted by him, but the lowest mean grip strength was recorded when the shoulder was positioned in 180^0 of flexion with elbow 90^0 flexion with respect to wrist positions (neutral and extension). Explanation of this finding may lie in the length tension-property of muscle contraction. In our study grip strength was measured in combination of various shoulder and elbow positions with wrist in neutral or extension positions that might have produced different muscle lengths and thus grip strengths. Highest mean grip strength was recorded with 180^0 shoulder flexion and elbow fully extended with respect to wrist positions (neutral and extension). Grip strength with the elbow extension regardless of shoulder position was significantly higher than the elbow flexion position. It may be attributed to the fact that the length-tension relationship of the forearm muscles involved in producing grip strength is most favorable when the elbow is in an extension position (*Lehmkuhl & Smith,* 1985; *Su et al*, 1994). These results are in accordance with the study performed by *Su et al (1994).*

Previous studies have established that there is a relationship between handgrip strength with position of elbow (*Balogun et al*, *1991*; *Kuzala & Vargo, 1992*).

The results of the study indicate that using 0^0 shoulder flexion with elbow in fully extended position, significantly greater grip strength can be obtained as compared to any other combination of shoulder and elbow positions (Table No.2). But this result is in contrast to the standardized testing protocol given by *(Fess & Moran, 1981*). In standardized testing protocol the subject's shoulder is adducted and neutrally rotated, the elbow flexed at 90^0, and the forearm and wrist in neutral positions. These kind of alternative positions as suggested in the present study from standardized positions are useful in identifying positions which maximize biomechanical abilities and may assist in the design of environments and tools (*Richards et al*, *1996*).

In essence, our study affirms that various joint positions can affect grip strength, especially the elbow and shoulder joints with respect to wrist positions (neutral and extension). Some clinically useful information may be derived from these findings. For example, in the sports rehabilitation programmes, it would be feasible to evaluate the sports injured patients' grip strength using different combined elbow and shoulder positions to determine their maximal grip force. Later, with this knowledge, an individualized treatment program can be designed to train the athlete in the specific upper extremity positioning that provides the greatest efficiency to minimize the incidence of overuse disorders.

Our study was limited to symptomatic subjects as well as ambidextrous people. The use of convenience sample limits the generalization of the results of this study to the population at large. In our study majority of subjects were right-handed. These norms should be used with caution for left handed persons. During testing, we did not strictly control two wrist movements (neutral and extension). Another limiting factor is fatigue as there were large numbers of testing positions.

Conclusion

The changes in wrist position on grip strength are observed with variations in shoulder and elbow positions. It is vital that when measuring grip strength, one understands how small changes in body position can result in altered grip strengths. Hence the findings are valuable in evaluation and rehabilitation training of hand injured athletes or patients. Further studies are needed to find out how individual variables such as ambidexterity, work characteristics and as well as anthropometric measurements of subjects, can influence grip strength in combination of shoulder, elbow and wrist angles.

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Correlation Study on H-Reflex with Leg Length in Indian Population

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Abstract

This was a co-relational study done to determine the relationship of H-reflex with leg length and limb length in Indian population. Sixty females between 19-25 years of age were included in the study according to the inclusion criteria. H-reflex of all the subjects having leg length between 27 to 49 cm and limb length ranging from 75-99 cm was recorded. Correlation was derived between H-reflex latency and leg length & H-reflex latency and limb length using Karl Pearson formula. A significant correlation was observed between the H-reflex latency and leg length & and limb length.

Keywords: H-Reflex Latency, Leg Length, Limb Length

Introduction

The H-reflex is a monosynaptic reflex elicited by sub maximal stimulation of the tibial nerve and is recorded from the calf muscle. This reflex involves conduction of impulses from the periphery to and from the spinal cord and occurs at latencies that are considerably longer than the latency of direct motor response. This conduction can occur only with central amplification of the motor response due to reflex activation of motor neurons. The arc of the H-reflex includes conduction in large fast conducting Ia fibers.

H-reflex is extensively used both as a research and a clinical tool *(Wang, 2002)*. H-reflex is a sensitive test of poly neuropathies and may be abnormal in mild neuropathies. This can be important in the electrodiagnostic evaluation of radiculopathies even when needle EMG is unrevealing *(Buschbacker, 1999)*.

Several factors contribute to H-reflex parameters such as age, gender, body mass index, skin temperature and height *(Buschbacker, 1999; Stetson and Albers, 2002; Scaglioni et al, 2003)*. It is found that there is no age influence on H-reflex parameters for subjects in the range of 20 to 40 years of age. Latency of reflex response increases significantly in advanced ages. As far as gender is considered, reflex differences are observed among sexes, due to morphological and functional features, stronger stimulus intensity being necessary for women. Latency for men is longer because men have longer legs *(Peterson, 2005)*. The H-reflex latency shows increase with cooling and decreases with warming *(Preston & Shaprio, 1992)*. The most important factor affecting H reflex is leg length *(Riccardo et al, 2001)*. There is significant correlation found between leg length and H-reflex in normal subjects.

Various studies have been done in this regard, but few studies are done on Indian population. This study will help us to determine the correlation between H reflex and leg length in normal subjects among Indian population.

Material and Methods

One hundred and two female students studying at Sardar Bhagwan Singh Post Graduate Institute of Biomedical Sciences & Research were chosen as the population of the study. Sixty healthy volunteers participated in the study. Informed consent was obtained from each and every individual.

Before beginning with the procedure, the selected subjects were explained the entire procedure in detail. Leg length was measured between the middle of mid popliteal line and the medial malleolus. Limb length was measured from the most prominent point on anterior superior iliac spine to the medial malleolus. The subject was made to lie prone comfortably on a couch with leg and thigh comfortably supported. The feet were allowed to hang freely with dorsum at right angle to tibia. The resistance of the skin of forearm was reduced using cotton dipped in alcohol. The recording electrodes were placed at the distal edge of the calf muscle and the reference electrode on Achilles tendon. The ground electrode was placed between the stimulation electrodes and the recording electrodes. The tibial nerve was stimulated in popliteal fossa with a submaximal stimulus by the use of bipolar surface electrode. The cathode was kept proximal to the anode to avoid anodal block.

The latency of H-reflex was measured from the stimulus artifact to the first deflection from the baseline and the amplitude was measured from the base to the peak of the negative phases. The stimuli were adjusted so as to evoke maximum H-response amplitude. At this strength a small M-response was also observed sometimes. Attention to M-response helped in monitoring the strength of stimulation. At least five H-responses were studied for analysis.

Karl Pearson correlation was used to analyze the relationship between leg and limb lengths with the H-reflex latency. The significant value was fixed at $p < 0.05$ with confidence interval of 95%.

Results

Table 1 describes the physical characteristics of the subjects. The age of the subjects' ranged between 19-25 years (mean 21.03, SD ± 1.52).

Table 1: Description of the subjects

VARIABLE	MEAN	±SD
Age, yrs	21.03	1.52
Height, meter	1.60	0.91
Weight, kg	54.29	8.89
Body Mass Index	21.28	1.26

Table 2: Correlation between leg and limb length with H-latency

	LIMB LENGTH	H-LATENCY
Leg Length	**1.000***	**0.957***
Limb Length		**0.949***

** Significant at 0.01 level of confidence*

Table 2 enlists the observed values of correlation coefficients of leg length (range 27-49 cm) and limb length (range 75-99 cm) of 60 subjects with H-latency. A very high degree of significant positive relationship was found indicating that H-Latency increased with increase in the leg and limb lengths.

Discussion

This study was designed to analyze the effects of leg length and limb length on H-reflex latency on Indian subjects.

When correlation was drawn between leg length and H-reflex latency, a positive and highly significant correlation (r = 0.957) was obtained meaning that as the leg length increased H-latency also increased. When the correlation was drawn between limb length and H-reflex latency a positive and highly significant correlation (r=0.949) was obtained that indicates that as the limb length increased the H-latency also increased suggesting that as the length of the conduction pathway increased the time taken for excitation to traverse also increased. H-reflex measures the efficacy of synaptic transmission as the stimulus travels in afferent (Ia sensory) fibers through the motor neuron pool of the corresponding muscle to the efferent (motor) fibers. The afferent (sensory) portion of the H-reflex begins at the point of electric stimulation and results in action potentials traveling along afferent fibers until they reach and synapse on α motor neurons (αMNs). The efferent portion of the H-reflex pathway results from action potentials generated by the αMNs, traveling along efferent fibers until they reach the neuromuscular junction and produces an H-reflex, suggesting that as the pathway for reflex arc increases the time taken for excitation of motor neuron pool also increases. This delays the onset of wave and finally affects the H-latency. The findings of the present study are in general agreement with the results of some earlier studies done by *Shahram & Ghavanini (2004) and Riccardo et al (2001).*

Ghavanini & Ghavanini (2001) studied the role of various constitutional factors influencing H-reflex latency. But among them leg length was the only variable strongly correlated with H-reflex latency. There are two methods of measuring leg length. In this study leg length was measured from mid popliteal line to medial malleolus. Another method is to measure from cathode to medial malleolus. The former method has more reliability and reproducibility. *Frank et al (2004)* did a study on H-reflex latency where they found that a high correlation was present between leg length and H-reflex latency. In a study done by *Buschbacker (1999)* it was concluded that there was a significant correlation between height and H-latency. The data of this study supported the concept that there is a significant correlation between leg length and H-latency which is also shown in a study done by *Aminoff (1999)*. The findings of this study were interpreted in the light of previous studies and one can say that this study will help to further determine various neurological diseases with different leg lengths and limb lengths. This study will also help in making a normative data for diagnosing various neurological diseases.

Conclusion

From the correlation of variables between the leg length and H-latency a positive and highly significant (r = 0.957) value was obtained. When limb length and H-latency was correlated, a highly significant positive correlation (r = 0.949) was obtained. Out of leg and limb lengths, it was further found that leg length is significantly more related with H-latency than the limb length. It was suggested that alternate statement can be drawn from the conclusion.

a. H-latency is significantly correlated with leg length.

b. H-latency is significantly correlated with limb length.

c. H-latency increases as the leg and limb length increases.

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Effect of Combined Electrical Stimulation as a Recovery Modality on Selected Physiological Transients in Adolescent Judo Players

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Abstract

The study was conducted on 14 Haryana state level junior judo players to find out the effectiveness of Russian current stimulation as a recovery modality following exhaustive exercise on heart rate, temperature, blood lactate and blood pressure. Each subject was asked to do 20-m shuttle run test until exhaustion for three times with one week gap in between. After shuttle test, each subject underwent the following three recovery interventions, between 3-33 min, in a systematic random order. Recovery I: passive recovery where the subject was asked to sit for 33 minutes. Recovery II: active recovery where the subject was asked to walk/run at 60% maximal heart rate (MHR) between 3-33 minutes. Recovery III: electrical stimulation where the subject received Russian current (50 hz, 10 sec on: 50 sec off) for 5 min i.e. 3rd to 8th min and 18th to 23rd min of recovery with interspersed 10 min rest in between. Heart rate, temperature, blood lactate, systolic blood pressure, diastolic blood pressure was recorded before the shuttle test and 3rd, 8th, 18th, 23rd and 33rd minutes of recovery period. ANOVA repeated measures (with- in subjects) was used to see the effect of electrical stimulation on physiological parameters in different timings and ANOVA (between subjects) to compare the electrical stimulation with active and passive recovery. Significant level was set at '0.05' ($p<0.05$). Results showed electrical stimulation produced increased heart rate but not significantly, when compared to passive recovery but significantly less when compared to active recovery. Russian current also significantly increased the blood lactate level when it compared to both active and passive recovery values at regular intervals. Active recovery produced significantly lesser body temperature and lactate as well as significantly higher systolic blood pressure when compared to both passive and electrical stimulation modalities. It is concluded that electrical stimulation results in increased blood lactate production without much changes in other physiological parameters.

Keywords: Russian Current, Blood Lactate, Heart Rate, Blood Pressure, Shuttle Run

Introduction

Surface neuromuscular electrical stimulation (NMES) is a useful treatment tool in sports medicine apart from treating other clinical conditions such as stroke, cerebral palsy, and spinal cord injury.

NMES protocols consist of a combination of pulse parameters and time modulations to induce muscle contractions that aim to simulate both endurance and resistance training *(Binder-Macleod and Synder-Mackler, 1993; Dudley et al, 1999; Bax et al, 2005; Delay et al, 2005).*

In humans, transcutaneous chronic electrical stimulation sessions can increase muscle oxidative capacity, capillarisation of fast twitch fibers, or induce some fiber type transitions among type II fiber sub types *(Cabric et al, 1987; Gauthier et al, 1992; Thériault et al, 1996; Perez et al, 2002).* Traditionally Russian current has been used to strengthen individual muscles; however *Perez et al (2003)* reported in their study that low intensity current does improve the delta efficiency of muscle at high sub-maximal work load without improving endurance performance in normal healthy individuals. Further *Kesar et al (2008)* reported in their study that frequency modulation is better than pulse duration modulation in torque production during the functional electrical stimulation. So Russian current, a medium frequency current that produce a low frequency current through frequency modulation, could be the best choice to improve the endurance performance than the low frequency current used by *Perez et al (2003)*.

Accumulation of blood lactate has been considered to be a cause for the fatigue in athletic population that may lead to various injuries during training and competition, however till date no study has reported the effect of electrical stimulation on blood lactate or whether it could be used as a recovery modality after exhaustive training.

The purpose of the present study is to examine the effect of Russian current stimulation as a recovery intervention in the clearance of blood lactate and restoration of other physiological parameters and compare it with traditional active and passive recovery.

Material and Methods

Fourteen male judo players aged between 15 to 19 yrs, who were actively participating in at least state level competitions and were training at SAI, Regional center, Hisar, Haryana were recruited for the present study. After getting their informed consent, they were fully apprised of possible risks or discomfort associated with the electrical stimulation protocol. Each subject was asked to do a 20-m shuttle run test until exhaustion for three times with one week gap in between. After shuttle test, each subject underwent the following three recovery interventions, between 3-33 min, in a systematic random order.

Recovery Intervention I: Passive recovery where the subject was asked to sit for 33 minutes. *Recovery Intervention II:* Active recovery where the subject was asked to walk/run at 60-65% of MHR (120-130 beats/min) during 3rd to 33rd of minute of recovery period. *Recovery Intervention III:* Electrical stimulation through TORC Plus TR-841 (Johari digital Healthcare Ltd, Jodhpur, India an ISO Certified unit) in which the subject received Russian current stimulation (frequency 2500Hz, sweep 50 Hz). Subject's bilateral quadriceps and hamstrings (total 4) were used as stimulation sites. In order to maintain the consistency in electrode placement the distance between ASIS and base of patella was divided into three parts with two elastic bands fitted in the junction areas (total 4). Each stimulation site, two superiorly and two inferiorly located, as well as elastic band, two anteriorly and two posteriorly, received four medium sized circular electrodes (total 16). In each stimulation site the electrodes of channel 1 and 2 were placed criss-cross (X) manner. Seventy two mA intensity current (i.e. 60% of maximal) with 10 sec on and 50 sec off duration was used to stimulate the four sites for 5 min with 10 min rest in between (i.e. Quadriceps and Hamstrings stimulations were done during 3rd to 8th min and 18th to 23rd min periods of recovery).

The minute heart rate (beats/min), temperature (°F), blood lactate (mmol/L), systolic and diastolic blood pressures (mmHg) were recorded before the shuttle test and at 3rd, 8th, 18th, 23rd and 33rd minutes of recovery period. Heart rate was monitored using Polar telemeter (F6 model, Polar Electro Oy, Finland). Oral temperature was measured using Digital Clinical Thermometer an ISO approved model with accuracy ±0.1ºF (Geon Corporation, Taiwan).

A hand-held portable lactate analyzer (Lactate Plus, Nova Biomedical, Waltham, MA, USA) along with non reusable strip was used to determine blood lactate level.

Blood pressure was measured using Sphygmomanometer (Pagoda an ISI approved model, Elite Surgical Industries, New Delhi) and Stethoscope (Micro-Tone model, Malhotra Surgical Industries, Delhi). All the measurements were recorded as per manufacturer's user manual.

Data is presented by mean, standard deviation. It was further analyzed by ANOVA repeated measures (within subjects) to see the effect of electrical stimulation on physiological parameters in different timings and ANOVA (between subjects) to compare the electrical stimulation with active and passive recovery. Significant level was set at '0.05' ($p<0.05$).

Results and Discussion

Results showed there was no significant difference during rest (pre-exercise) as well as at 3rd minute post exercise recovery period in all the physiological parameters among the three recovery groups.

Table 1: Changes in physiological transients at different intervals during electrical stimulation recovery (n=14).

	HEART RATE (BEATS/MIN)		ORAL TEMPERATURE (ºF)		BLOOD LACTATE (MMOL/L)		SYSTOLIC BP (MMHG)		DIASTOLIC BP (MMHG)	
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
Pre-exercise	78.64	9.45	97.15	1.36	3.41	1.18	131.43	10.77	84.00	7.69
3rd min	118.43	9.61[c]	95.91	2.04[b]	11.80	4.15[c]	156.21	17.29[c]	73.93	8.55[b]
8th min	113.28	12.34[c,d]	97.56	0.98[e]	13.84	4.04[c,d]	138.86	13.81[a, f]	85.29	9.40[e]
18th min	105.78	8.67[c,f,h]	98.36	0.66[b,f,i]	10.59	3.68[c,g]	127.86	12.66[f,i]	86.43	10.32[e]
23rd min	107.14	10.93[c,f,h]	98.21	0.65[b,e,g]	11.44	5.07[c]	128.29	10.64[f,h]	87.57	9.09[a,e]
33rd min	98.21	8.45[c,f,i,m]	98.16	0.64[b,e,g]	7.78	2.79[c,e,i,m]	122.86	11.99[a,f,i]	86.00	8.39[d]

Values are mean ± standard deviation, BP. [a,b,c] are 'p' value 0.05,0.01,0.001 respectively when compared to pre exercise value. [d,e,f] are 'p' value 0.05,0.01,0.001 respectively when compared to 3rd min value. [g,h,i] are 'p' value 0.05,0.01,0.001 respectively when compared to 8th min value. [j,k,m] are 'p' value 0.05,0.01,0.001 respectively when compared to 18th min value

Table 1 shows the changes in physiological parameters during electrical stimulation recovery. Minute heart rate remains significantly ($p< 0.001$) increased than the pre-exercise level throughout recovery period. However, it does show a trend of decrease gradually from 3rd min to 33rd min except at 23rd min, the period which coincides with the second electrical stimulation phase, where it increased slightly from 105.78 ± 8.67 to 107.14 ± 10.93 beats/min. All heart rate reduction values are significantly lower ($p < 0.001$) than 3rd min value of 118.43 ± 9.61

beats/min except at 8th min, of recovery i.e. the phase of first electrical stimulation, where the value of 113.28 beats/min reduced the significant level to 0.05. Pre-exercise oral temperature value of 97.15 ± 1.36ºF reduced significantly ($p < 0.01$) to 95.91 ± 2.04ºF after exhaustive work, which returned to near normal, 97.56 ± 0.98ºF, at 8th min. Thereafter, oral temperature increased significantly ($p<0.01$) at 18th min, 23rd min, 33rd minute intervals of post recovery period. In contrast to the first electrical stimulation period, during second electrical stimulation period the temperature decreased from 98.36 ± 0.66ºF to 98.21 ± 0.65ºF without any significant difference.

All the measured blood lactate values after exhaustive work are observed to remain significantly higher ($p<0.001$) than the pre-exercise value of 3.41 ± 1.18 mmol/L. After the first electrical stimulation period, blood lactate level significantly increased from 11.80 ± 4.15 to 13.84 ± 4.04 mmol/L ($p < 0.05$) at 8th min, then it reduced significantly to 10.59 ± 3.68 mmol/L ($p<0.05$) at 18th min post-recovery. After second electrical stimulation period, blood lactate level increased marginally to 11.44 ± 5.07 mmol/L without any significant difference at 23rd min, followed by significant reduction observed at 33rd min with the value of 7.78 ± 2.79 mmol/L ($p<0.001$).

Pre-exercise systolic blood pressure of 131.43 ± 10.77 mm Hg increased significantly to 156.21 ± 17.29 mmHg at the 3rd min after exhaustive work ($p<0.001$), followed by first electrical stimulation this significant level reduced to '0.05' ($p < 0.05$) with the value of 138.86 ± 13.81 mm Hg recorded at 8th min post-recovery. In comparison to 8th min, systolic BP of 18th min reduced significantly below the pre-exercise level with mean value of 127.86 ± 12.66 mm Hg ($p<0.001$), following second electrical stimulation mean value increased slightly, 128.29 ± 10.64 mm Hg, with slight reduction in significance ($p < 0.01$) at 23rd min.

Mean diastolic blood pressure was observed to decrease from pre-exercise value of 84.00 to 73.93 mm Hg at the 3rd minute of recovery. Thereafter a slight increase in diastolic blood pressure after first electrical stimulation was observed from 73.93 ± 8.55 mm Hg to 85.29 ± 9.40 mm Hg, as well as after second electrical stimulation, from 86.43 ± 10.32 mm Hg to 87.57 ± 9.09 mm Hg, without any significance.

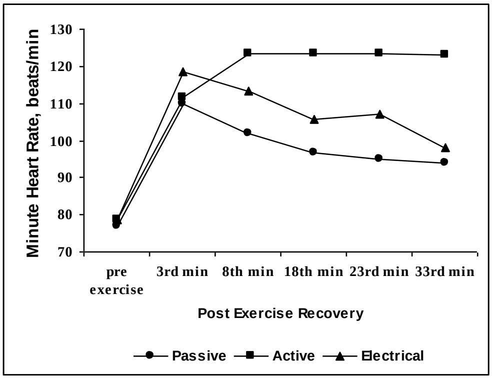

Fig.1: Mean minute heart rate values at rest and recovery heart rates during different interventions, following exhaustive shuttle run test (N=42).

Table 2 & Fig 1 compare heart rate recovery with electrical stimulation, active and passive recovery interventions.

Compared to passive recovery, there is a highly significant increased heart rate values in active recovery at 8th min, 18th min, 23rd min, and 33rd min post exercise intervals ($p<0.001$), first as well as second electrical stimulations produced significant increase in heart rate (101.93 ± 10.79 vs. 113.28 ± 12.34, $p < 0.05$ at 8th min and 94.93 ± 12.05 vs. 107.14 ± 10.93, $p<0.01$). In comparison to the active recovery, electrical stimulation produced significant decrease in heart rate at the 18th min, 23rd min and 33rd min intervals ($p< 0.001$); however this significant level was reduced after the first electrical stimulation at 8th min (123.50 ± 3.06 vs. 113.28 ± 12.34 beats/min, $p<0.05$).

Table 2: Comparison of minute heart rate (beats/min) recovery at different time intervals during the three recovery modes.

		PASSIVE	ACTIVE	ELECTRICAL
Pre-exercise	Mean	76.86	78.71	78.64
	±SD	9.25	7.77	9.45
3rd minute	Mean	110.00	111.64	118.43
	±SD	11.86	13.12	9.61
8th minute	Mean	101.93	123.50	113.28
	±SD	10.79	3.06^{c}	12.34^{a,d}
18th minute	Mean	96.57	123.57	105.78
	±SD	10.92	2.06^{c}	8.67^{a,f}
23rd minute	Mean	94.93	123.50	107.14
	±SD	12.05	2.77^{c}	10.93^{b,f}
33rd minute	Mean	94.00	123.14	98.21
	±SD	13.16	2.48^{c}	8.45^{f}

Values are mean ± SD in beats/min. ^{a,b,c} are ‘p’ value 0.05,0.01,0.001 respectively when compared to passive recovery value (i.e.) passive vs. active and passive vs. electrical. ^{d,e,f} are ‘p’ value 0.05, 0.01, 0.001 respectively in active vs. electrical

Table 3 & Fig 2 compare electrical stimulation temperature recovery with active and passive recovery. There is no significant difference between passive and electrical stimulation recovery through out the recovery period, however electrical stimulation shows a significant higher temperature compared to active recovery at 18th min (98.36 ± 0.66ºF vs. 97.19 ± 0.92ºF, $P<0.001$). This significant level reduced to ‘0.01’ after a second electrical stimulation at the 23rd min (98.21 ± 0.65ºF vs. 97.31 ± 0.87ºF, $p<0.01$), again the significant level increased to ‘0.001’ at 33min (98.16 ± 0.64ºF vs. 97.08 ± 0.82ºF, $p<0.001$).

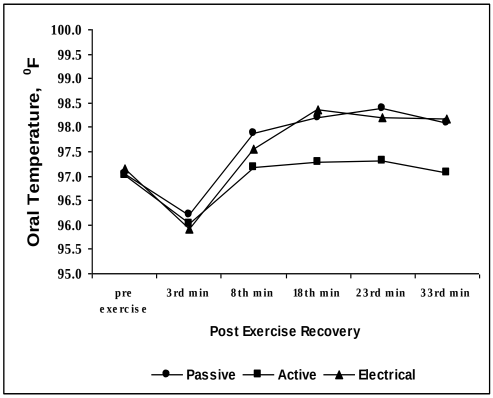

Fig.2: Mean oral temperature values at rest and recovery oral temperature values during different interventions, following exhaustive shuttle run test (N=42).

Table 3: Comparison of oral temperature (ºF) recovery at different intervals during the three recovery modes.

		PASSIVE	ACTIVE	ELECTRICAL
Pre-exercise	Mean	97.04	97.02	97.15
	±SD	1.18	1.28	1.36
3rd minute	Mean	96.20	96.02	95.91
	±SD	1.38	1.87	2.04
8th minute	Mean	97.88	97.19	97.56
	±SD	0.64	0.95	0.98
18th minute	Mean	98.20	97.28	98.36
	±SD	0.49	0.92^{b}	0.66^{f}
23rd minute	Mean	98.40	97.31	98.21
	±SD	0.53	0.87^{c}	0.65^{e}
33rd minute	Mean	98.08	97.08	98.16
	±SD	0.34	0.82^{c}	0.64^{f}

Values are mean ± SD in ºF. ^{a,b,c} are ‘p’ value 0.05,0.01,0.001 respectively when compared to passive recovery value (i.e.) passive vs. active and passive vs. electrical. ^{d,e,f} are ‘p’ value 0.05,0.01,0.001 respectively in active vs. electrical

Table 4 & Fig 3 compare electrical stimulation recovery with both active and passive recovery. After first electrical stimulation, the mean value of 13.84 ± 4.04 mmol/L is observed to be significantly higher than both active (8.78 ± 3.21 mmol/L, $p<0.01$) and passive (10.21 ± 4.17 mmol/L, $p<0.05$) recovery. However after the second electrical stimulation, significant level reduced to '0.05' when compared to the active (active 6.41 ± 3.09; electrical 11.44 ± 5.07 $p<0.05$) recovery. After the 8th min of recovery even though blood lactate levels of active recovery is lesser than passive recovery but the differences were not observed to be significant in statistical terms.

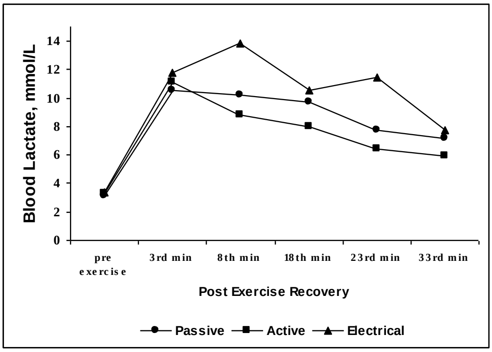

Fig.3: Mean blood lactate value at rest and recovery blood lactate during different interventions, following exhaustive shuttle run test (N=42).

Table 4: Comparison of blood lactate recovery at different time intervals during three recovery modes

		PASSIVE	ACTIVE	ELECTRICAL
pre exercise	Mean	3.16	3.29	3.41
	±SD	1.15	1.04	1.18
3rd minute	Mean	10.54	11.16	11.80
	±SD	3.12	3.11	4.15
8th minute	Mean	10.21	8.78	13.84
	±SD	4.17	3.21	4.04^{a,e}
18th minute	Mean	9.75	8.03	10.59
	±SD	3.75	4.70	3.68
23rd minute	Mean	7.72	6.41	11.44
	±SD	4.35	3.09	5.07^{d}
33rd minute	Mean	7.16	5.91	7.78
	±SD	3.26	3.26	2.79

Values are mean ± SD in mmol/L. ^{a,b,c} are 'p' value 0.05,0.01,0.001 respectively when compared to passive recovery value (i.e.) passive vs. active and passive vs. electrical. ^{d,e,f} are 'p' value 0.05,0.01,0.001 respectively in active vs. electrical

Unlike voluntary contractions, during electrically elicited contractions, smaller and more fatigue-resistant motor units are not always recruited prior to larger and more fatigable ones *(Binder-Macleod et al., 1995; Feiereisen et al., 1997; Heyters et al., 1994; Knaflitz et al., 1990; Trimble and Enoka, 1991)*; therefore, rapid lactate accumulation was thought to result in part due to the difference in recruitment order between electrical stimulation and voluntary activation of motor units.

Conclusion

The results of the present study show that electrical stimulation causes increment in heart rate, blood lactate and blood pressure, decrement in oral temperature when compared to the active and passive modes of recovery as well as with in different intervals. Since electrical stimulation stresses cardio-vascular system with out reducing the lactate, it can be concluded that electrical stimulation may not be a useful tool in recovery after exhausted exercise.

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Analysis of Self- Perception among Female College Students

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Abstract

Evaluation of self perception among athletes can be very effectively utilized in the process of their performance enhancement. The present study was conducted for exploring the same among 185 female college students of Chandigarh (95 sportspersons and 90 non-sportspersons). The subjects were administered Semantic Differential Scale and obtained data was statistically analyzed for all 10 components of the variable self perception as well as for overall self perception. The results indicated that sportspersons were significantly better than non-sportspersons on overall self perception and its three components.

Key Words: Self-Perception, Athletes, Semantic Differential Scale

Introduction

Concept of self has always fascinated sports psychologists and although extensive research has been carried out in relation to different sports settings but still this phenomenon of "self" is attracting more and more research as the same serves as a prime predictor of dynamic behavior of an athlete. His mood, motivational patterns and his state of well being are all influenced by this "self". In fact, self perception is a process in which an individual decides about his own attitudes and feelings from watching himself behaving in different situations. This is particularly true when internal cues are so weak or confusing that they effectively put the person in the same position as an external observer. Self exploration stems from the experiences consciously and might be viewed as a person's overall estimation of his self competence and self worth based on reality. Understanding of self can help the athlete in correctly evaluating his own self attributes which can then be exploited to expand his sport performance. According to *Allport (1961)* self is "a warm central private region of our life and as such, it plays a crucial part in our consciousness, in our personality, and in our organism; it is indeed considered as a core of our being".

There are varieties of ways to view the self; and self-concept, self-esteem, self-estimation, self-awareness, self-image, self-perception etc. are few of the commonly employed terms. Studies have been carried out to substantiate sportspersons' higher levels of self-esteem as compared to non-sportspersons (*Higgins, 1980; Mahoney, 1989*); overall higher level of self esteem among athletes (*Riordan et al, 1983; Davies, 1989; Bowker et al, 2003)*; positive relationship between sports participation and self concept (*Olszewska, 1982; Lynn, 1991*) but there seems to be lack of research with regard to self perception in relation to sports participation. This study was therefore, undertaken to explore self perception among sports and non-sportspersons.

Material and Methods

For the purpose of this study, 195 female students within the age group of 19 to 24 years and studying in various colleges of Chandigarh during session 2006-2007 were selected as subjects. Out of these 95 were those who had participated in one or more sporting events at intercollegiate or above level, and 90 were those who had never participated in any such organized sporting event. To obtain data for the present study, all the subjects were administered the Semantic Differential Scale developed by *Osgood et al (1967)*. This scale had been found to have a co-efficient of reliability of 0.85. The scale consisted of two parts; first part contained items related with "myself as I am..." whereas the second part contained items relating to "myself as I would like to be…" The difference between the scores of these two parts indicated the level of self perception among the subjects. The lower the difference; the higher the self-perception. The subjects were asked to rate themselves, using an 8-point scale, on ten pairs of opposite adjectives that were based on *Rosenbeg's (1965)* self-esteem measure. The ten pairs of adjectives were: Good-bad; Optimistic-Pessimistic; Confident-Non-confident; Strong-Weak; Attractive-Unattractive; Sociable-Unsociable; Independent-Dependent; Aggressive-Non-aggressive; Successful-Failure; and Cooperative-Uncooperative.

Results

The results of the mean difference between the scores of two parts of the scale, SD and F-values with regard to the two groups of subjects i.e. sports-persons and non-sportspersons on the five components of self perception i.e. Good-Bad; Optimistic-Pessimistic; Confident-Non-confident; Strong-Weak; and Attractive-Unattractive have been presented in Table-1.

Table-1: Statistical derivatives of sportspersons and non-sportspersons on components of self perception

Component	Sportspersons		Non-Sportspersons		F-Value
	Mean	SD	Mean	SD	
Good-Bad	**0.55**	**0.66**	**1.04**	**1.13**	**13.45****
Optimistic- Pessimistic	**0.52**	**0.68**	**1.10**	**1.11**	**18.10****
Confident- Non-Confident	**0.92**	**0.94**	**1.19**	**1.15**	**2.88**
Strong-Weak	**0.86**	**0.80**	**1.12**	**0.94**	**4.03**
Attractive- Unattractive	**0.74**	**0.79**	**1.34**	**1.29**	**14.48****
Sociable-Unsociable	**0.90**	**0.91**	**1.26**	**1.05**	**5.92**
Independent-Dependent	**0.72**	**0.84**	**1.04**	**1.17**	**4.53**
Aggressive-Nonaggressive	**0.73**	**0.81**	**1.10**	**1.17**	**6.04**
Successful-Failure	**1.02**	**0.99**	**1.50**	**1.26**	**7.88**
Cooperative-Uncooperative	**0.68**	**0.99**	**0.87**	**1.11**	**1.56**
Overall Self Perception	**0.76**	**0.84**	**1.16**	**1.14**	**14.55****

** p<0.01

The results depicted in Table-1 have revealed significant differences between sportspersons and non-sportspersons on the three components of self-perception i.e. good-bad, optimistic-pessimistic and attractive-unattractive (p<0.01 in all the three cases, F-values being 13.45, 18.10 and 14.48

respectively). With regard to the other components i.e. confident-non confident, strong-weak; Attractive – Unattractive; Sociable - Unsociable; Independent - Dependent; Aggressive - Non-aggressive; Successful - Failure; Cooperative – Uncooperative, the differences among the two studied groups were not found to be significant, although sportspersons had demonstrated better self-perception on these two components as well. However, with regard to overall self-perception, the difference between the two studied groups have been found to be significant ($p<0.01$).

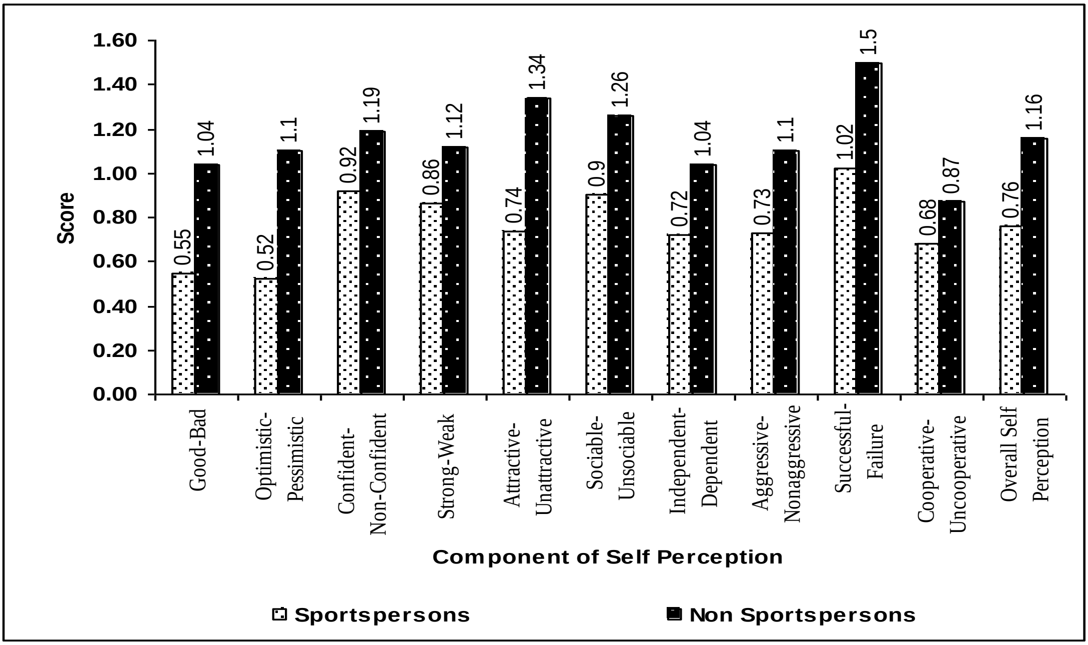

Figure 2: Comparison of mean scores of various components of self perception in sports and non sportspersons

Discussion

From the results in Table-1, it is evident that the sportspersons were found to be having significantly higher level of positive self-perception on the component Good-Bad as compared to the non-sportspersons (F-value being 13.45, $p<0.01$). This can, perhaps be attributed to the fact that sports participation inculcates the quality of fair play, adherence of codes of conduct, and obedience of rules & laws (*Kumar et al, 2003*).

On the component Optimist - Pessimist also, the sportspersons have demonstrated significantly better level of optimism as compared to the non-sports participants ($F=18.10$, $p<0.01$). In sports, as the participants always strive hard to excel and do better than other participants, it cultivates among them the quality of persistence and will to fight for win in all situations, as without optimistic approach one cannot expect to win. *Salokun & Torila (1985)* had found athletes to be having positive outlook and more self assured than non-athletes.

With regard to construct Attractive - Unattractive, once again the sportspersons have exhibited significantly higher and better level of perceiving themselves as compared to the non-sportspersons. This may be due to the reason that one tends to attain physical fitness as well as feeling of physical well being through participation in sports, which in turn promotes positive feeling among them on this component of self perception. This "feel good factor" further engenders in the athletes the greater perception of better body image and feeling of greater competence (*Robinson and Shaver, 1969*).

Finally, as depicted in the figure, the sportspersons have revealed their superiority over the non-sportspersons on the overall self-perception as they have been found to be significantly better on the variable overall self perception. *Baize and Sheila (1991)* had also found that students who participated in high school athletics had higher self-esteem. *Gupta (2006)* had also reported higher levels of personally perceived as well as socially perceived self esteem among the players of experimental group who had participated in the mental simulation training programme of basketball skills as compared to the control group. The results of the present study have also undoubtedly brought about the fact that participation in sports provides certain amount of self satisfaction which indeed helps in developing better self perception among athletes.

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Left Ventricular Dimensions of Adolescent Males: A 12 Weeks Interval Training Report

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Abstract

The purpose of the study was to find out the effect of 12 weeks of interval training with 60-80% intensity for 5-15 repetitions of 400meters on left ventricular end diastolic diameter (LVEDD), left ventricular end diastolic volumes (LVEDV), left ventricular end systolic diameter (LVESD) and left ventricular end systolic volumes (LVESV) of adolescent males. Echocardiographic measurements in athletes should take into account the specific sport and the quantity and quality of training. Sixteen non-residential untrained male subjects (8 Experimental & 8 Control) ranging between 14-16 years were selected for the study. Before the 12 weeks training protocol two-dimensional and Doppler echocardiography was performed for measuring LVEDD, LVESD, LVEDV and LVESV of adolescent boys. Changes in all the parameters were insignificant in case of control group as the initial and final test means yielded lesser values than the tabulated value. The initial and final test means of LVEDD and LVEDV of the experimental group were 44.75cm, 45.5cm and 91.75ml and 95.38ml respectively and the mean difference were insignificant ($p>0.05$) whereas, 't' value of LVESD and LVESV of the experimental group were 3.77 ($p <.05$) and 3.64 ($p <.05$) respectively. The result indicates that the 12 weeks interval training was effective for significant reduction of LVESD and LVESV values of the adolescent boys.

Key wards: LVEDD, LVESD, LVEDV and LVESV.

Introduction

Regular physical exercise induces changes in the body that are termed as physiological adaptations to increased loads. In general, these adaptations are favorable and enable the individual to increase physical performance capacity (*Macfarlance et al, 1991*). Adaptations of training include the structure and function of cardiovascular system in addition to its functional control (*Urhausen and Kindermann, 1992*). Strength training induces changes to pressure loads, whereas endurance training requires volume loads and elicits an increased maximal cardiac output, by increasing stroke volume (*Andersen et al, 2000 and Astrand et al, 2003*). It has been found that sports performance and training induced adaptations are determined mainly by genetic factors and to a limited extent by training (*Kuipers, 2005*).

All forms of athletic training are associated with left ventricular hypertrophy (LVH). However, the exact effects on cardiac structure and function depend upon the type of training (*Gilbert, 1977; Nishimura, 1980*). Endurance training exerts a volume overload on the left ventricle and produces left ventricular cavity enlargement with proportional increases in myocardial thickness (*Morganroth et al, 1975 and Longhurst, 1981*). Long-term athletic training is associated with cardiac morphological changes, including increased left ventricular cavity dimension, wall thickness and calculated mass that are commonly described as "athlete's heart" (*Rost and Hollmann, 1983; Hutson et al, 1985; Maron, 1986; and Spirito et al, 1994*). These changes seem to present adaptations to the hemodynamic load produced by long term, frequent, intensive exercise programmes (*Longhurst et al, 1980; Keul et al, 1981 and Longhurst et al, 1981*). The extent to which left ventricular cavity dimensions is increased by systematic training is modest in most athletes (*Astrand et al, 2003*).

Echocardiography has become firmly established in cardiological diagnostics in last few years. Two-dimensional echocardiography yields important information, not only about pathological changes, but also about structural and functional adaptations about healthy hearts. It is useful to the sports cardiologists as it is non-invasive and is repeatable (*Urhausen and Kindermann, 1992*).

The purpose of the present study was to evaluate the effect of 12-weeks of interval training on echocardiographically determined left ventricular end diastolic diameter (LVEDD), left ventricular end systolic diameter (LVESD), left ventricular end diastolic volume (LVEDV) and left ventricular end systolic volume (LVESV) of adolescent boys.

Material & Method

Sixteen non-residential untrained male subjects ranging between 14-16 years were selected for the study. Out of these 8 subjects served as control and other 8 were included in the experimental group. Before and after the training protocol two-dimensional Doppler echocardiography tests were performed for measuring LVEDD, LVESD, LVEDV and LVESV of al the boys. Images of the heart were obtained in multiple cross sectional planes by using standard transducer position (*Tajik et al, 1978*).

Twelve weeks training was imparted to the experimental group. Initially general conditioning programme was imparted for a period of four weeks to the experimental group and for the next 12 weeks the interval training method was adopted for development of cardio-vascular endurance as per the details given in table 1. Before each training session 20 minutes of general warming up and after the training session 20 minutes of cool down protocol was followed. For the control group no such training was applied.

TABLE – 1: Weekly Schedule of Training Programme

Method	Interval training
Intensity	60 – 80%
Duration	70 to 90 sec
Distance	400 meters
Repetitions	5 – 15
Recovery	Active and incomplete, the next repetition was started when Minute Heart Rate dropped to 110 – 120 beats.
Load Frequency	Thrice a week

The initial and final test scores were compared for significance using t-test (*Garet, 1969*). The statistical analysis was tested for significance at 0.05 level of confidence.

Results and Discussion

LVEDD of experimental and control subjects before and after the training were 44.75, 45.38 and 45.5, 45.25 cm respectively. Table-2 reveals that the t-ratios obtained for the mean differences in the initial and final values for the experimental and control groups yielded insignificant values of 1.05 and 0.22 respectively, since both these values were lesser than the ‘t’ value of 2.36 required for significance at 0.05 level. LVESD of the subjects before and after interval training were 29.13 and 27.13 cm (experimental) and 28.75 and 28.75 cm (control). T-ratio for the experimental group showed significant decrease in LVESD in contrast to the control group. The t-ratios obtained for the mean differences between initial and final tests of the experimental and the control groups in LVEDV were 1.14 and 0.04 respectively, which were not significant, whereas LVESV showed significant decrease in case of experimental group ($P<0.05$).

TABLE 2: Significance of differences between the initial and final test means of experimental and control groups in LVEDD, LVESD, LVEDV and LVESV

Parameters	Initial Test	Final Test	DM	t-ratio
Exp. LVEDD (cm)	44.75	45.50	0.75	1.05
Cont. LVEDD (cm)	45.38	45.25	0.13	0.22
Exp. LVESD (cm)	29.13	27.13	2.00	3.77*
Cont. LVESD (cm)	28.75	28.75	0.00	0.00
Exp. LVEDV (ml)	91.75	95.38	3.63	1.14
Cont. LVEDV (ml)	95.00	94.88	0.12	0.04
Exp. LVESV (ml)	33.00	27.75	5.25	3.64*
Cont. LVESV (ml)	32.13	32.38	0.25	0.12

Exp. = Experimental Group while Cont. = Control Group
$t_{.05}$ (7) =2.36, * Significant at 0.05 level

Exercise training causes a number of well-known physiological changes in the heart: an increase in LVEDD and LV wall thickness that lead to increased left ventricular mass, stroke volume is increased and heart rate is decreased in resting conditions (*Brornstad et al, 1993 and Fagard, 1997*). The values obtained by echocardiography for cardiac dimensions and wall thickness for athletes do not provide a distinct data set or a bimodal distribution and are usually within the ranges accepted as normal. Although such values are usually significantly different from the normal in statistical terms, the reports on echocardiography findings in athletes are somewhat contradictory, possibly because of varying methodology (*Turpeinen, 1996 and Fagard, 1997*).

Left ventricular end diastolic diameter (LVEDD) and left ventricular end diastolic volume (LVEDV) changes were insignificant in the case of experimental subjects following interval training in the present study. Interval training requires a prolonged effort to have an effect on the LVEDD and LVEDV in an individual. The training for endurance activity is invariably of long durations during which cardiac output is sustained at high levels. The response to this type of stimulus, which may be called volume stress, may facilitate cardiac hypertrophy through an increase in the size of the ventricular cavity.

In the present study, the duration of interval training might not have been sufficient enough to cause significant increase in left ventricular end diastolic diameter and left ventricular end diastolic volume. *Pelliccia (1999*) reported that most of the elite athletes had absolute left ventricular cavity dimensions within normal limits. The magnitude of cavity dimension seems extraordinary given the fact that in normal populations (*Knutsen et al, 1989, Devereux et al, 1984, Valdeg et al, 1979*) or in previously sedentary persons undergoing short-term exercise training programmes (*DeMaria et al, 1978 and Adams et al, 1981*), it is necessary to point out that hypertrophy of the myocardium does not manifest in every endurance-trained athlete. One of the reasons of the varying myocardium remodeling response might be inadequate training programme stimulus in this regard (*Laughlin and McAllister, 1992 and Urhausen & Kindermann, 1999).*

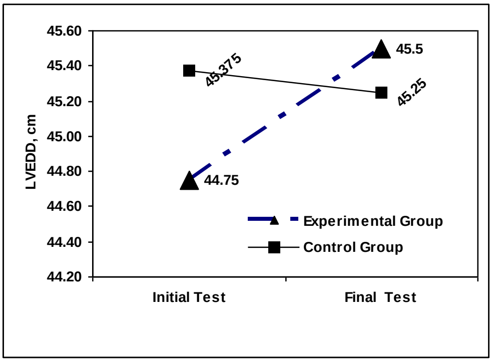

Figure 1: Comparison of LVEDD in the control and Experimental groups after 12 week interval training

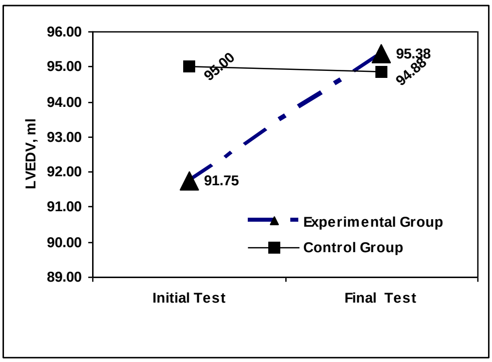

Figure 2: Comparison of LVEDV in the control and Experimental groups after 12 week interval training

In fact, for significant development of LVEDD & LVEDV prolonged period is required. The duration of training employed in this study might have been inadequate and hence there was no significant increase in LVEDD & LVEDV of the experimental subjects. The LVEDD & LVEDV of the subjects are graphically represented in Figures 1 & 2. The finding related to LVEDD was found to be in agreement with the views of *Rubal (1987), Snoeckx (1982)* and *DeMaria (1978)* and the findings of LVEDV duly support the findings of *Wolfe and co-workers (1979*).

Figures 3 & 4 represent the changes in LVESD and LVESV in the subjects after the training. Due to the interval mode of endurance training, the experimental group had to carry out a higher pre-load in regular way, for 12 weeks, which has resulted in an increase in CO during the workout.

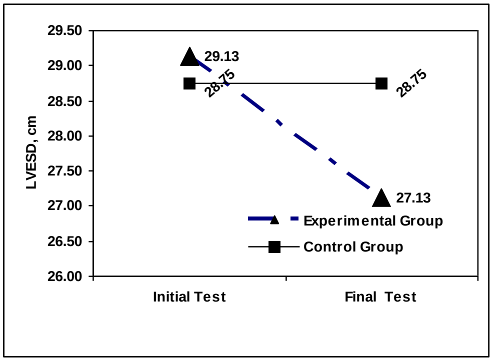

Figure 3: Comparison of LVESD in the control and Experimental groups after 12 week interval training

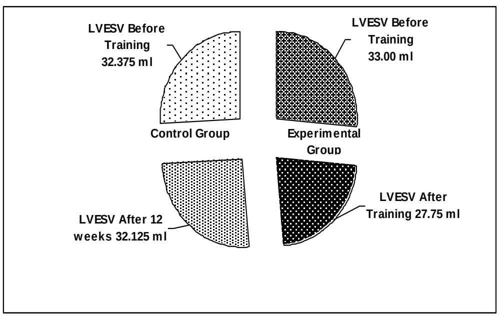

Figure 4: Comparison of LVESV in the control and Experimental groups after 12 week interval training

The resting bradycardia with increased stroke volume needs a powerful contraction of the left ventricle with every beat of the heart. The significant decrease of LVESD & LVESV in the experimental subjects may be due to the forceful stroke output resulting in the resting bradycardia. The results of LVESD were found to be in agreement with the similar results reported by *DeMaria (1978)* and the findings of LVESV were found to be concurring with the views of *Astorri and co-workers (1986)*.

Conclusions

The interval training of moderate to long duration with 60 to 80% intensity for a period of 12-weeks was successful in significantly decreasing Left Ventricular End Systolic diameter and Volume whereas it failed to cause statistically significant changes in the Left Ventricular End Diastolic diameter and Volume in the experimental subjects.

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Effect of Packages of Training on Functions of Haemoglobin Concentration and Mean Arterial Pressure among School Boys

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Abstract

The purpose of this study was to find out the effect of packages of training on functions of Haemoglobin concentration and Mean arterial pressure among school boys. Sample of ninety subjects drawn at random among the schoolboys of Elisa bondolfi Gregory (EBG) matriculation School Madurai. Their age ranges from fifteen to eighteen. They were divided into three equal groups namely control Group (Group – I), Run & walk group (Group – II) and interval training group (Group-III). The subjects were tested in order to find out Haemoglobin concentration, Mean Arterial pressure, Blood glucose and Blood Lactic Acid concentration in the yearly morning before the start of the training program. Group II were given Run & walk program for Ten weeks on alternate days a week for one hour to one and half hour duration. Group III were given Interval training for Ten weeks on alternate days a week for one hour to one and half hour duration. The control group did not involve any training. The data collected on the pre and posttest data on selected dependent variables were subjected to ANCOVA to find out significant. Scheefe's post hoc test was used to find out which of the paired means differed significantly. Analysis of data revealed that the haemoglobin concentration was increased due to the treatment of ten weeks of Run & Walk and Interval training. The Interval training increased in the haemoglobin concentration more than the Run & Walk group and control group. However, the Run & Walk group increased the haemoglobin concentration more than the control group.There was no significant difference in Mean Arterial pressure, blood glucose and blood lactic acid concentration level due to the influence of the ten weeks of Run & Walk and Interval training groups.

Keywords: Haemoglobin, Mean Arterial Pressure, Blood Glucose, Blood Lactic acid Packages of training, Interval training

INTRODUCTION

Sports training is a planned and controlled process in which, achieving a goal, change in complete sports motor performance, ability to act and behaviour are made through measures of content, methods and organization.

Sports training must be understood as a specialized process of all-round physical conditioning aimed at the methodical preparation of athletes.

Success in competitive sports and games can be attributed to many factors, training being one of the most important factors. Different training methods have been commonly lead to improve physical fitness and its related standards of performance of athletes or players. The training methods include, interval training, fartlek training, hollow sprint training, Resistance training, Altitude training, Alternative pace training, Weight training, Aerobic training and Anaerobic training etcetera.

Physical training provide a means of acquiring optional fitness in systematized controlled fashion. The intensity, load and vigor of packages of physical training are indeed challenging and enjoyable to the performer. The package of training has contained all the above said qualities.

Physical training brings a lot of changes in the body that is an increase of maximum respiratory minute volume in exercise A slight increase in oxygen diffusion capacity Ten to thirty percent increase in maximum oxygen uptake. An increase in stroke volume and maximum cardiac output an increase in size of the heart. An increase in total haemoglobin and blood volume.

Effect of packages of training on physiological variables is considered as both scientific discipline and applied science as a sub discipline of physical education, it is concerned with the study of cardiovascular, cardio respiratory, neuromuscular and metabolic process and the effects of packages of training exercises on them. Its study includes the sources of energy for movement, the process of energy generation and the effects that movement has on the body system. Through the research it is proved that the packages of training programme of both maximal and sub-maximal levels brings about the changes in various systems in the human body.

Materials & Methods

To execute this investigation, the research scholar employed random sample of ninety subjects drawn at random among the schoolboys of Elisa Bondolfi Gregory (EBG) Matriculation School Madurai. Their age ranges from fifteen to eighteen. They were divided into three equal groups namely control Group (Group – I), Run & walk group (Group – II) and interval training group (Group-III). The subjects were tested in order to find out Haemoglobin concentration, Mean Arterial pressure, Blood glucose and Blood Lactic Acid concentration in the yearly morning before the start of the training program. Group II were given Run & walk program for Ten weeks on alternate days for one hour to one and half hour duration. Group III were given Interval training for Ten weeks on alternate days a week for one hour to one and half hour duration. The control group did not involve any training. The initial and final results were recorded.

Independent Variable

i. Run and Walk Program
ii. Interval Training

Dependent Variable

i. Haemoglobin concentration
ii. Mean arterial pressure
iii. Blood glucose
iv. Blood lactic acid concentration

Criterion measure

Haemoglobin content from the blood sample in mg% was determined by the procedure prescribed by *Sahil's (1985)*.

The mean arterial pressure was measured by ascultatory method using sphygmomanometer and stethoscope. The blood pressure for all subjects was taken in the morning after ten to twelve minutes of rest in a comfortable position. Mean Arterial Pressure was calculated by using the formula

Mean Arterial Pressure = Diastolic pressure + 1/3 pulse pressure

Where, *Pulse pressure = (systolic pressure – diastolic pressure)*

Blood Glucose in mg/dl was estimated as per *Astar and King (1980).* For the estimation of lactic acid in blood the procedure prescribed by Barker and Summerson (1980) was followed.

Training programme

The following schedule of training was given for the Run & Walk and Interval training group.

Run and walk program

1. 50 steps run, 50 steps walk
   (i) 5 sets the first day.
   (ii) Every two weeks the number of sets was increased by one until 10 sets were completed.
   (iii) Used the same set procedure for each new series of run-walk.
2. 50 steps run, 40 steps walk
3. 50 steps run, 30 steps walk
4. 50 steps run, 20 steps walk
5. 50 steps run, 10 steps walk
6. 75 steps run, 10 steps walk
7. 100 steps run, 10 steps walk
8. 125 steps run, 10 steps walk
9. 150 steps run, 10 steps walk
10. 175 steps run, 10 steps walk
11. 200 steps run, 10 steps walk
12. Individual Program

Interval training program

WEEK : 1ST, 2ND , 3rd

Day : I, II , III

Program	Repetition	Recovery
80 Meters	4 - 6	Walk 5 minutes
100 Meters	3 - 4	Walk 5-8 minutes
150 Meters	2 - 3	Walk 10 minutes
200 Meters	2 - 3	Walk 10 minutes
300 Meters	1	--

WEEK : 4th, 5th, 6th

Day : I, II , III

Program	Repetition	Recovery
100 Meters	4 - 6	Walk 5 minutes
150 Meters	3 - 4	Walk 5-8 minutes
200 Meters	2 - 3	Walk 10 minutes
300 Meters	2 - 3	Walk 10-15 minutes
400 Meters	1	--

WEEK : 7th, 8th, 9th & 10th

Day : I, II , III

Program	Repetition	Recovery
100 Meters	4 - 6	5 min Walk
150 Meters	3 - 4	5-8 min Walk
200 Meters	2 - 3	10 min Walk
300 Meters	2 - 3	10-15 min Walk
400 Meters	1	--

Statistical technique

Analysis of covariance was used to find out the significance difference among the treatment groups.

Scheffe's post-hoc test was used to find out the paired mean significant difference between the groups

Results

TABLE – I (A): Computation of Analysis of Covariance of Haemoglobin Concentration Scores of Control, Run & Walk and Interval Training Groups (Scores in gm/ 100ml)

	Control Group	Run & Walk Group	Interval training Group	Source of variance	Sum of Squares	df	Means Squares	F-ratio
Pre-test means	13.01	13.12	12.70	B	2.76	2	1.38	
				W	21.68	87	0.25	5.52*
Post-test means	12.96	13.32	13.54	B	5.04	2	2.52	
				W	10.65	87	0.12	21.00*
Adjusted Post-test means	12.93	13.24	13.65	B	7.33	2	3.67	
				W	10.47	86	0.12	30.12*

B - Between Group Means, W - Within Group Means NS - Not Significant, * - Significant, Df - Degrees of freedom Table Value for 0.05 Level = 3.11)

The result of the study showed that experimental groups had significantly improved in Haemoglobin concentration due to Run & Walk and interval training when compared with the mean difference of the control group.

TABLE – I (B): Ordered Adjusted Haemoglobin Concentration Means and Differences between the Means of Control, Run & Walk, Interval Training Groups (Scores in gm/100ml)

Control Group (N=30)	Run & Walk Group(N=30)	Interval training Group (N=30)	Mean Difference	Scheffe's Test CI Value
12.93	13.24		0.41*	
		13.65	0.72*	0.25
12.93	13.24	13.65	0.31*	

CI – Confidence Interval Value *-Significant at 0.05 Level

TABLE – II: Computation of analysis of covariance of mean arterial pressure score of control, run & walk and interval training groups. (Scores in Milimeters of Mercury)

	Control Group	Run & Walk Group	Interval training Group	Source of variance	Sum of Squares	df	Means Squares	F-ratio
Pre-test means	**95.25**	**95.92**	**96.29**	**B**	**16.46**	**2**	**8.23**	**0.35 NS**
				W	**2072.02**	**87**	**23.82**	
Post-test means	**94.81**	**95.26**	**94.60**	**B**	**6.79**	**2**	**3.40**	**0.31 NS**
				W	**939.96**	**87**	**10.80**	
Adjusted Post-test means				**B**	**9.10**	**2**	**4.55**	**0.66 NS**
				W	**594.24**	**86**	**6.91**	

The result of the study showed that experimental groups had no significant effect on mean arterial pressure due to Run & Walk and interval training when compared with the mean difference of the control group.

TABLE-III: Computation of analysis of covariance of blood glucose, Score of control, run & walk and interval training groups. (Scores in per mg/100ml)

	Control Group	Run & Walk Group	Interval training Group	Source of variance	Sum of Squares	df	Means Squares	F-ratio
Pre-test means	**92.62**	**93.25**	**93.92**	**B**	**25.36**	**2**	**12.68**	**1.00 NS**
				W	**1098.75**	**87**	**12.63**	
Post-test means	**91.46**	**92.38**	**93.37**	**B**	**54.36**	**2**	**27.18**	**1.62 NS**
				W	**1462.76**	**87**	**16.81**	
Adjusted Post-test means				**B**	**27.81**	**2**	**13.91**	**2.69 NS**
				W	**445.10**	**86**	**5.18**	

The result of the study showed that experimental groups had no significant effect on Blood glucose levels due to Run & Walk and internal training when compared with the mean difference of the control group.

TABLE – IV: **Computation of analysis of covariance of blood lactic acid score of control, run & walk and interval training group** (Scores in Mmoles)

	ControlG roup	Run & Walk Group	Interval training Group	Source of variance	Sum of Squares	df	Means Squares	F-ratio
Pre-test means	**10.07**	**10.50**	**10.37**	**B**	**2.96**	**2**	**1.48**	**0.55 NS**
				W	**234.33**	**87**	**2.69**	
Post-test means	**10.23**	**10.57**	**10.40**	**B**	**1.67**	**2**	**0.84**	**0.34 NS**
				W	**217.93**	**87**	**2.50**	**0.04 NS**
Adjusted Post-test means				**B**	**0.11**	**2**	**0.06**	
				W	**146.63**	**86**	**1.71**	

The result of the study showed that experimental groups had no significant effects on Blood Lactic acid due to Run & Walk and interval training when compared with the mean difference of the control group.

Discussion

Experimental groups had significantly improved in haemoglobin concentration due to Run & Walk and Interval training when compared with the mean difference of the control group

Ten weeks of Run & Walk and Interval training may have caused a small increase in the production of red blood cells. Therefore, total haemoglobin increases slightly with such training. The concentration of haemoglobin at rest is known to decline slightly with training because of the increase in plasma volume that is somewhat larger than the increase in red cells, expansion of plasma volume in trained persons further reduces haemoglobin concentration during exercise.

Haemoglobin is obviously vital to exercise because it transports oxygen from the lungs to the working muscles. Since red blood cells do not ordinarily leave the vascular space during exercise, it is not surprising that total haemoglobin does not change with exercise. Haemoglobin concentration during exercise reflects the extent of any Haemo-concentration or haemodilution, haemoglobin concentration will rise with haemo-concentration and fall with haemodilution.

Run & Walk and Interval training showed increased blood volume and total Haemoglobin content. Most of the increase in blood volume reflects an increase in the amount of plasma rather than an actual rise in the red blood cell volume. Therefore haemoglobin concentration slightly increased after this training. Due to this training Interval training group increased in the haemoglobin concentration more than the Run & walk training group and control group. However the Run & Walk group increased the Haemoglobin more than the control group.

Experimental groups revealed no significant effect on mean arterial blood pressure due to Run & Walk and Interval training when compared with the mean difference of the control group.

During Run & Walk and Interval training, the dilation of blood vessels in the working muscles reduces the arterial resistance to blood flow more than the vasoconstriction in non-working tissues, increases the resistance. Therefore, the net effect of changes in blood vessels, size, during exercise is to decrease the blood pressure simultaneously however, cardiac output causes a greater systolic pressure, which more than counteracts the tendency toward reduced pressure caused by vaso dilation in the working muscles, since only a slight fall in blood pressure.

It was found that haemo-dynamic changes in older normotensive and hypertensive men and women who exercised for 45 min between 50-70% VO_2max and followed their cardio vascular changes from 1-3 hours post exercise. Mean blood pressure and cardiac output were significantly decreased, whereas measured haemodynamic changes in older normotensive and hypertensive men and women who exercised for 45 min between 50-70% VO_2max and followed their cardio vascular changes from 1-3 hours post exercise. Mean blood pressure and cardiac output were significantly decreased, whereas peripheral vascular resistant increased. Stroke volume was decreased, a change attributed to a reduction in preload caused by a possible decrease in plasma volume.

Run & Walk and Interval training programme involves moderate to streneous workloads. The typical response is an elevation of systolic pressure on average 8mm of Hg for each increase in workload of 2000 foot-pounds per minutes. Diastolic pressure follows the course of systolic, but to a lesser degree. Thus the mean arterial pressure raises approximately 3mmHg pounds for each 2000 foot-pounds per minute increase in workload. The Mean Arterial Pressure is usually calculated at one third of the way between diastolic and systolic pressure because of the shape of the arterial pressure wave form, and therefore control group and training groups did not have any significant improvement after 10 weeks of Run & Walk and Interval training on Mean Arterial Pressure.

Experimental groups had no significant effect on Blood glucose levels due to Run & Walk and Internal training when compared with the mean difference of the control group.

Run & Walk and Internal training increases blood flow in subjects and improve the microcirculation. There was increased peripheral blood flow, which brings greater amount of glucose to the site of utilization. Such increased utilization of glucose may bring about desirable decrease in blood sugar. The Run & Walk training leads to hyperglycemia, excess of sugar in blood due to glucogenolysis. But Interval training leads to lypocemia. The practice of taking glucose during exercise is aimed more at preventing hypoglycemia than giving energy for the exercise.

Due to the Run & Walk and Internal training the rate of total Carbohydrates oxidation was also similar during the first 2 Hrs of exercise in both trials. However, CHO oxidation began declining during the third hour of the placebo trial, at a time when muscle glycogen was low and blood Glucose concentration was declining. Blood glucose concentration and the rate of CHO oxidation eventually fell to 2.5 mmol/ltr and less 1.4g/min respectively at the time of fatigue. Thus the lowering of blood glucose during the later stages of prolonged strenuous exercise appeared to play a major role in the development of muscular fatigue. The only time that carbohydrates should possibly be avoided is in the 30-60 min immediately before competition or training. For some individuals has timing of feeding may produce a rapid fall in blood glucose levels in the first 20min or 80 of exercise and so impair performance.

It was found that during prolonged heavy exercise, the water balance may be disturbed and the stores of available energy, particularly glycogen, may be critically too. Therefore, the individuals' ability to transport oxygen from the air to the working muscles may not always be the limiting factor. It has been found that the subjective feeling of glucose in the fasting subject and for a depletion of the glycogen depots in the working muscles. An increase in heart rate with reduction in stroke volume as work proceeds is often observed during prolonged exercise, particularly in a hot environment. If dehydration and the fall in blood sugar are prevented by proper supply of fluid and sugar, performance capacity is better maintained during prolonged exercise, therefore control group and training groups did not have any significant improvement after 10 weeks of Run & Walk and Interval training on Blood Glucose.

Experimental groups had no significant effects on Blood Lactic acid due to Run & Walk and Interval training when compared with the mean difference of the control group.

Run & Walk and Interval training prolonged for hours the work output during maximal effects decreases gradually. After the rest, a workload that normally could be tolerated for 6 minutes had to be terminated after about 4 minute due to exhaustion. The peak lactate level in the blood correspondingly decreased.

It is believed that the limiting factor must be sought at the cellular level in the exercising skeletal muscles, and could be anything from a change in the properties of the membranes of muscle fibers, and distributed ATP-ADP 'machine' etc to a depletion of the oxygen stores or a reduced capacity to neutralize the metabolites produced.

Subjects in Run & Walk and interval training can work for hours with an oxygen uptake around 70 to 80 percent of their maximum with little or no increase in blood lactate concentration. From physiological side it is important to determine those speeds and to train in Interval methods and forms with identical or varying speed intensities which will lead to a steady state Lactate or almost equal Balance between ATP breakdown and its regeneration with low to medium blood lactate concentration and less PH decrease. This means that active pause between the runs will help accelerate the elimination of lactic acid by high oxygen transportation. By working at 30-50% VO_2 max, the Lactate values can be eliminated 2-3 times faster.

It was found that due to 10 weeks of Run & Walk and Interval training at sub maximal intensity elicits a lower blood lactate response in children than in adults and an age-related increase towards adult values during development. In 12 to 18 Years old boys suggest that glycogenolysis and consequent ability to produce lactate is limited in children and adolescence compared with adults, therefore control group and training groups did not have any significant improvement after 10 weeks of Run & Walk and Interval training on Blood Lactic Acid Concentration.

Conclusions

Within the limitations of the present study, the following conclusions were drawn.

The haemoglobin concentration was increased due to the treatment of ten weeks of Run & Walk and Interval training. The Interval training increased in the haemoglobin concentration more than the Run & Walk group and control group.

However, the Run & Walk group increased the haemoglobin concentration more than the control group.

There was no significant difference in Mean Arterial pressure, blood glucose and blood lactic acid concentration level due to the influence of the ten weeks of Run & Walk and Interval training groups.

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A Study of Job Satisfaction among Physical Education Teachers Working in Government, Private and Public Schools of Haryana

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Abstract

In this study, an attempt was made to compare job satisfaction among Physical Education teachers working in different types of schools such as government, private and public schools in the state of Haryana. It was hypothesized that there would be significant difference among government private and public school physical education teachers as regards to their job satisfaction. In order to achieve the objective of the study, Job Satisfaction Scale (JSS) by developed by Singh and Sharma was administered on a sample of total 300 physical education teachers working in the state of Haryana. Out of these, the teachers working in government schools numbered 116 whereas from private and public school category, 92 teachers each were taken for the purpose of the study. Results of the study showed that significant differences in job satisfaction existed among the three categories of the teachers. It was found that government school physical education teachers differed significantly from their counterparts in public schools whereas this difference was not found to be significant between government and private school teachers and also between private and public school physical education teachers.

Key Words: Job Satisfaction, Government Schools, Private Schools, Public Schools

Introduction

Today, teaching in Physical Education has become a demanding profession which requires exceptional skills. Physical education teaches have to play a very vital role and their work involves a number of duties such as planning, teaching, evaluative, administrative and various unclassified ones. A physical education teacher requires a greater variety of talents than any other teaching area. His responsibilities are diverse and the society looks up to him as a leader who can create and maintain general fitness of the sedentary people on one hand and help produce sports persons at grass root level, on the other. As a result, physical education teachers working in schools feel their workload heavier, strenuous and difficult too. Some of them feel that in proportion to the expectations of the society they are not given due place, recognition, autonomy, pay, working conditions, opportunities for growth and advancement and so on. All this leads to job dissatisfaction or low job satisfaction among teachers in general and physical education teachers in particular in many developing countries around the world (*Dinham and Scott, 1998; Scott et al, 2001, Van Den Berg, 2002*). The effects of this trend include reduced ability to meet students' needs, significant incidences of psychological disorders leading to absenteeism and stress-related illnesses (*Farber, 1991; Troman and Woods, 2000*). Most importantly, though teacher dissatisfaction appears to be a main factor in teachers leaving the profession in many countries including India.

Job satisfaction has been considered to be a function of the perceived relationship between that one wants from one's job and what he perceives it is offering (*Locke, 1969*). Certain factors, if present, contribute to job satisfaction and if absent, contribute to job dissatisfaction, and vice-versa. *Herzberg et al (1959)* developed two - factor theory of job satisfaction and concluded that there were certain conditions of employment that, if present, acted as job satisfiers (motivators) and other conditions that acted as job dissatisfiers (hygiene factors). Several research studies have attempted to replicate and/or apply *Herzberg's (1959)* study in educational settings *(Johnson, 1967; Sergiovanni, 1966; Robert Simmons, 1970; Graham, 1985; Litt and Turk, 1985).* Although a lot of research has been done on job satisfaction among teachers much has not been done on job satisfaction among physical education teachers whose job has been intensified to a great extent as discussed earlier.

Therefore, the present study has been undertaken to investigate job satisfaction among physical education teachers working in Haryana schools and to find out the difference in job satisfaction among physical education teachers working in the three categories of schools i.e. government, private and public schools in Haryana. The present study, on the basis of this objective, hypothesized that there would exist significant differences among the government, private and public schools physical education teachers regarding their job satisfaction.

Material & Method

Sample

The sample of the study consisted of a total 300 Physical Education teachers, out of which 116 teachers were teaching in government schools whereas from private and public schools category 92 teachers each were taken for the purpose of the study.

Test Used

For measuring job satisfaction among teachers, Job Satisfaction Scale (JSS) developed by Singh and Sharma was used. This scale provides measure of the extent of job satisfaction which an employee perceives from various conditions and constituents of his job.

Procedure

The physical education teachers were personally contacted for the purpose of data collection. Most of them were contacted individually at their places of posting whereas some of them were contacted in groups also during Zonal, District and State level school competitions organised by the Haryana School Education Directorate from time to time. A brief description of the test scale along with the objectives and importance of the study were explained to the subjects to ensure their honest, correct and sincere responses. After data collection, all the answer sheets were scored on the basis of scoring procedure as given in the manual. The raw scores were statistically analysed and results were interpreted accordingly.

Results and Discussion

Job satisfaction among 116 government, 92 private and 92 public school physical education teachers was examined. Their mean scores, standard deviations and standard error of means were worked out alongwith F-ratios

(ANOVA) to find out whether significant differences existed among the three categories of teachers on the variable job satisfaction. Post Hoc Test comparison was also used to find out where the actual difference existed. The results so obtained are given in Table - 1

Table – I: Analysis of Variance for Job Satisfaction among Physical Education Teachers working in Government, Private and Public Schools

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SUM OF SQUARES	F
Between Groups	5363.12	2	2831.56	5.78**
Within Groups	14558.12	298	490.10	
TOTAL	151221.24	300		

** Significant at 0.01 level

Table 2: Post Hoc Test Comparison of Means on Job Satisfaction among Physical Education Teachers working in Government, Private and Public Schools

GROUP	MEAN (GOVT)	MEAN (PRIVATE)	STAT.	DF
Govt. Vs. Private	84.69	80.67	1.229 ^{NS}	206
Govt. Vs. Public	84.69	74.21	3.718**	206
Private Vs. Public	80.67	74.21	1.826 ^{NS}	182

^{NS} = Non Significant ** Significant at 0.01 level.

A comparison of government, private and public school Physical Education teachers on the variable job satisfaction is given in Table - 1 and Table 2. The results presented in Table 1 indicate that there is a significant difference in job satisfaction among the three categories of physical education teachers working in government, private and public schools of Haryana state as the obtained F value 5.78 was found higher than the table value of 4.68 required to be significant at 0.01 level of confidence. Further, to confirm the significant differences between the paired means, Scheffe's Post-hoc Test has been applied.

The obtained results given in Table 2 clearly indicate that physical education teachers working in government schools are having higher mean score (84.69) as compared to the mean scores of those working in private (80.67) and public (74.21) schools. The table further shows that this difference is significant between government and public school physical education teachers at 0.01 level of confidence. It means that the teachers working in government schools are better in terms of job satisfaction than those working in the other two categories of schools but the difference in job satisfaction is significant only between two groups i.e. government and public schools physical education teachers.

The better job satisfaction among government school physical education teachers may be attributed to factors such as better service conditions, job security and prestige along with many more. There are aspects such as feeling of the sense of achievement and independence, autonomy, feedback on quality of performance and completion which might be the contributing factors for higher job satisfaction among physical education teachers working in government schools than their other two counterpart groups. These teachers have a better position in their job in terms of higher pay scales, job security, more freedom, decision making power, less interference by managements (in case of private and public schools it is more) and manageable class sizes. There is lesser role ambiguity and role conflict also which is more common among teachers in privately managed and public schools.

It was hypothesized that there would be significant difference in job satisfaction among physical education teachers working in government, private and public schools; as most of the previous studies have shown that teachers working in government schools have more job satisfaction than private and public school teachers. Keeping this in view, it was predicted that government, private and public school physical education teachers would differ significantly as far as job satisfaction in concerned. *Pal (2001)* also found in his study significant difference on job satisfaction among physical education teachers working in government, private and public schools of Chandigarh, Mohali and Panchkula. Earlier, *Lata (1982)* also noted in her study that women teachers working in government schools are more satisfied with their job than their counterparts working in private schools.

On the basis of the results discussed above, the hypothesis that significant difference would exist on job satisfaction among the physical education teachers working in different types of schools i.e. government, private and public schools, is accepted.

Conclusions

On the basis of above findings, the following conclusions which may be considered as the highlights of the study are: Significant differences are found among physical education teachers working in government, private and public schools in Haryana on the variable job satisfaction.

There are significant differences on job satisfaction between government and public school physical education teachers. Physical education teachers working in government schools have the highest job satisfaction followed by private and public school physical education teachers respectively.

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Effect of Self-Efficacy on the Performance of Athletes

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Abstract

Athlete is an excellent portrayal of the complex interaction between the mind and the body that interest sports psychologists from time to time. Research in the field of psychological traits like self efficacy in athletes are of vital significance to get the information needed by the Sports trainer and coaches who are loaded with the responsibility for selection, counseling and also training of athletes for the competition. Thus the purpose of the study was to investigate the effect of the psychological trait self-efficacy on the sports performance of the male and female athletes in the age group of 13 to 19 yrs from the schools of Punjab and Chandigarh. The subjects comprised of 200 athletes from the disciplines of Cricket, Kho-Kho, Volleyball, Softball and Athletics. Out of them 100 belonged to Inter-School level and 100 to School National level. The data was collected using Self-efficacy Questionnaire developed by *Bandura (1977).* The results were drawn using 2x2 ANOVA which showed that School National Level athletes were significantly better on perceived physical ability and self-efficacy than the School District Level athletes.

Key Words: Self Efficacy, Sports Performance, Perceived Physical Ability, Athletes, School Level, District Level

Introduction

Sports psychology in many ways is a fortunate scientific field of inquiry as it provides an arena for the study of human performance and emotions spanning the "thrill of victory to the agony of defeat" as well as group dynamics, organizational behavior and individual personality characteristics. Overall the literature supports, the idea that the mental preparation strategies have a positive effect on the performance as it is assumed that physical ability of an individual are related to his psychological structure because the environment in which the physical abilities are displayed constitute an ideal setting for the development of psychological characteristics as well. The rationale of this research work circles around the factors like self-efficacy which is the axis of human traits and to a large extent affects the outcome of the specific behavior.

Self-efficacy is people's belief in their capabilities to perform in ways that give them control over events that affect their lives. Bandura (1977) used self-efficacy to denote a situationally specific variable which influences performance and determines how much efforts individual will expand and how long they will persist in the face of obstacles and difficult experiences. Therefore, higher the self efficacy more will be the intensive effort while lower the self-efficacy less will be the effort and difficult tasks will be viewed as threats.

Moritz et al (2000) examined the relationship between self-efficacy and performance in sport. Based on 45 studies (102 correlations), the average correlation between self-efficacy and sport performance was observed to be 0.38. Given the heterogeneity of findings, follow-up univariate and multivariate moderator analyses were conducted by them. Results indicated that the most important moderator was concordance, thereby highlighting the importance of matching the self-efficacy and performance measures. Additional moderators examined by them included the types of self-efficacy measures, the types of performance measures, the nature of the task, and the time of assessments. These variables accounted for approximately 44% of the variance in the self-efficacy-performance relationship.

Weinberg and Yukelson, Jackson (1980) have conducted a series of experiments testing self-efficacy prediction in a competition and found that high self-efficacy subjects persist significantly longer in an aversive muscular endurance task than low self-efficacy subjects,

McAuley (1993) reported the role played by exercise self-efficacy in the maintenance of exercise participation of previously sedentary middle-aged adults 4 months after the termination of a formal exercise program. He examined the influence of self-efficacy, physiological (aerobic capacity, sex, body composition), and behavioral (past exercise frequency and intensity) parameters in the maintenance of exercise participation through correlational and multiple regression analyses. He observed that self-efficacy significantly predicted exercise behavior at follow-up when controlling for biological and behavioral influences. Aerobic capacity, exercise efficacy, and exercise behavior in combination were significantly related to current energy expenditure in aerobic physical activity. Similarly McAuley and Courneys (1992) also found that more efficacious sedentary older adults reported greater positive affect during graded exercise testing than did individuals with low self-efficacy.

The study was conducted to investigate the effect of self-efficacy on the performance of athletes.

Material & Method

The subjects consisted of 200 male and female athletes ranging between 13 to 19 yrs from the schools of state of Punjab and Chandigarh. The athletes were from the disciplines of Cricket, Kho-kho, Volleyball, Softball and Athletics. Out of the total sample of 200 athletes, 100 belonged to Inter-school level and 100 to School national level.

Self-efficacy

(a) Perceived physical ability
(b) Confidence in physical self presentation

A standardized questionnaire on Self efficacy developed by *Bandura (1977)* was used for the collection of the data. The scale consisted of 22 items in the form of a questionnaire which was required to be answered by keeping in a view the situation. Each response was rated on a 6 points scale from strongly agree to strongly disagree. Three scores were computed viz (i) total physical self efficacy (sum of all items), (ii) perceived physical ability (sum of first 10 items) (iii) confidence in physical self presentation (sum of last 12 items).

Higher score reflected a stronger sense of physical self-efficacy, a greater confidence in presentation of physical skills and a higher physical ability.

All the subjects were assembled in the groups at their respective schools and the purpose of the test was explained to them. They were made to understand the procedure to fill up the questionnaire and were told to record the answers without any delay and the sheets were later segregated as per their achievements and the data was compiled strictly according to the instructions in the test manuals and scoring keys.

The data obtained was compared and statistically treated at two different level of sports performance of male and female athletes to obtain results on the basis of the findings and observation

Result and Discussion

Table 1: Mean and SD Values of Group Based On Performance (School National and School District Level) and Gender on the Variable Perceived Physical Ability (Self –Efficacy)

		MEAN	±S.D
Performance	**National**	**32.04**	**5.51**
	District	**30.03**	**4.76**
Gender	**Male**	**34.19**	**4.31**
	Female	**27.83**	**4.04**

Table 1, compares the mean and SD values of perceived physical ability (PPA) scores among the national and district level school athletes. National level athletes exhibit higher mean physical ability score (Mean 32.04, SD±5.51) as compared to the district level athletes (Mean 30.03, SD±4.76). The statistical analysis indicates that the school national level athletes were found significantly better on perceived physical ability than the district level.

A similar analysis related to the sex revealed significantly greater PPA score in case of male athletes (Mean 34.19, SD±4.31) as compared to the females (Mean 27.83, SD±4.04). The results of the study are in agreement with the similar findings reported by *Eccles et al (1993)* who also observed that boys had more competence beliefs and values than girls.

Table 2: Result of 2x2 ANOVA of Group Based on Performance (School National and School District Level) and Gender and their interaction effect on the Perceived Physical Ability (Self –Efficacy)

SOURCE OF VARIANCE	SS	DF	MS	F-VALUE
Performance (National & District)	**201.99**	**1**	**201.99**	**12.53****
Gender (Male & Female)	**2054.39**	**1**	**205.39**	**127.40****
Performance x Gender	**37.87**	**1**	**37.87**	**2.35**
Within	**16.12**			

*P<0.05, **P<0.01

Table 2 presents results of ANOVA of group based performance (School national and School district level) on the variable (self efficacy) perceived physical ability. The F value demonstrates that the difference between School National and School District Level athletes with regard to their performance on the variable perceived physical ability (self-efficacy) was found to be significant (p<0.01). The statistical value with regard to the groups based on gender also differed significantly on perceived physical ability (self-efficacy)

The result with respect to the performance x gender interaction were SS=37.87, DF=1, MS=37.87 and f-value+2.35 which is not significant. It shows that the inter-action effects of 2x2 ANOVA design are not significant with regards to variable perceived physical ability.

Table 3: Mean and SD Values of Group Based On Performance (School National and School District Level) and Gender on The Variable Confidence in Physical Self – presentation (Self –Efficacy)

	SUBJECTS	MEAN	S.D
Performance	National	38.23	6.76
	District	34.55	6.46
Gender	Male	39.90	6.77
	Female	32.88	4.85

Table 3, presents the mean score of school national and school district level athletes on the confidence in physical self-presentation. National level athletes having mean values 38.23 and 34.55 respectively. The difference between School national level athletes and School district level athletes on confidence in physical self –presentation was statistically significant (p<0.01). The mean result indicate that the school national level athletes were having better confidence in their physical self presentation than School District level athletes. The SD values of both groups were 6.76 & 6.46, which demonstrates that the group had some different intra-group variability among the subjects.

Further the mean values of male athletes was 39.90 with SD being 6.77 where as female athletes had a mean value of 32.88 and SD 4.85.The difference between the mean value of two groups was significant and the results demonstrated male having an edge over females on the said variable. The SD values of both the group demonstrated that the two samples had a different intra-group variability.

Table 4: Results of 2x2 ANOVA of Group Based On Performance (School National and School District Level) and Gender And Their Inter-action Effect on The Variable Confidence in Physical Presentation (Self –Efficacy)

SOURCE OF VARIANCE	SS	DF	MS	F
Performance(National & District)	677.13	1	677.13	22.16**
Gender(Male &Female)	2464.03	1	24.64	80.62**
Performance x Gender	199.98	1	199.98	6.44**
Within	30.56			

*P<0.05, **P<0.01

Table 4 presents results of ANOVA (2x2 factoral design) of group based performance(School national and School district level) on the variable (self efficacy) confidence in physical self presentation. The value with regard to performance were SS=677.13, DF=1, MS=677.13 and F-value=22.16. The F value demonstrates that the difference between School National and School District Level athletes with regard to their performance on the variable confidence in physical self presentation was found to be significant(p<0.01)

The statistical values with regard to the groups based on gender are: SS=2464.03, DF=1, MS=24.64 and F-value being 80.62 which was significant (p<0.01). The result with respect to the performance x gender interaction were SS=199.98, DF=1, MS=199.98 and f-value=6.54. The result relating to the main effect of interaction was significant indicating that the dependent variable was influenced by above mentioned condition of inter-action.

Table 5: Mean and SD Values of Group Based On Performance(School National and School District Level) and Gender on The Variable Self –Efficacy (TOTAL)

	SUBJECTS	MEAN	S.D
Performance	National	70.27	10.35
	District	64.58	8.33
Gender	Male	74.14	7.45
	Female	60.71	6.46

Table 5, presents the mean and SD score of school national and school district level athletes on the self-efficacy (Total). However, the School district level athletes had 64.58 as the mean value and 8.33 as SD value. Whereas, School national level having mean values of 70.27 and SD value of 10.35. The mean result indicate that the school national level athletes were found more self-efficacious. The standard deviation values demonstrate the intra-group variability among the subjects. Further the mean values of male athletes was 74.14 with SD being 7.75 where as female athletes had a mean value of 60.71 and 6.46.The SD value demonstrated the intra-group variability among the subjects.

Table no 6 Result of 2x2 ANOVA of Group Based On Performance (School National and School District Level) and Gender and Their Inter-action Effect on The Variable Self –Efficacy (TOTAL)

SOURCE OF VARIANCE	SS	DF	MS	F-VALUE
Performance (National & District)	**1618.77**	**1**	**1618.77**	**39.44****
Gender (Male &Female)	**9018.21**	**1**	**9018.21**	**219.74****
Performance x Gender	**411.86**	**1**	**411.86**	**10.04****
Within	**41.04**			

*P<0.05, **P<0.01

Table 6 presents results of ANOVA (2x2 factoral design) of group based performance (School national and School district level) on the variable self efficacy. The total value with regard to performance were SS=1618.77, DF=1, MS=1618.77 and F-value=39.44. The F value demonstrates that the difference between School National and School District Level athletes with regard to their performance on the variable self efficacy. It was found to be significant (p<0.01)

The statistical values with regard to the groups based on gender are: SS=9018.21, DF=1, MS=9018.21 and F-value being 219.74. This shows that groups based on gender differed significantly on self-efficacy (total). The result with respect to the performance x gender interaction were SS=411.86, DF=1, MS=411.86 and f-value=10.04 which was found to be significant. It shows that dependent variable was affected by the above interaction paradigm.

Conclusion

School national level athletes were found significantly better on perceived physical ability, confidence in physical presentation and self-efficacy total as compared to School district level athletes.

Male athletes were found significantly better on the variable confidence in physical self-presentation and self-efficacy total except for the perceived physical quality as a source of self-efficacy.

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Effectiveness of Integrated Neuromuscular Inhibitory Technique and LASER with Stretching In the Treatment of Upper Trapezius Trigger Points

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Abstract

Upper trapezius trigger point is a common cause for neck pain, decreased cervical range of motion and affects functional activities. The purpose of this study was to compare the effectiveness of Integrated Neuromuscular Inhibitory Technique (INIT) and, Laser with stretching in reducing pain, improving ROM and functional activities of subjects with neck pain due to upper trapezius trigger points. Twenty-two subjects diagnosed with upper trapezius trigger point were included in the study. Seventeen subjects completed the study, in two groups. Group A (7 females, 3 males) received INIT and Group B (6 females, 1 male) received Laser with stretching. The total number of treatment was six days alternatively, within two weeks. The outcome measures were taken before and after treatment. Outcomes were measured by Visual numeric scale, cervical range of motion and neck disability index (NDI).Within the groups the VNS, NDI and cervical lateral flexion showed significant change in the mean value. The comparison of pre and post VNS in Group A, there was a significant reduction in VNS with a p value which was significant ($p = 0.005$).The pre and post VNS in group B showed a significant reduction in VNS, ($p = 0.018$), though there was no significant difference in the VNS score between groups ($p=.166$). The pre and post left lateral flexion (LLF) in Group A and group B showed a significant increase ($p = 0.012$) and ($p = 0.027$) respectively. NDI exhibited reduction across both the groups with a significant difference between the groups ($p=.045$) .This study concluded that both INIT and Laser with stretching are equally effective in managing subjects with neck pain due to upper trapezius trigger point.

Key Words: ***Myofascial pain, Trigger point, INIT, Trigger point pressure release, PRT, MET, LASER***

Introduction

Myofascial pain syndrome is one of the common musculoskeletal pain disorders which affects almost 95% of people with chronic pain disorders and is a common finding in specially pain management centre *(Skootsky, 1989; Simons et al, 1999 and Shah et. al, 2008).* It is characterized by trigger points, which are defined as hyperirritable spots within taut bands of skeletal muscle fibers. The syndrome is associated with tenderness in the muscle, characteristic referred pain, spasm and restriction of motion. Among the various muscles of the cervical region, the upper trapezius is more prone for developing trigger points due to continuous overload and micro-trauma as it has minimal antigravity function, leading to cervical myofascial pain syndrome *(Simons et al, 1999; Si-Huei & Chen, 2008).*

Myofascial pain syndrome responds well when treatment is targeted at the trigger points. The various treatment techniques that are utilized for treating trigger points are LASER, trigger point injection, spray and stretch method, dry needling, ultrasound, TENS, trigger point pressure release (TrPPR)/ischemic compression (direct inhibitory pressure), muscle energy technique (MET), myofascial release therapy (MRT), positional release therapy (PRT) i.e. strain counter strain technique and integrated neuromuscular inhibitory technique (INIT) *(Chaitow, 2001; Farina et al, 2004)*. The effectiveness of INIT was reported in two case series, which showed rapid results with decreased pain and stiffness. The individual components (TrPPR, PRT and MET) of INIT has also been proved effective for treating myofascial pain syndrome *(Ambrogio & Roth, 1998; Chaitow, 2000; Chaitow & Judith, 2001)*. LASER along with stretching is an effective treatment for trigger points (*Simunovic, 1996*). LASER alone as well as in combination with stretching has been proven to be effective in reducing cervical myofascial pain *(Ceccherelli et al, 1989; Beckerman et al, 1992; Hanten et al, 2000; Hakguder et al, 2003; Gur et al, 2004; Ilbuldu & Cakmak, 2004; Kiralp & Huseyin, 2006).*

The aim of this study was to compare the effectiveness of INIT and LASER with stretching in reducing pain, improving range of motion and functional activities in subjects with neck pain due to upper trapezius trigger point, since both these treatments can be utilized in the modern clinical setting.

Materials and Methods

Twenty-two subjects aged between 20- 40 years of age with neck pain who were referred to the department of physiotherapy at Father Muller Medical College were assessed for upper trapezius trigger point and included in the study. Informed consent was obtained from all the subjects, but five subjects withdrew from the study due to various reasons. Seventeen subjects completed the study. The study was approved by the ethical committee of the hospital.

Inclusion criteria:

1. Patients with neck pain due to upper trapezius trigger point in the age group of 20 – 40 were included for this study.

Exclusion criteria:

1. Subjects with moderate to severe cervical, thoracic and shoulder degenerative pathology.
2. Individuals with neuromuscular entrapment or compression syndrome of cervical spine, or shoulder origin.
3. Subjects having history of trauma to spine or neck shoulder region, history of surgery to spine and shoulder.
4. Subjects with any systemic disorder.
5. Subjects with congenital and acquired spinal deformities.
6. Subjects with any space occupying lesion in neck and shoulder region.

Outcome measure

- Visual numeric scale-Primary outcome
- Neck Disability Index
- Cervical Range of Motion

Visual Numeric Scale Recording

The VNS consists of a simple 10 cm line, one end marked with zero and the other being marked with ten. Each number in between (1-9) was marked at 1 cm distance each. The points 0 - 10 indicated the pain level, zero representing no pain and 10 indicating the worst and most severe type of pain (*Wong & Baker, 1988*). All other numbers from one to nine, indicated on the line, where the pain was. The subject chose a number on the scale, rating his/her own pain appropriately. *Ritter et al (2006)* in their study established that measurement of pain using visual numeric scale is a valid measure.

Neck Disability Index score

The NDI questionnaire is a 10 item questionnaire which included feedback of the subjects regarding their pain, ability to do activities of daily living, ability to concentrate and presence of headaches. The scale consisted of discrete categories within which each item was weighted and responses were summed up and its percentage was taken. *Vernon and Mior (1991)* concluded from their study that NDI had a high degree of reliability and internal consistency.

Goniometric Assessment of Cervical Range of Motion

The universal goniometer was used to measure the cervical range of motion of flexion, extension, lateral flexion to both sides and rotation to both sides (*Norkin & White, 1998*).

A total of twenty-two subjects were randomly assigned to the two groups by simple randomization using chits, to avoid bias. Five subjects withdrew due to various reasons. Group A comprised of 10 subjects and was treated with Integrated Neuromuscular Inhibitory technique (INIT) while group B (LASER and stretching) had 7 subjects to whom LASER and stretching was administered. For the purpose of this study Laser was considered as a control group. All subjects were assessed to rule out pain in the neck arising from compressive and entrapment syndromes. Foraminal compression test and upper limb tissue tension tests were performed. Subjects with neck pain due to upper trapezius trigger points were included in the study and an informed consent was obtained from the subjects for the same. The subjects' intensity of pain was documented on visual numeric scale (VNS). The subjects were then provided with a neck disability questionnaire (NDI). The questions on the scale were explained in detail and the subjects were then asked to choose the most appropriate alternative, the therapist cleared any difficulties in understanding or choosing an alternative in the questionnaire.

After the pain scale and NDI questionnaire was administered, cervical range of motion was measured. The trigger point in the upper trapezius was identified and marked with a marker. It was then measured from the acromion process and recorded so that subsequent treatments over the same trigger point were standardized.

Integrated Neuromuscular Inhibitory Technique Sequences

In Group A, powder was applied in the area of upper trapezius where trigger point was marked. Then trigger point pressure release was applied by using pincher grip between the thumb and index finger intermittently until the patient reported that the local or referred symptoms had reduced. The pressure was applied in an intermittent manner initially and then continuously for 90 seconds according to patient's tolerability.

After this procedure the pressure was maintained without complaints of referred pain pattern. Patient's head was passively laterally flexed towards the affected side; the therapist then held the patient's forearm and moved the affected side shoulder passively to approximately 90^o of abduction, while monitoring the tender point pain with the other hand. Then the fine tuning was made with slight flexion or extension of the shoulder so that maximum ease was achieved.

The upper trapezius was stretched using Muscle Energy Technique (MET). The patient was asked to take the stabilized shoulder towards the ear (a shrug movement) and the ear towards the shoulder. The degree of contraction was mild and pain free (20% of maximum voluntary contraction). The contraction was sustained for 10 seconds and upon complete relaxation of effort, the therapist gently eased the head/neck into an increased degree of side bending and rotation, where it was stabilized, and the shoulder stretched caudally. The stretch was maintained for 10-30 seconds.

Duration of treatment - Alternate days for two weeks, with three treatments in one week. A total of six sessions of treatment were given.

LASER and post-isometric stretching (MET)

To Group B subjects, a BTL-5000 LASER was applied to the upper trapezius trigger point. The LASER emission was calibrated automatically by the equipment before each use.

The patient was asked to lie still for three minutes and the LASER was applied perpendicular with energy of 1 Joule/cm^2 and frequency of 1000 Hz to the upper trapezius trigger point which was marked. Minimal pressure was applied during the treatment till the patient's pain tolerance *(Baxter, 1995)*. After laser application, the upper trapezius was stretched using muscle energy technique (MET) on alternative days for two weeks, with three treatments in one week. A total of six sessions of treatment were given.

Results & Discussion

A total number of 17 subjects with upper trapezius trigger point, 13 females and 4 males with the mean age of 25.07±4.5 constituted the sample of the study. In group A, there were 7 females and 3 males; whereas group B had 6 females and 1 male. Six subjects of group A and 7 of group B reported right side symptoms.

Table 1: Comparison of pre and post VNS score in Group A and B

GROUP	PRE	POST	P
A	4.90±2.56	5.29±1.38	0.005
B	0.30±0.68	2.00±1.83	0.018

Table 2: Comparison of pre and post NDI score in group A and group B

GROUP	PRE	POST	P
A	36.64±8.719	21.70±3.151	0.005
B	55.49±19.457	27.29±5.691	0.018

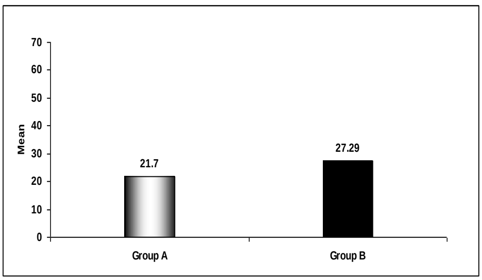

Figure 1: Comparison of post NDI score between Group A and Group B

Figure 1: Comparison of post VNS score

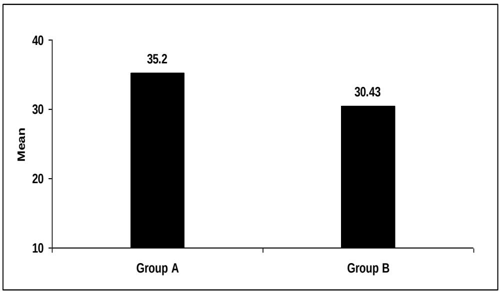

Figure 2: Comparison of pre NDI score between Group A and Group B

The aim of this study was to compare the effect of INIT and LASER with stretching in reducing pain; improving ROM and reducing disability in subjects with upper trapezius trigger point.

There was significant reduction in pain as assessed by VNS in the group that was managed with INIT (Table 1 & Fig 1). The pain reduction may be due to the stimulation of mechanoreceptors which has influence on pain gate during the application of trigger point pressure release and increased circulation, after releasing the pressure which ultimately resulted in pain reduction. PRT also helps in reducing tender point in the affected muscle by the mechanism of automatic resetting of the muscle spindles. This is supported by the findings of *Albert and Fernandez (2006)* who used PRT to reduce tenderness of the upper trapezius. A study done by *Wong and Alvarez (2004)* reported that PRT is effective in reducing pain in the hip musculature. *Fernandez et al (2006)* concluded that trigger point pressure release and transverse friction massage reduced pain due to upper trapezius trigger point in patients with pain. *Hanten et al (2000)* also reported reduction in pain after trigger point release to the muscles. In this study the integrated approach (Trigger point pressure release + PRT) was used in group A, the combined effect might be more than the single technique.

In the Laser group (Group B), there was also significant reduction in pain (Table 1 & Fig 1) which might be attributed to the increment in the local micro circulation in the trigger point area and washout of pain substances. It has been proposed that LASER may improve the oxygen supply by increasing the microcirculation. As explained by several authors hypoxia plays a major role in the development of pain due to trigger point. A study done by *Ceylan and coworkers (2004)* used infra red laser and found reduction in pain and increased excretion of serotonin degradation products in 24 hour urine excretions. They used 904 nm, for three minutes where as *Ceccherelli and coworkers (1989)* used 1000 Hz, 1 joule/cm^2 in muscles with cervical myofacial pain. The same dosage was used in the present study also.

There was no significant difference in VNS score between the two groups before the treatment. After treatment, again no significant difference was observed between the two groups with respect to VNS. This shows that both INIT and Laser are effective in reducing neck pain due to upper trapezius trigger point.

Among the various cervical ranges of motion measured, only lateral flexion showed significant change. The lateral neck flexion improved significantly in the group which received INIT. This improvement in the ROM may be due to PRT and MET which mainly works on decreasing the spasm or tightness of muscle by first resetting the muscle spindle and inhibiting the muscles by activating the golgi tendon organ. This phenomenon is called post isometric relaxation in which there is a period of a relative hypotonicity during which a stretch of the involved muscle is more easily achieved than before contraction. A study by *Lewit and Simons (1984)* observed that post isometric relaxation helps in reducing the increased tension by restoring the full length of the muscle.

The neck disability score decreased significantly in the group that received INIT (Table 2 & Fig 2). The improvement may be attributed to the ROM increments produced by the same. The NDI score within LASER group showed significant improvement, but there was no statistically significant difference between the groups, which may be due to the uneven distribution of subjects between the two groups. Though the total number of participants in this study was less to generalize the effect, this study gives an insight in to the application INIT in managing Myofacial trigger points.

Conclusion

This study supports that upper trapezius trigger point can cause neck pain, with restriction in cervical range of motion and increased disability according to neck disability index. Individually both Integrated Neuromuscular Inhibitory technique (INIT) and Laser with stretching was found to be effective in reducing neck pain, improving cervical range of motion and reducing neck disability, however when both groups are compared, there is no difference in the outcome measures. Hence it can be concluded that both INIT and Laser with stretching are equally effective in managing neck pain due to trapezius trigger point.

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The Role of Anxiety in Achievement

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Abstract

The present study was designed to investigate the relationship of anxiety with achievement of high school students and also to see the regional and gender differences on the basis of their anxiety. The study was conducted over a sample of 400 (200 boys and 200 girls) high school students studying in Xth class in 8 different schools (4 urban and 4 rural) affiliated to CBSE, New Delhi. Sharma's general anxiety scale for children was used to measure anxiety and the aggregate score of the selected students in the board examinations was taken to show their level of achievement. The results reported that there exists a negative and significant relationship between anxiety and achievement. Significant differences were observed between boys and girls, rural and urban students on the basis of their anxiety.

Keywords: Anxiety, Achievement, Boys, Girls, Rural, Urban

INTRODUCTION

Achievement in different fields of life such as sports, academics, industry, business etc. has great importance for both the student, and those around him/her. There can be no doubt that it is affected by many factors that may reduce it, like anxiety or by others that may enhance it, like general mental ability, emotional and social maturity.

The present age may be said to be an age of anxiety. Anxiety has been taken synonymous with apprehension, dread and uneasiness. This emotion stems from fear, but it is more a fear of what will happen or what has happened than of a clearly apparent fear provoking situation. Anxiety is a state of diffused apprehension. It is vague, non-specific and objectless.

Researchers generally agree that certain degree of anxiety may motivate the student and make inclined to better achievement. Hence, anxiety is considered a motive for high achievement. However, a high anxiety score may be one of the obstacles to achievement. That is, the relationship between the two variables may be either linear or curvilinear.

A fair number of previous studies have found a significant relationship between achievement and anxiety *(Diaz et al, 2001)*. Generally, it could be concluded that there is a positive relationship between high degrees of achievement and low anxiety. There is specific degree of anxiety that increases achievement, but if anxiety increases beyond a certain level the reverse happens. On the basis of the Yerkes-Dodson law both the task difficulty and the level of anxiety must be taken into consideration. That is, "on difficult tasks low levels of arousal improve performance relative to high levels, but on easy tasks, the reverse is true" (*Reber, 1995*).

Most of the young students in these days are influenced by the western culture and science & technology. They are more worried about their achievement in various fields of life. Due to the influence of anxiety, students fall short of the expected level of achievement. Hence, the present investigation is designed with following objectives:

- To investigate the relationship of anxiety with achievement.
- To find out the gender and regional differences on the basis of their anxiety. .

Hypotheses

i) There exists a significant negative relationship between anxiety and achievement.

ii) There is significant difference in the anxiety level of boys and girls.

iii) Significant difference exists between rural and urban students on the basis of their anxiety.

Materials and Methods

The present study was conducted on a representative sample of 400 students of standard X, randomly selected from 8 different schools of four districts of Punjab i.e. Amritsar, Kapurthala, Bathinda and Patiala. Samples were drawn through multistage random sampling technique by giving due representation of factors like gender and region.

The present study is a correlation research where the dependent variable is achievement and the independent variable is anxiety.

TOOL

General anxiety scale for children *(Sharma, 2003)* has been used to measure the anxiety of the students. Marks obtained by the students in their annual C.B.S.E. Board matriculation examination were taken as an index of their level of achievement.

In order to analyze the data, raw scores obtained on the basis of anxiety test and achievement, were converted into T-scores. The product moment coefficient of correlation between anxiety and achievement scores was computed. t-test was applied to find the significance of the differences between the mean anxiety scores of boys and girls, rural and urban students.

RESULTS AND DISCUSSION

The results reveal that the value of 'r' = -.149 (df=398, N= 400) is negatively significant at 0.05 level of confidence, depicting that there is significant negative correlation between anxiety and achievement.

In order to see the effect of boys or girls separately, again product moment coefficient of correlation between the anxiety and achievement of boys and girls were found to be of the order of 'r' = -.128 (df = 198, N = 200) which is not significant and 'r' =-.238 (df = 198, N = 200) which is significant at 0.05 level. This may be due to the high anxiety score of the girls as compared to boys but researchers agree that anxiety can be a multifaceted agent. At its simple or optional level it can be a motive, but at its high level it can be a hindrance. Anxiety in its earlier phase puts a person in a state of instability and imbalance. To reduce that tension, the person must remove causes, and here anxiety may be motive to get rid of what upsets an individual.

The above results are quite in conformity with the results of studies conducted by *Spielberger (1966); Abu Marak (1988*); *Dodds (1975); El-Anzi, (2005)* who found negative correlation between anxiety and academic achievement.

Table showing the results of t-test for the variable of Anxiety

VARIABLES	GROUP	MEAN	SD	DF	'T'
Anxiety	Boys	47.88	10.25	398	4.343*
	Girls	52.12	9.29		
Anxiety	Rural	52.07	9.96		
	Urban	47.93	9.63	398	4.223*

* Significant at .05 level

The results of above table indicate that there is significant difference in the anxiety of boys and girls as well as rural and urban students as the t-values (4.343) and (4.223) are found to be significant at .05 level.

The results reveal that and girls are more anxious than boys and these are in line with the findings of previous studies (Dodds, 1975; Abu Marak, 1988; Pomerantz, Altamatt and Saxon, 2002; El-Anzi, Freih Owayed, 2005). The reasons for sex differences in anxiety may be society's attitude towards females. They bear more responsibilities and demands in different situations of life.

The reasons for urban student's lower anxiety as compared to rural ones may be due to the fact that urban high schools students are more intelligent active alert and have more facilities for getting education at their disposal and hence react with all situations without being anxious. Moreover, their parents are also educated and help their wards in solving their problems whereas in rural setting, parent are illiterate and students have to help in their parent's work besides getting education. On the basis of the above results interpreted, all the three hypotheses stands accepted.

CONCLUSIONS

1. Anxiety plays negative role in the achievement of the high school students. It indicates that a certain level of anxiety is essential for achieving high.
2. Significant differences exist between boys and girls, Rural and urban students on the basis of their anxiety.

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Aerobic Capacity in Endurance Trained and Resistance Trained Athletes

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Abstract

The study was aimed at comparing the aerobic capacity in endurance trained and resistance trained athletes. Thirty male athletes who received endurance training and thirty male athletes who received resistance training for a period of more than 1 year were chosen for the study. Physical parameters were measured and exercise stress testing was done on a cycle ergometer with a portable gas analyzing system. Functional capacity (FC) as percentage of predicted $\dot{V}O_2max$ was measured to study the aerobic capacity. Highly significant ($P<0.001$) differences existed in values of FC for endurance trained and resistance trained athletes. The higher aerobic capacity displayed by the endurance trained when compared to resistance trained athletes could be due to variations in adaptations that happen in them due to different types of training protocols. The levels of aerobic capacity reported from athletes abroad are higher compared to our athletes and this could prove to be a potential area of improvement for their much awaited superior performance in international arena.

Key words: Endurance training, Resistance training, Functional capacity, $\dot{V}O_2max$.

Introduction

Primary interest in fitness research has traditionally centered upon cardio respiratory endurance (*Mead et al, 1981).* As there are not many studies conducted in the field of exercise physiology in India, this study was conducted to analyze the variations in aerobic energy capacities of South Indian male athletes who underwent two different forms of training. The athletes were divided into two groups based on their training. In one group there were athletes who predominantly received endurance training which involved continuous steady paced prolonged exercise in moderate intensities for long distances. On the other hand, the athletes in the other group received resistance training in the form of weight lifting. With this method, exercises were designed to strengthen specific muscles by causing them to overcome a fixed resistance, usually in the form of a dumbbell or weight plates on a pulley – or cam-type machine *(McArdle et al, 1996).* The endurance trained athletes were mainly long distance and marathon runners; while the resistance trained athletes were predominantly sprinters but included hurdlers, long jumpers and volley ball players. This would result in various adaptations (*Mead et al, 1981).* Measurement of aerobic energy transfer in these individuals required the evaluation of long term energy system and it was done by assessing the Functional Capacity (FC). FC was considered as the percentage of predicted $\dot{V}O_2max$ ($\dot{V}O_2max$ is the maximal amount of oxygen a person could take in per unit time).

Material and Methods

Selection and preparation of Participants

Sixty elite male athletes were selected from Prime Sports Academy - Chennai. Thirty of these were undergoing endurance training and the other thirty were undergoing resistance training (apart from event specific training and muscle stretching) for more than one year at the college grounds of Madras Medical College. All the subjects were between 19-25 years and procedures followed were in accordance with the ethical standards set by the institution and as per the "Joint Statement of the *American Thoracic Society (2003)* and the American College of Chest Physicians (ACCP) on Cardiopulmonary Exercise Testing". Every individual was informed about the objective of the study and his consent was obtained. Respiratory or cardiovascular disabilities and intake of medications contraindicating their participation in the exercise stress test were ruled out. A detailed clinical examination was also done to exclude any systemic pathology. All the participants did not involve in any kind of exercise for 6 hours before the test. The subjects were instructed about the importance of the test and proper technique was demonstrated. Precautions like loosening of tight clothing, usage of nose clips and keeping the pneumotach clip in the upright (12 'O' clock) position were adequately taken care of.

Determination of Aerobic Capacity:

The athlete's physical parameters were recorded and predicted $\dot{V}O_2max$ was calculated using the following formula given by *Froelicher and Myers (2006).*

$$\textbf{Pred. } \dot{V}O_2 \textbf{ max} = \textbf{wt (kg) x (50.72 - 0.372 x age)}$$

Exercise stress testing was done on a cycle ergometer in the CPX EXPRESS system, which is a portable breath-by-breath gas analyzing system. It analysed the gas concentration and determined the FC. The gas analyzer module of the CPX express system contains O_2 and the CO_2 breath-by-breath analyzers. The O_2 sensor consisted of a zirconium cell and CO_2 sensor was a dual path infra red (IR) analyzer. The system was calibrated and made ready for use.

An incremental protocol where the wattage changed in discrete steps was selected for the bike (cycle ergometer). The time increment was specified as 30 seconds and a work increment of 15 Watts, allowing a work rate increase by a single 15 Watt step every 30 seconds. The subjects were completely familiarized with the test procedures before the experimental data collection. Before administration of each test, the seat handle bars and toe clips of the cycle ergometer were adjusted to the needs of each subject. Resting data for O_2 production per unit time ($\dot{V}O_2$) was collected for 3 minutes of rest, followed by 3 minutes of unloaded pedaling, followed by the incremental phase of exercise (with a single 15 Watt step every 30 seconds) during which the subject maintained the bike revolutions anywhere between 40-60 revolutions/min. The $\dot{V}O_2$ was displayed on the LCD screen of the CPX system. As the wattage increased the subject found it more and more difficult to maintain revolutions between 40-60 revolutions/min. Subjects were required to remain seated throughout the test and verbally encouraged to pedal maximally. Exercise was continued to his supra maximal limit, a stage after which he could not continue to exercise. This was considered as the subject's point of peak exercise and a leveling-off or peaking-over in oxygen uptake was considered as $\dot{V}O_2max$. Then the subjects were allowed to recover from exercise by continuing to pedal the bike without any resistance and the recovery data was colleted for 5-10 min.

The mean and standard deviation of FC for both the groups were first calculated and the data was subjected to Student-t test with a significance level of 0.05.

Results & Discussion

The mean of FC (as % of predicted $\dot{V}O_2max$) in endurance trained athletes was found to be 108.82 ± 7.85. This was significantly higher (P<0.001) when compared with the resistance trained athletes, where it was found to be 94.64 ± 5.05.

The higher values of FC seen in endurance trained athletes were consistent with previous reports *(Barnard et al, 1979; Niemelä et al, 1980; Boileau et al, 1982; Svedenhag & Sjödin, 1984; Draper & Wood, 2005)*. Earlier studies have investigated the reasons for these elevated levels of FC and found that it lies in the various adaptations to training *(McArdle et al, 1996)*. Pulmonary adaptations include an increase in tidal volume, respiratory rate, and pulmonary ventilation for better O_2 exchange by the lungs. Cardiovascular changes like an increase in heart size and plasma volume raises the cardiac output so that O_2 per pulse is increased. According to *Rywik et al (1999)* a reduction in cardiac after load to increase the cardiac output may occur by increasing the arterial compliance by endothelium derived dilation (EDD) or non –EDD. Adaptations at the motor unit level include the predominance of slow twitch, low tension and fatigue resistant (type I) fibers which makes them perform physical activity for long durations (*Coggan et al, 1992)*. These slow twitch fibers are the so called red muscle fibers which have high capillary density for better O_2 storage and increased mitochondrial size and number for better O_2 extraction *(Magel et al, 1978)*. These adaptations at the cellular level favors the aerobic machinery. Enzymes involved in aerobic production of ATP like pyruvic acid dehydrogenase and other enzymes in the Krebs cycle were also shown to be elevated (*Coggan et al, 1992)*.

Metabolic adaptations include the enhanced capacity to mobilize, deliver and oxidize lipid and this allows carbohydrate storage for intense exercise and prevents lactic acid accumulation *(Crampes et al, 1989)*. The number of beta receptors on the leukocytes of endurance trained athletes has been reported to be less *(Fujii et al, 1998)*. If similar changes occur in the muscle fiber then the epinephrine induced glycolysis and production of lactic acid would be less in them. Alterations in carbohydrate metabolism include a greater ability to oxidize carbohydrates. This allows large quantities of pyruvate to move through aerobic pathways and again prevents lactic acid accumulation *(Holloszy & Coyle, 1984)*. Although it is known that during exercise, blood borne glucose can enter the muscles without the aid of insulin, *Takala et al (1999)* have identified that aerobic and not resistance training is associated with enhanced insulin sensitivity in skeletal muscle.

Possible changes that occur at the genetic level include genetic variation at the Na^+K^+ATP-ase alpha 2 locus which influences the trainability of $\dot{V}O_2max$ in sedentary Caucasian subjects. *Rankinen et al, (2000)* reported that Na^+K^+ATP-ase play an important role in maintaining the electrolyte balance in working muscles and may contribute to endurance performance). Studies have also linked the alpha 2 adrenoceptor DRA2A gene variability with elite endurance status *(Wolfarth et al, 2000).*

Dasgupta et al (2000) demonstrated that long distance runners and middle distance runners had a significantly higher $\dot{V}O_2$max (51.03 ± 1.96 and 52.26 ± 2.8 ml/kg/min respectively) than the short distance runners (46.34 ± 5.18 ml/kg/min) when they were subjected to graded exercise on a treadmill. In our study, conducted on athletes from South India, the mean value for $\dot{V}O_2$max recorded on cycle ergometer in the endurance athletes was 46.66 ml/kg/min with SD ± 3.36 (10.7% lower). The resistance trained athletes of our study demonstrated a mean $\dot{V}O_2$max of 40.69 ml/kg/min with SD ± 2.17 (12.1% lower). The values achieved by endurance athletes were was also 26% lower than the mean values recorded from long distance runners of eastern India *(Das & Bhattacharya, 1995).* But, the authors of this study have measured $\dot{V}O_2$ max with Queens College Test.

An assessment of Aerobic capacity of Indian senior and junior female hockey players by *Laroia et al (1998)* revealed that the relative $\dot{V}O_2$ max of the senior and junior players were 47.0 and 40.9 ml/kg/min respectively and were observed to be much lower than their international counterparts. An evaluation of maximal oxygen uptake capacity as a measure of cardio respiratory fitness in Indian air force personnel by *Banerjee et al (1988)* showed that their mean absolute $\dot{V}O_2$ max values were found to be around 2.5 and 2.4 l/min in 21-29 and 30-39 years age group respectively. $\dot{V}O_2$ max per Kg body weight values, viz. 38.6 and 35.2 ml/min/Kg in the aircrew and 40.8 and 35.5 ml/min/Kg in the ground duty subjects, in the age group 21-29 and 30-39 years respectively. Interestingly, *Raju et al (1986)* studied oxygen consumption in sportsmen of different events and reported that there were no significant differences seen in VO_2 max, blood pyruvate and blood lactate in sportsmen of different events.

Svedenhag & Sjödin B (1984) measured maximal oxygen uptake on the treadmill and the $\dot{V}O_2$max values were 72.1 ml/kg/min in 800-1500-m group and 78.7 ml ml/kg/min in 5000-10,000-m group. These values were a staggering 54% and 68% higher than the current studies. *Boileau et al (1982)* too reported high mean $\dot{V}O_2$max values (76.9 ml/kg/min) in the long distance runners. These wide differences could possibly be due to the variations in race, nutrition and level of training. Our study results are in line with the results of *Niemelä et al (1980)* who reported significantly higher $\dot{V}O_2$max values in endurance runners (75.3 ml/kg/min) in comparison to the sprinters (46.0 ml/min/kg). The sprinters of this study had on an average 13% higher value of $\dot{V}O_2$max as compared to the resistance trained athletes of the present study.

Kilding AE, et al (2006) measured actual $\dot{V}O_2$max during the multi-stage fitness test in international-level intermittent sport athletes and compared these with the predicted values. Their predicted values (53.6+/-3.9 & 51.3+/-4 ml/kg/min) were reported to be significantly lower (9.3% and 13.2%, respectively) than the actually measured

VO_2max (59.1+/-6.6 ml/kg/min). In our study the predicted values were 8.1% lower and 5.3% higher than the measured values in endurance and resistance trained athletes respectively.

Conclusion

Endurance trained athletes' exhibit higher aerobic capacity as compared to the resistance trained athletes and possibly due to the variations in adaptations that happen in them due to different types of training. The levels of aerobic capacity reported on foreign athletes are higher as compared to the endurance athletes of the present study and seems to be a possible potential area for improvement.

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A study of Body Mass Index in boys of 10-17 years in age

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Abstract

The study was conducted on a cross sectional sample of 228 children ranging in age from 10-17 years. Body weight, height was measured and Body Mass Index (BMI) was computed for each subject. The results indicate that BMI increased as age increased, except at the age of 12-13 years. On an average, it is found that the body mass index for 17-year-old boys was 20-25% greater than that of eight and nine year olds. Comparison of BMI values generated from the present study with those reported by *Cooper (1992)*, it is seen that the average BMI values of boys of the present study lie well below the health fitness zone (HFZ) limits. It is seen that for 10-13 year-olds, the percentage of subjects who fell below the HFZ limits ranged from 21-64%, with only 36-68% of subjects achieving the HFZ limits. Clearly, this indicates inadequate weight mass relative to height measurement, implying a very lean physique. Frequency of BMI values greater than 20 has been found to be very low in the present study. These results contrast those reported for American children, where obesity is clearly on the rise. The observation of underweight subjects in this study also poses a need for people to pay more attention to their health and what is being consumed. Over all, the study shows positive results for Punjabi boys. It can be confirmed that Punjabi boys at present are not confronting the obesity problem.

Key words: Endurance training, Resistance training, Functional capacity, VO_2max.

Introduction

The decline in physical activity as a result of modernization and industrialization has made the people prone to a number of debilitating diseases such as hypertension, obesity, coronary heart disease, diabetes etc. This has drawn the attention of health scientists to study the problem seriously and make efforts for the health promotion of the society. Some of the western countries have recognised the gravity of this situation. The United States of America (U.S.A.) began serious efforts in this direction in the year 1970 and their scientists are continuously engaged in helping its people change their life style to move towards a state of optimal health.

Modernization and industrialization has left great impact on the life styles of the people. This impact has shifted life style towards negative side more in which physical activity is declining. Nutriental intakes are going on increasing. In addition to this juicy food, fast food has taken the place of the essential food required by the body. Physical activity is declining day by day. According to *National Centre for Health Statistics (1994)*, obesity has been found at highest rates among poor and minority groups. *Natural Centre for Health (1994), Kuczmarski (1992), Piani and Schoenborn (1993), Williamson (1993),* have found that during the 1960s there was significant increase in obesity in westerns people. According to *Millar (1987), Laurier et al, (1992)* several international comparisons have shown that westerns are among the heaviest people as compared to other people of the world.

According to *Gostmaker et al. (1987), Ross et al. (1987), Lohman et al. (1987)* National Surveys also reveal that a large number of western children and teenagers are obese.

Health fitness is a significantly scrutinized subject in the United States, and it is practical to compare this issue among young children and teenagers in India and the U.S.A. Just as the Body Mass Index serves as a key for people to follow and evaluate in the U.S.A., it is similarly used in India to determine the overall fitness of an individual. Across the world, people's habits are changing as technology is evolving more rapidly. This change of habit and how it affects the lifestyles of children, serves as a key issue when health fitness is studied. In order to learn about the health-related fitness of 10-17 year old Boys in India, the present study has been conducted.

Materials and Methods

The study was conducted on a cross sectional sample of 228 children ranging from 10-17 years old in age. These subjects were selected on a random basis from various educational institutes in the Patiala district of Punjab. It is known that children of this age are naturally active and can reach the apex of their fitness potential better and faster than adults can do so (*Shepard, 1978*). This is why it is more meaningful and significant to carry out health-related physical fitness tests on schoolboys of this age range. In addition, the national sports scene is mainly dominated by athletes from Punjab. This fact would also serve a greater purpose when comparing the fitness of males in Punjab to men from other developing countries. Due to the cooperation and high availability of school children, the success rate of the testing had been notably increased.

The subjects for this study were chosen from the following schools:

- V.H.R Senior Secondary School, Patiala
- Govt. Senior Secondary School, Ghanaur, Patiala
- Dudhial Khalsa Senior Secondary School, Patiala
- Dudhial Public School, Bishan Nagar, Patiala
- Govt. Primary school, New Power House Colony, Patiala
- Govt. Primary school, Deep Nagar, Patiala
- Govt. Senior Secondary School, Civil Lines, Patiala
- Govt. Primary School, Civil Lines, Patiala
- Little Flower Senior Secondary school, Patiala
- University Model School, Punjabi University, Patiala

Depending upon the date of birth and the date of the examination, the decimal ages of the subjects were calculated. The following table gives the classification of the subjects into yearly age groups along with the number of subjects (N) tested in each age group.

Age Range (years)	Mean Age (years)	N	SD	CV
9.500-10.499	10.00	26	0.25	6.08
10.500-11.499	10.96	28	0.28	7.93
11.500-12.499	12.12	26	0.26	6.96
12.500-13.499	12.87	28	0.30	8.97
13.500-14.499	14.04	30	0.28	8.03
14.500-15.499	14.94	29	0.31	9.76
15.500-16.499	16.00	31	0.28	7.85
16.500-17.499	16.93	30	0.29	8.47

Height and weight of the students were measured by using standard instruments and techniques. The portable weight machine was pre-calibrated and used to measure the body weights of the students. Anthropometeric rod was used to measure the height of the subject. The 2 meter rod consisted of 200, one centimeter divisions; these were further subdivided into 1 millimeter increments. This experiment was conducted by first distributing the cyclostyled Performa to the test subjects; this clearly stated the information used to determine and re-confirm their ages. Then, a field laboratory was established and the normal school boys, falling in the range of 10-17 years, were selected to obtain their heights and weights.

The heights of the subjects were measured by the anthropometric rod. This was done by determining the vertical distance from the horizontal floor to the vertex. The subject was asked to stand erect against a wall. Both of his heels were made to touch each other and the wall, with the toes at approximately 30^{o} apart. The subjects were also told to "stretch their bodies upward" and to keep their heads in a F-H plane. Then the anthropometric rod was held vertically in front of the subject in the mid saggital plane. The horizontal moveable arm of the anthropometer was brought down to the point vertex on the head. At this point, the height was recorded to the nearest millimeter.

In order to measure the exact weight of the subjects, it was important to make sure that they had minimal clothing (preferably a vest and short). The subjects were then told to stand erect in the center of the scale platform. At this point the weight was recorded to the nearest kilogram. The scale was checked before each weight was taken in order to make sure that scale had zero error when recording,

Body Mass Index (BMI) was computed for each subject using the following formula.

$$\text{BMI} = \frac{Weight}{Height^2}$$

Where weight is in kilograms and height is in meters.

The statistical computations were made by using a computer SPS package. The results were then cross-checked manually by using the statistical formulae.

Results and Discussion

Table 1 enlists the mean values of body weight among the boys 10 to 17 years of age.

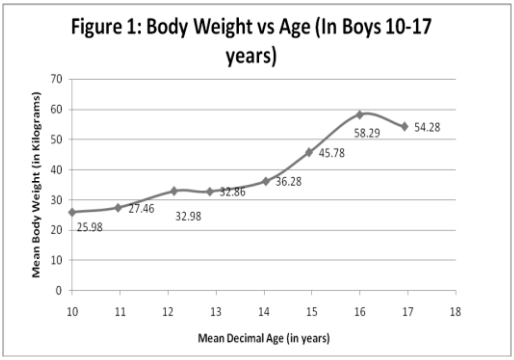
Table 1: Mean values of body weight (kg) of boys from 10-17 years of age

Decimal Age (years)	N	Mean	SD	C.V
10.05	26	25.98	4.06	16.51
10.96	28	27.46	4.37	29.05
12.12	26	32.98	4.59	21.03
12.87	28	32.86	3.96	15.70
14.04	30	36.28	4.79	22.97
14.94	29	45.78	6.08	36.93
16.00	31	58.29	8.31	69.13
16.93	30	54.28	8.33	69.30

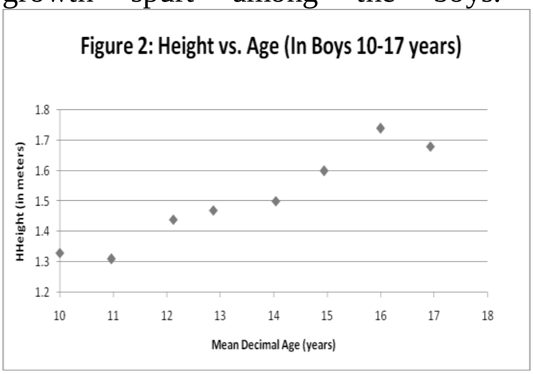
Table 2: Mean values of Height (m) of boys from 10-17 years of age

Decimal Age (years)	N	Mean	SD	C.V
10.00	26	1.33	.12	1.33
10.96	28	1.31	.14	2.04
12.12	26	1.44	.08	5.81
12.87	28	1.47	.09	8.27
14.04	30	1.50	.08	5.80
14.94	29	1.60	.10	9.31
16.00	31	1.74	.06	4.09
16.93	30	1.68	.06	4.11

The distance curve for body weight displays that the maximum weight gain (magnitude of 9.5kg-12.5kg) lies between the ages of 15 and 16 years (Fig. 1).



Generally, body weight is in fact the most frequently used single measurement in determining the growth and health status of children. From the graphical representation, it can be determined that weight continues to increase during the period from 10-17 years in these subjects. At 15 and 16 years of age, it is found that the body weight is notably high. This could be due to the composition of the sample, indicating that the chosen boys were comprised from different socio-economic levels. Due to this heterogeneity, it is possible that the differences in two peaks occurred due to the differences in the adolescent growth spurt among the boys.



In this study, it was important to note that these boys were consistently heavier by 2-3 kg than the results from a similar growth study that was conducted by *Giri (1990).* In 2001, *Kaur* studied the health related fitness of Jat Sikh school boys in the age range of 9-12 years. *Kaur* also reported higher body weights in her study in comparison to the boys studied by *Giri (1990).* The results related to body weight in the present study are in agreement with *Kaur's* findings. This is due to the difference in several factors such as dietary habits and life styles due to further development of technology in Punjab. It is thought that development in technology has reduced people's movement, which in turn has produced negative impact on the metabolic activity, resulting in weight gain in the boys tested. Parents are sending their children to schools in buses or using their own conveyance as compared to the earlier means like bicycles or walking to attend to the school activities. This probably has resulted in the decline in physical activity of the school going children. Although the body weight of the boys at all age levels has shown an increase over the years but a comparison with the body weight of American boys of similar ages reveal that Punjabi boys on an average are still much lighter than their American age peers.

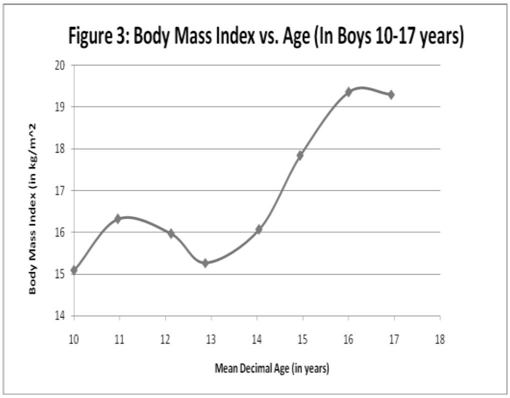
It is interesting that the comparison of the stature of Punjabi boys from the present study with the boys studied by *Giri (1990)* produced almost comparable values from 8-11 years. After this age range, differences appeared. It is thought that a difference in growth spurts and growth rates could be a major factor contributing to the dissimilarity between the two studies. At 18 year of age, the heights attained by the subjects of both the studies actually show comparable values, indicating no change in the final attainment of the adult stature. The differences in the rate of growth are understood and can be linked to the genetic and environmental factors.

BMI provides a relative comparison of a subject's weight and height. Even though measuring the BMI is more accurate than height/weight tables, BMI is also based upon the concept that a person's weight is proportional to his or her height. This technique is regarded to be fairly accurate for those individuals who do not have excessive muscles mass. This means that the BMI should not be used for athletes. This method should however be used for sedentary individuals who are not over active. Thus, BMI can provide relevant information regarding the prevalence of overweight/underweight trends in boys from the present study.

Table 3: Mean values of Body Mass Index (BMI) of boys from 10-17 years of age

Decimal Age (years)	N	Mean	SD	C.V
10.05	26	15.09	4.05	16.39
10.96	28	16.32	3.99	15.88
12.12	26	15.97	1.67	2.80
12.87	28	15.27	1.93	3.71
14.04	30	16.07	1.63	2.66
14.94	29	17.84	2.17	4.69
16.00	31	19.36	2.56	6.52
16.93	30	19.30	2.48	6.12

The table 3 enlists the results pertaining to this BMI index on Punjabi boys in the age range of 10-17 years.



The results indicate that BMI increased as age increased, except at the age of 12-13 years. On an average, it is found that the body mass index for 17-year-old boys was 20-25% greater than that of eight and nine year olds. By comparing the BMI values generated from the present study with those reported by *Cooper (1992)*, it is seen that the average BMI values of boys of the present study lie well below the health fitness limits. It is seen that for 10-13 year-olds, the percentage of subjects who fell below the HFZ limits ranged from 21-64%, with only 36-68% of subjects who could achieve the HFZ limits. Clearly, this indicates inadequate weight mass relative to height measurement, implying a very lean physique. Physiologically, this is unhealthy for these subjects. Young bodies need to prepare for intensive growth processes, and body systems need to prepare for the challenges faced by adolescent changes.

Ultimately, it is uplifting to note that the number of overweight individuals is decreasing, meaning that number of BMI values over 20 has been found to be very low in the present study. These results contrast those reported for American children, where obesity is clearly on the rise. The observation of underweight subjects in this study also poses a need for people to pay more attention to their health and what is being consumed. Over all, the study shows positive results for Punjabi boys. It can be confirmed that Punjabi boys are not confronting with the obesity problem. Since obesity and other weight problems are not persistent, these boys are less prone to developing complex medical health problems like diabetes, hypertension, coronary heart disease, or even colon cancer. This is not the case for their American peers.

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A Study of Emotional Health of Indian and Brazilian Players Playing In Junior Volleyball World Championship 2009

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Abstract

The main objective was to study and compare the Emotional Health of the volleyball players of India and Brazil. All the players of Indian team and the players of Brazilian team who came for men Volleyball world Championship held at Pune in August 2009, were selected for the study. They were administered the Cattell's 16 PF questionnaire. The result were analyzed with the help of 't' test which shows that there are significant differences between Indian volleyball players and Brazilian volleyball players on emotional factors of 16 PF Questionnaire. Indian players have scored high on factor 'E', factor 'F', factor 'I' and Factor 'O' whereas Brazilian players have scored high on factor 'H' and factor 'L'. Indian players score High on Factor 'E' means that they tend to be Dominant, assertive, aggressive, stubborn, competitive, bossy, dominant, and on Factor 'F' means Enthusiastic, spontaneous, heedless, expressive, cheerful, surgency and Factor 'I' means Tender-minded, sensitive, over-protected, intuitive, and Factor 'O' means Apprehensive, self blamed, guilt-prone, insecure and worrying. The players of both the team have found comparable scores on Factor 'A' and 'C'.

Key words: **Volleyball, emotional health, psychological health, game, sport,**

Introduction

Today, volleyball has spread to 220 countries around the world, and is recognized as a truly international, widely played, popular sport. The World League is the longest and most flourishing of all the international events organized by the FIVB. The World League is sometimes confused with the other international volleyball competitions – Volleyball World Cup and Volleyball World Championships.

A sport is very important in physical as well as psychological development of individual. The sportsmen are mentally healthy than non-sportsmen, because sports plays therapeutic role in player's life *(Ismail, & Gruber, 1965, 1971; Havelka & Lazarevic, 1981)*. In sports the players gets satisfaction as he is cheered by spectators. It is very important for his psychological development. Sports provide a channel for the expression of emotions through motor activity *(Mecloy Layman, 1984; Silva, 1984)*. A number of studies have been reported in the literature about the psychological profile of players *(Das et al, 1975; Bacanac, & Radovic, 1989, Bacanac et al, 1989; Bacanac, & Mihajlovic, 2001)*

The purpose of this study is to evaluate emotional health of Indian and Brazilian team's in volleyball world championship.

In the World Championship, Brazil and India were played in the semi final. The Match was played in the best of five sets. In the fifth set, India lost the match. Reason behind this may be the differences in the physical and psychological abilities.

Material & Methods

As the main objective of the investigation was to study and compare the emotional health of the volleyball players of Indian and Brazilian teams, all the players of Indian team and the players of Brazil team who came for men Volleyball world championship held at Pune in August 2009, were selected for the study.

Table no 1: Sample of the study

Country	N
India	12
Brazil	12

Cattell's 16 PF questionnaires was used for measuring emotional health on factor E, F, H, I, L and O.

The results were analyzed with the help of student 't' test. The scores of Indian and Brazilian Volleyball players on the test were compared.

Results and Discussion

Indian and Brazilian teams scored comparable values (Table 2) on Factor 'E' of 16 PF means that they are not significantly different from each other on factor 'F'. This can be interpreted that players from both the team equally dominant, assertive, aggressive, stubborn, competitive, bossy and dominant.

Table 2: Statistical comparison of score in factor 'E' among the Indian and Brazilian Volleyball teams.

Country	Mean	N	SD	't' value
India	6.08	12	1.31	
Brazil.	5.83	12	1.11	0.50
Total	5.96	24	1.20	

**significant at 0.05 level*

Indian team scored greater on Factor 'F' than the Brazilian team (Table 3). It indicates that Indian players were more enthusiastic, spontaneous, heedless, expressive, and cheerful than the Brazilian team counterparts. Enthusiasm, spontaneity and cheerfulness are the signs of emotional healthiness, but one characteristic namely heedlessness can play a negative role in the success of team.

Table 3: Statistical comparison of score in factor 'F' among the Indian and Brazilian Volleyball teams.

Country	Mean	N	SD	't' value
India	4.58	12	1.50	
Brazil	3.75	12	0.45	**1.84***
Total	4.17	24	1.17	

**significant at 0.05 level*

Indian team exhibited significantly greater score on Factor 'I' than the Brazilian team. It implies that Indian players are more liable to be tender-minded, sensitive, over-protected, and intuitive than their Brazilian counterparts.

Table 4: Statistical comparison of score in factor 'I' among the Indian and Brazilian Volleyball teams.

Country	Mean	N	SD	't' value
India	**5.67**	**12**	**1.37**	
Brazil	**4.67**	**12**	**1.15**	**1.93***
Total	**5.17**	**24**	**1.34**	

**significant at 0.05 level*

The mean scores of Indian team in Factor 'O' are significantly greater than the Brazilian team (Table 5). It indicates that Indian players tend to be more apprehensive, self blamed, guilt-prone, insecure and worrying than their counterpart.

Table 5: Statistical comparison of score in factor 'O' among the Indian and Brazilian Volleyball teams.

Country	Mean	N	SD	't' value
India	**7.17**	**12**	**1.64**	
Brazil	**6.42**	**12**	**1.38**	**1.21**
Total	**6.79**	**24**	**1.53**	

**significant at 0.05 level*

Brazilian team has scored significantly high score in Factor “H” that is indicative of boldness, venture and they are uninhibited, can take stress.

Table 6: Statistical comparison of score in factor ‘H’ among the Indian and Brazilian Volleyball teams.

Country	Mean	N	SD	‘t’ value
India	5.75	12	0.87	
Brazil	6.75	12	1.36	2.15*
Total	6.25	24	1.22	

significant at 0.05 level

Brazilian team was found to possess significantly higher mean score in factor (L) than the Indian team. This factor signifies that the Brazilian players tend to be more suspicious, hard to fool, distressful and skeptical than their Indian team counterparts.

Table 7: Statistical comparison of score in factor ‘L’ among the Indian and Brazilian Volleyball teams.

Country	Mean	N	SD	‘t’ value
India	4.92	12	2.02	
Brazil	7.33	12	1.30	3.48**
Total	6.12	24	2.07	

significant at 0.05 level

In Volleyball, psychological characteristics are more important because the player’s alertness depends on it. The players can play easily and win whenever they are free of pressure/tension. Emotionally healthy person can control his negative feelings. Emotional health is most important in sports.

In general, the score of the Indian team was observed to be greater on Factor ‘E’, ‘F’, ‘I’ and ‘O’. It means that Indian team was quiet well on these traits. These Factors assess traits namely enthusiasm, spontaneity and cheerfulness of the players which are the signs of emotional healthiness, but one characteristic that can play a negative role in the success of a team is heedlessness. Indian team has been found to demonstrate significantly high score in this trait than their Brazilian counterparts. But in Factors ‘H’ and ‘L’ Brazilians have exhibited greater scores than their Indian peers. Indian players tend to be shyer, withdrawing, cautious, retiring, than the Brazilians.

The investigators feel that the besides having the support of the audience the Indian team and its confident game resulted in better performance in service, block, counter attack and team combination only in the second and the fourth set. Because of these things, there was immense pressure on the Brazilian team and as a result, it lost two sets. Moreover, in the deciding set because of glorious past as well as quality and confidence; supported by professional sportsmanship, the awesome performance of the Brazilian team was witnessed to make their way to the finals.

Conclusion

The score of Indian team are high on Factor ‘E’, ‘F’, ‘I’ and ‘O’. It means that Indian team was quiet well on these traits. These Factors measure enthusiasm, spontaneity and cheerfulness of the players which are the signs of emotional healthiness, but one characteristic can become an obstacle in success of team which is heedlessness. Indian team has scored significantly high on it. The Indian team was found to be dominant, assertive, aggressive, stubborn, competitive, bossy, dominance, enthusiastic, spontaneous, heedless, expressive, cheerful, tender-minded, sensitive, over-protected, intuitive, refined, apprehensive, self blamed, guilt-prone, insecure, worrying, Guilt-proneness.

Whereas, the Brazilian team was found to be better than the Indian team in traits that included boldness, venturesome, uninhibited, could take stress, Suspicious, Hard to fool, distressful skeptical. Both the teams were emotionally healthy and the differences are relative.

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