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Editor's Page



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It is in deed a matter of happiness to declare that the Volume 6, No. 2 issue, 2010 of **Journal of Exercise Science and Physiotherapy (JESP)** is out of press for the readers. This issue of JESP contains eight articles on diverse important aspects of exercise science. **Juneja et al from Nagpur** from Patiala presents systematic review article to identify the overall trends of association of isometric strength and dynamic activities and summarize the findings of reported literature on the relationship of Isometric strength and dynamic performance. They conclude that although there are conflicting opinions regarding the use of isometric measurements, most studies in the review report moderate to strong correlation between Isometric strength and dynamic performances specially those which involve large amounts of force and explosive power. **Banerjee & John et al from Patiala** in their study evaluated the Effect of Music Therapy on Salivary Cortisol as a Reliable Marker of Pre Competition Stress in Shooting Performance. The purpose of the current study was to estimate the contribution of Music Therapy on Salivary Cortisol in reducing Pre Competition Stress, and its effect on shooting performance. Results of their investigation indicated that relaxation therapies such as Music Therapy may decrease pre-competition stress and therefore enhance shooting performance. They concluded that four weeks of Music Therapy has an effect on HPA-Axis by decreasing the level of Salivary Cortisol as a reliable physiological marker of pre-competition stress. **Debnath et al from Dehradun, Uttaranchal** formulated an integrated proprioceptive assessment scale covering all possible and related proprioceptive testing methods. Furthermore the test-retest reliability for each new measurement procedure was tested and the sensitivity, validity and the reliability of the scale was examined by them. **Dahiya and Rathi** from Kurukshetra, Haryana investigated the trend of academic research in Physical Education in Indian Universities, submitted by Post-Graduate students during their master's programme. it was reported by them that though the academic research made in various Indian Universities has been centered on individual practice, yet research title have been transformed from theoretical translation to step in an intensive study on objective facts. They recommend that there should be a Central Agency to compile every year the abstract of the Research studies completed in Physical Education in various Indian Universities at Post-Graduate level. **Gothi et al** from Sadra, Gujrat compared the health related fitness of three groups of physical education teachers of three districts of Gujrat. They reported no significant differences in cardio-vascular Endurance, Body Mass Index, Body Weight, Fat Mass, Total Body Water, Impedance, Fat Percentage and Height between physical education teachers of different districts in Gujarat. **Shenbagavalli, & Divya** investigated the effect of specific yogic exercises programme and combination of specific yogic exercises with autogenic training programme on selected physiological variables in college men students. They concluded that the practice of the combination of specific yogic exercises with autogenic training and specific yogic exercises programme was significantly effective in promoting desirable changes in the percent body fat, psychological variables such as job anxiety, occupational stress and biochemical variables such as high density lipoprotein, low density lipoprotein and fasting blood sugar. **Shenbagavalli and Poomayil in another study investigated the** effects of yoga practices and naturopathy treatments on blood sugar and blood pressure of diabetic patients. Their study revealed that the selected blood sugar and blood pressure were significantly reduced due to the influence of yogic practices and naturopathy treatments in diabetic patients. **Jadhav et al** from Aurangabad conducted a survey of Varsity Volleyball Players regarding the prevalence of injuries. They observed that 36% injuries were of recurrent nature in volleyball players. Lower limb injuries were found to be predominant; the ankle and knee being the most commonly injured anatomical location. Most injuries involved soft tissue and related to the muscle and tendon. Most common circumstances giving rise to injuries were spiking, blocking, diving, and setting. They further report that volleyball players directly involved in attack or defense were found to be more susceptible to injury. Muscle injuries were observed to be the most common type.

S.K. Verma

Isometric Strength and Its Relationship to Dynamic Performance: A Systematic Review

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Abstract

Study Design: Systematic Literature Review

Objective: 1) to identify the overall trends of association of isometric strength and dynamic activities 2) to summarize the findings of reported literature on the relationship of Isometric strength and dynamic performance.

Background: Isometric Strength measures have been used for many years to predict dynamic performance but there are considerable controversies regarding the potential of isometric muscle assessments to predict dynamic performance. Although researches have been conducted to study the relationship, it is important that the current available literature be reviewed to summarize the findings for clinical use.

Methods: A systematic review was conducted to identify the published studies that correlated the Isometric and dynamic variables. Studies were searched using electronic databases and the methodological quality of each study was assessed using the modified Downs and Black 13 point criteria.

Results: Fifteen studies met the inclusion criteria. Marked difference in the methodology and variables used for isometric and dynamic activities were observed. Most studies correlated isometric strength assessments to dynamic activities or dynamic strength measurements.

Discussion & Conclusion: Although there are conflicting opinions regarding the use of isometric measurements, most studies in our review report moderate to strong correlation between Isometric strength and dynamic performances specially those which involve large amounts of force and explosive power.

Keywords: Isometric, dynamic, strength, power, performance, methodological quality

Introduction

Strength is a fundamental quality necessary in achieving optimal physical function and is defined as the ability to produce more force. (Siff M; Stone MH et al., 1993). Thus the display of strength has characteristics which include a magnitude, rate and direction. The force production can be measured by isotonic, isometric or isokinetic methods. The isotonic techniques require lifting a particular weight through a fixed number of repetitions such as 1RM testing or using prediction equations (Bryzcki, 1993). The Isokinetic measurements involve the use of isokinetic devices. The isometric testing is done by a maximal voluntary contraction performed at a specific angle against an unyielding resistance which in series with a strain

gauge, cable tensiometer, force platform or similar device whose transducer measures the applied force (Stone et al., 2002).

In dynamic activities such as sports, if greater strength makes a difference then the stronger teams should perform better. Sports requiring rapid directional changes and acceleration or movement sequences primarily depend upon average power production but activities such as jumping, sprinting, and weightlifting may depend a lot on peak power (Garhammer, 1993; Thomas et al., 1996; McBride et al., 1999; Kauhanen et al., 2000). It can be argued that peak power depends to great extent on maximal strength. Therefore, it might be expected that maximum strength would have a greater effect in sports in which relatively larger loads have to be

overcome (Stone *et al*, 2002) such as throwing events and American football.

Isometric assessment of muscle function have been used in exercise science for over 40 years and often both maximal force and rate of force development are recorded (Wilson & Murphy, 1996). These tests have shown high reliability in both single and multijoint test protocols (Murphy & Wilson, 1996; Wilson & Murphy, 1996). Isometric tests are easy to perform as they require only a single maximal contraction and relatively simple equipment. In spite of the potential clinical relevance of measurement of isometric strength, there appears to be considerable controversy regarding the use of isometric assessment and the ability of these tests to monitor changes in dynamic performance.

Therefore the purpose of this review is 1) to identify the overall trends of association of isometric strength and dynamic activities 2) to summarize the findings of reported literature on the relationship of Isometric strength and dynamic performance

Methods

Inclusion and Exclusion Criteria

Peer reviewed publications that studied the association between Isometric Strength of muscles and its association with dynamic tasks were included. Non-peer reviewed articles and invited clinical commentaries in professional magazines were excluded. The inclusion criteria required that the subjects were measured for their Isometric strength and for performance of a dynamic task which involved similar muscles and a correlation was done between the two.

Literature search

The electronic literature search was done using databases such as Pub MED, CINHALL, and MEDLINE. “Isometric Strength”, “Isometric muscle assessment/testing” were used as key words for the search combined with other keywords such as “dynamic activities”, “dynamic performance”, “Isotonic” and “Isokinetic”. Various abstracts obtained from the search were scrutinized as per our inclusion criteria. Full texts of these articles were obtained from various electronic databases and libraries. Help of colleagues in different universities was also taken for obtaining some articles which were not available in libraries accessible to the authors.

Assessment of Methodological Quality

The methodological quality of each study was assessed independently using the Downs & Black revised checklist for measuring study quality which is appropriate for non randomized controlled trials (Downs & Black, 1998; Santamaria *et al*, 2010). The checklist has good test-retest reliability ($r=0.88$) and inter-rater reliability ($r=0.75$). Only the criteria relevant to assessing potential sources of bias in randomized control trials were applied leading to a modified checklist of 13 items with a maximum score of 13.

Results

The literature search from various sources yielded more than 80 articles. Following the deletion of duplicate articles and analyses of abstracts and titles as per the inclusion and exclusion criteria, only 21 studies were considered for the review. The full texts of these studies were analyzed for the detail content and only 15 studies were finally included in the systematic review.

Study Quality

Table 1: Assessment of Methodological Quality of Study

<i>Downs & Black Criteria</i>	<i>McGuigan et al (2010)</i>	<i>McGuigan et al (2008)</i>	<i>Requena et al (2009)</i>	<i>Stone et al (2004)</i>	<i>Kraska et al 2009</i>	<i>Cuhna et al (2007)</i>	<i>Stone et al (2003)</i>	<i>McGuigan et al (2006)</i>	<i>Lord JP et al (1992)</i>	<i>Folland et al (2005)</i>	<i>Murphy & Wilson (1996)</i>	<i>Aleksander et al (2009)</i>	<i>Merek Guy et al (1996)</i>	<i>Khamoui et al (2011)</i>	<i>Nuzzo et al (2008)</i>
Item 1. Clear Aim	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Item 2. Outcomes described	+	+	+	+	+	-	-	+	+	+	+	+	-	+	+
Item 3. Subjects described	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Item 4. Interventions described	+	+	+	+	+	-	-	+	+	+	+	+	+	-	+
Item 6. Main findings clearly described	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+
Item 7. measures of random variability	+	+	+	+	+	-	+	+	+	+	+	+	-	-	-
Item 10. reporting of probability variables	-	-	+	+	-	-	+	-	-	+	-	+	-	-	-
Item 11. Subjects asked representative of entire population	+	-	+	-	+	+	+	+	-	+	-	-	+	+	-
Item 12. Included subjects representative of entire population	+	+	+	-	+	+	+	-	-	+	-	-	+	-	-
Item 16. Planned analysis	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
Item 18. Appropriate statistics	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Item 20. Accuracy of outcome measures	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Item 22. Power calculations	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-
TOTAL SCORE	11	10	12	11	10	8	10	10	9	12	9	10	8	9	8

Following application of the modified Downs and Black checklist (Downs & Black, 1998; Santamaria et al., 2010), a mean score of 9.9 (with a minimum of 8 and a maximum of 12) was obtained. The findings of the methodological assessment are listed in Table 1. Some studies only reported $p < .05$ and did not mention the exact p values. Also only two studies out of a total of 15 performed priori power calculations. In 3 studies the interventions were not clearly described probably because the interventions used were well established and commonly used procedures.

Participants

In the studies reviewed, a total of 569 participants were evaluated with age

ranging from 13.72 ± 3.14 to 32.9 ± 9.2 and were behaviorally ranging from healthy active individuals (non-sportspersons) to professional sportspersons.

Variables Used For Finding the Relationship

Isometric Measurements

Isometric Mid Thigh Pulls

Isometric strength assessment testing using the isometric midhigh pull exercise (Peak Force-PF) was observed to be one of the most commonly used Isometric test in various researches included in our review (Stone et al., 2003; Stone et al., 2004; McGuigan et al., 2006; Winchester, 2008; Kraska et al., 2009; McGuigan & McGuigan et al., 2010). Vertical ground

reaction force data were collected using a force platform. Subjects were instructed to pull on the immovable bar (performed in a power rack with pins) as quickly as possible and were required to maintain effort for 5 seconds. It has been suggested that instructions stated as “hard and as fast as possible” produce optimal results for recording maximal force and Rate of Force Development RFD. The knee angle was adjusted to 130° (extended leg = 180°). The subjects were required to maintain this knee angle throughout the duration of the trial (Bemben et al., 1990; Sahaly et al., 2001; Haff et al., 2005). After the warm-up, subjects performed three 3-second long maximum isometric mid-thigh pulls inside a power back while standing on a force plate.

Isometric Strength of isolated muscles

Isometric Maximal force of the Knee extensor muscles with the knee and hip angles equal to 90 and 110 degrees, respectively were used by Requena et al (2009) in their study. The unilateral knee extension isometric force of the dominant leg was recorded by standard calibrated strain-gauge transducer.

Lord et al (1992) measured the Isometric Peak force of knee extension and flexion on an Isokinetic Rehabilitation System at velocities of 0 degrees, 60 degrees, 120 degrees, and 180 degrees/sec.

A standard variable resistance leg extension machine (Cybex VR2) was adapted for isometric Work in one study (Folland et al, 2005). The participants completed four sets of 10 repetitions of 2s duration, with one set being completed at each of four angles of knee flexion: (50° , 70° , 90° and 110°). The other leg was

trained for isokinetic strength for 9 weeks. After 9 weeks of training the strength was compared in both lower limbs.

Isometric Squats

In the study conducted by Nuzzo et al (2008) an isometric squat force was measured at, a knee angle of 140° because this angle is closely associated with maximal force when assessing isometric squats at various knee angles. Following the test administrator’s verbal instruction, subjects pushed with maximal effort as quickly as possible against the immovable bar that was located on their shoulders

Isometric Bench Press

Aleksander et al (2009) performed the measurement of maximal muscle strength and Rate of Force Development under isometric conditions on specially designed isometric equipment. The subjects were tested in the bench press machine while the bar with a dynamometer was placed in two different positions. In the first position, the bar was fixed at a 2-5cm distance from the chest and in the second position the bar was fixed at a 30-50 cm distance from the chest, depending on the position where the elbow joint angle was 135° (180° full extensions). These two positions represent critical spots during the bench press.

Murphy and Wilson (1996) performed similar isometric tests at two joint angles and examined their relationship to dynamic performance. In addition, electromyography data were collected from the triceps brachii and pectoralis major muscles to compare underlying neural characteristics between the isometric tests and dynamic movement which was a seated medicine ball throw. The subjects in this study performed two isometric tests in a bench

press position, at elbow angles of 90 and 120 degrees.

In a study conducted by *Guy et al (1996)*, strength was determined isometrically for right and left grip, back pull, and leg lift. Total strength was calculated as the sum of the four measurements. Relative strength was calculated by dividing total strength by body weight.

Dynamic Strength Variables

The isometric strength was correlated to a variety of dynamic variables in the studies included in our review. It was observed the dynamic variables studied could be divided into two types-those which measured the dynamic strength or power directly and those which were activity related such as running, jumping and cycling.

1 RM Squats

The 1RM for the back squat was used as measure of dynamic strength using free weights in a study by *Murphy and Wilson (1996)*. The squat exercise required the subjects to rest the bar on their trapezius and was performed to the parallel position, which was defined as when the greater trochanter of the femur was lowered to the same level as the knee. The subjects then lifted the weight until their knees were fully extended. 1RM, maximal peak power output (MPP), and the peak power attained with an external load equivalent to the 50, 75, 100, and 125% of the body weight were also tested in half-squat exercise by *Requenna et al (2009)*. These variables were measured by means of 2 different half-squat tests.

Nuzzo et al (2008) used similar 1 RM squats but they were performed so that the depth corresponded to a 70° knee angle.

Bench Press (1RM)

The bench press was used as an assessment of upper body strength by *McGuigan et al (2010)* and was performed in the standard supine position. The subjects lowered the bar to midchest and then pressed the weight until the elbows were fully extended. No bouncing of the weight was permitted. For estimation of the subjects 1RM *Aleksander et al (2009)* used a regression equation (*Bryzcki, 1993*). The formula permits one to "assess muscular strength in a safe, efficient manner, without requiring subjects to attempt maximum lifts.

Isokinetic Measurements

Isokinetic knee extension and flexion strength was measured in some studies. *Lord et al (1992)* measured quadriceps isokinetic strength at velocities of 0 degrees, 60 degrees, 120 degrees, and 180 degrees/sec. Isokinetic strength Knee extension strength was also measured at three velocities by *Folland et al (2005)* and correlated the values with Isometric strength.

Dynamic mid thigh pulls

Dynamic midthigh pulls begin at a position identical to the isometric position: dynamic pulls were finished with a simultaneous maximum effort shoulder shrug and plantar flexion (*Stone et al, 2003*). This method (midthigh pulls) of assessing Peak Force and Peak power was chosen because it was a movement position used in training. Previous research has established its potential usefulness as a test, and the positions (hip and knee angle) achieved in the test and the explosive nature of the tests is similar to that of critical aspects and positions of weightlifting and throwing movements

(Lanka, 1982; Bartonietz, 1996; Bartonietz, 2000; Lanka et al, 2000). Dynamic force-time variables were also obtained from a mid-thigh high pull by Khamoui et al (2011). Velocity-time parameters (peak velocity, rate of velocity development) were derived from 2 different dynamic activities: the mid-thigh high pull with a 30% IsoPF load and the vertical jump.

Dynamic Performance Variables

15meter sprint time (Requenna et al., 2009) was measured using photocells at the start and finish lines. The players performed 20 minutes of individual warm-up including several accelerations.

Cycle power (WPP) was measured using a modified (18 second) inertia-corrected Wingate protocol (Stone et al, 2004). The test was conducted using a pan-loaded cycle ergometer equipped with competition racing handlebars, saddle, and chain. The test ergometer was configured to the exact dimensions (saddle height, headset height, and saddle-to-headset distance) as that of the athlete's competition cycle. Wheel revolution was determined using an optical sensor. The measurement time (18 second) was chosen due to the similarity with riding time for a 250-m standard velodrome sprint.

Track Cycling Times Times for a 1-lap (333- m) maximum-effort sprint were measured by Stone et al, (2004) using a custom timing gate system.

Sprint times. For the 60m run Cuhna et al (2007) used video footage collected from a digital video camera images. The subjects ran over the entire 60m start from a standing position, with out spike shoes. 40-yd dash timing was also used by Guy et al (1996).

Vertical Jump. Vertical jump height was measured using two types of jumps (Requenna et al, 2009) - Squat Jump SJ and Countermovement Jump CMJ. In the Static Jump upon stepping onto the force plate, athletes were instructed to get in the "ready position," which consisted of assuming a squat position with a 90° knee angle measured with a handheld goniometer. Once in position, a countdown of "3, 2, 1 Jump" was given. A 3-s hold of the bottom position was used to eliminate the involvement of the stretch-shortening cycle (Nuzzo et al, 2008). Countermovement jumps were performed without a pause to a self-selected countermovement depth.

Kraska et al (2009) in their study performed the same jumps in weighted situations also using PVC pipe (0 kg) or barbell (20 kg) and assuming a squat position with a 90° knee angle measured with a handheld goniometer. Once in position, a countdown of "3, 2, 1 Jump" was given. A 3-s hold of the bottom position was used to eliminate the involvement of the stretch-shortening cycle (Cuhna et al, 2007). As a part of the vertical jump testing, vertical jump Peak velocity, vertical jump Height and vertical Jump rate of force development were also studied by Khamoui et al (2011) and correlated with isometric strength characteristics.

Broad jump

Standing broad jump was measured via a tape measure. Subjects were required to stand with their toes behind the zero point of the tape measure prior to jumping (McGuigan & Winchester, 2008). Subjects were not allowed a preparatory step of any kind but arm swings were allowed at the discretion of the subject. Distance was determined

measuring the point at which the heel of the trail leg touched the ground.

Anaerobic power was measured using Lewis power jump (LPJ), standing long jump (SLJ), Margaria-Kalamen stair run (M-K)

Aerobic power was assessed from a VO₂max test predicted from two 6-min bicycle ergometer rides. Heart rate was taken during the last two minutes of each ride, and the rides were separated by a 48-hr recovery period. No correlation was found with Isometric tests (Guy et al, 1996).

The other dynamic characteristic which were studied and compared with Isometric characteristics were - Sport-specific explosive strength tests such as Power snatch (SN), the Shot-put (SP) and the Weight throw (WGT) (Stone et al, 2003).

Table 2: Summary Of Study Design Features

Study	Participants Characteristics	Isometric force measurements	Dynamic activity/ strength test	Results
McGuigan et al (2010)	26 active males Age 22 ± 1 years Participating in regular exercise programs	Peak Force using mid thigh pull exercise	Vertical jump	r = 0.97 r = 0.70
McGuigan et al (2008)	22 male Age 18.4 ± 0.7 years NCAA Division 1 footballers	Peak Force using mid thigh pull exercise	1 RM for back squat and bench press and power clean Vertical jump Broad jump	r = 0.61-0.72 No correlation No correlation
Folland et al (2005)	33 recreationally active males Age 18-30 years		Isometric Quadriceps strength TRAINING & measurements at 4 angles in one lower limb	Isokinetic quadriceps strength TRAINING at 3 velocities in other limb Increase in Isokinetic strength was similar in two groups (intra-individual design)
Lord JP et al (1992)	20 males		Isometric Peak Torque (PT) of Knee extensors and flexors	Is kinetic measurement of the Knee extensors and flexors Angular velocity on joint angle at peak torques (JAPT) R = 0.48-0.52 (only for 60 deg & 180 deg per sec)
McGuigan et al (2006)	88 males Age 20.0 ± 0.4 years NCAA div II wrestling team		Isometric mid thigh pull exercise	1 RM Power clean 1 RM Squat 1 RM Vertical jump No correlation reported R = 0.88-0.93
Stone et al (2003)	5 males and 6 females Age 18-21 years Collegiate throwers		Isometric mid thigh pulls(IPF) close to training positions (knee 135-145 deg)	Peak power(PP) 1 rep movement power snatch (SN) Throwing ability (WGT) R = 0.87(at 60% of IPF) R = 0.94 0.79
Cubna et al (2007)	72 subjects (athletes 14.05 ± 1.58; non athletes 13.72 ± 3.14 years)		Isometric Leg press	Horizontal jump Dynamic peak force (PF) Drop Jump R = 0.92(at 60% of IPF) R = 0.793
Kraska et al (2009)	41 females and 22 males Age 19.9 ± 1.3 years Collegiate athletes		Isometric mid thigh clean pulls	Counter movement jump (CMJ) Static Vertical Jump testing (SJ) R = 0.36 R = 0.40
Stone et al (2004)	30 male cyclists for Part 1 (Age 30 ± 7.53) 16 male and 4 female for Part 2 (32.9 ± 9.2) International .		Isometric mid thigh pull on a custom made isometric rack (IPF)	Power tests Track Cycle times (in low gear and high gear) R = - 0.716 R = 0.696 R = 0.674 R = 0.652 R = 0.793
Requena et al (2009)	21 males Age 20 ± 3.8 years Soccer players		Isometric muscle force (MF) of knee extensors (IMF) and Plantarflexors (PF)	Counter movement Jump (CMJ) Static Vertical Jump testing (SJ) R = 0.36 R = 0.40 R = 0.674 R = 0.652 R = 0.793

Murphy & Wilson (1996)	24 healthy male subjects	Two isometric tests in bench press positions At elbow angles of 90 & 120	Seated Medicine Ball throw distance	R = 0.47 -0.55
Aleksander et al (2009)	22 males Age 21.5 ± 1.75	Max Force in a bench press action (isometric)	1 RM bench press using Matt Bryzki equation in Initial position Final position	R = 0.16 R = 0.33
Merek Goy et al (1996)	86 men Age 19.5 ± 1.6 Enrolled in Fitness classes	R grip L grip Back Pull Leg lift	Vertical Jump Lewis Power jump Standing Long jump Margaria kalamen Stair run	All strength measurements had significant but low relationships with power measurements
Khamoui et al (2011)	19 recreationally trained men Age 23.89 ± 2.92 years	Isometric PF (mid thigh pulls) Isometric mass adjusted PF (IsoPF/BM)	40 yard dash High pull peak velocity (HPPV) Vertical Jump (VJPV)	HPPV, VJ height & VJ peak velocity had significant relationship with Iso peak force/BM
Nuzzo et al (2008)	12 male athletes Age 19.83 ± 1.40	Isometric PF (mid thigh pulls)	Countermovement Jump Squat and powerclean 1 RM testing	Isometric mid thigh peak force was significantly correlated to Jump height Iso RFD was significantly correlated to Jump peak power

Discussion

Most of the studies we reviewed attempted to relate Isometric strength measures to dynamic strength measures or dynamic performances which required explosive power and speed. Although different studies have used different isometric measurements and dynamic variables, majority of researches have reported some relationship between the two. Most of the studies measured the isometric strength of various muscles in group action such as mid thigh pull (Stone et al, 2003; Stone et al, 2004; McGuigan et al, 2006; Kraska et al, 2009; McGuigan & Winchester, 2008; McGuigan et al, 2010), Isometric bench press (Murphy & Wilson ,1996; Aleksander et al, 2009) and Isometric squat (Nuzzo et al, 2008). Very few

studies measured isolated isometric strength of muscles and related it to dynamic activity (Lord et al., 1992; Folland et al., 2005; Requenna et al., 2009).

The dynamic variables studied could be divided into two types-those which measured the strength/power directly and those which were activity related such as running, jumping and cycling. The studies that measured dynamic strength utilized either 1 RM methods or Isokinetic measures (Table 2)

Amongst the Isometric measures studied, the midhigh pull was the most commonly used method to assess Isometric strength and was found moderately to strongly correlated to dynamic tasks such as Vertical jump, Power tests, Track Cycle times, Countermovement jump testing(CMJ) and 1 RM testing (Stone et al., 2004; Kraska et al., 2009; McGuigan et al., 2010). The significant correlation between mid thigh pull and dynamic variables such as Track cycle times and Throwing ability is interesting to note as the latter are speed and power related activities. This is in contrast to the findings of Wilson and Murphy, 1996 who reported that power and speed related activities are not correlated with Isometric activities It is also noteworthy that Isometric strength was found to be related to isokinetic measurements in a study done by Lord et al (1992). Another study conducted by Folland et al (2005) highlighted that after Isometric training in one leg and Isokinetic in the other leg of same subjects, 9 weeks later the isokinetic gains were similar in both legs. However conflicting results were reported by some researchers (McGuigan et al., 2006;

McGuigan & Winchester, 2008; Aleksander et al., 2009)

Isolated muscles were also measured in some studies reviewed. In only one study, aerobic activity was also measured and correlated with Isometric strength but was found to have insignificant correlation (Guy et al, 1996). Aerobic activity has completely different physiological mechanisms and it is understandable that no correlation was found between the two.

Conclusion

In spite of some conflicting reports on the subject, most studies included in our review indicate that Isometric strength and its testing has a strong potential to predict dynamic capabilities in activities involving strength and explosive power. Although, it would not be incorrect to comment that many dynamic power related activities have strong relationships to techniques and skill also. Many of the studies were done on skilled sportspersons and Isometric strength was still found to be correlated to force and explosive power activities. Therefore the use of Isometric strength assessments appears to be justified and can play an important role in assessments to predict dynamic performance of a particular type.

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The Effect of Music Therapy on Salivary Cortisol as a Reliable Marker of Pre Competition Stress in Shooting Performance

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Abstract

Studies have been performed on the psychophysiological responses of Music Therapy (MT) in normal and diseased, but little has been done on pre-competition stress (PCS) and Hypothalamic Pituitary Adrenal (HPA) axis response on sports population. The purpose of the current study was to estimate the contribution of MT on Salivary Cortisol (SC) in reducing PCS, and its effect on shooting performance (PS). One hundred male shooters between the age range of 29.5 ± 4.3 years were examined as experimental (N=50, MT along with the routine sports specific training) and control (N=50, only with the routine sports specific training). Duration of the study was 5 weeks, 4 weeks of interventional and 1 week study to determine the follow-up effect. Pre, post and follow-up data of quantitative phenotypic markers of HPA-Axis by SC and PS were analyzed. Compared to the control, experimental group has shown significant result, post-intervention ($p < 0.001$) and in follow-up ($p < 0.001$) in SC and in PS. Experimental group demonstrated in reduction of PCS level and increase in PS, whereas the control group showed non-significant result. Results indicated that relaxation therapies such as MT may decrease PCS and therefore enhance PS. It is concluded that four weeks of MT has an effect on HPA-Axis by decreasing the level of SC as a reliable physiological marker of PCS.

Key Words: HPA, Cortisol, Pre competition Stress, Music, Shooting.

Introduction

In shooting the requirement of good physical and psychological condition as well as technical perfection is highly demanded (*Antal et al., 1994*). Pistol shooting is a static activity requiring a strict control of body segments and posture to align the rear sight aperture and the foresight through proprioceptive feedback and gaze fixation either on the target directly or between the target and the weapon and, therefore, to increase precision of the shot (*Mononen et al., 2007*). Air pistol shooting is an Olympic sport requiring extreme mental concentration and movement precision for success. Compared to that for rifle shooting, there is very little literature related to pistol shooting. To our

knowledge, this is the first study to determine the efficacy of Music Therapy (MT) on Salivary Cortisol (SC) in professional shooters. Stress is most often used to describe an unpleasant emotional state or condition which is characterized by subjective feelings of tension, apprehension, and worry. In sports context it is commonly known as pre-competition stress or anxiety. Further, researches indicate that anxiety has a negative effect on these sport outcomes (*Terry & Slade, 1995*). Research on how athletes cope with sport-related stress has been recognized for both its practical and its theoretical importance because of the debilitating effects that stress may have on athletic performance (*Smith et al., 1998*). Findings of *Mellalieu et al (2009)*

suggest that, prior to competing; sport performers encounter more stressors pertinent to performance. These observations highlight that all the demands faced by the athletes should be considered when preparing and implementing interventions to manage competition stress. Pre-competition anxiety is a widely prevalent condition that exists among athletes of all levels and within every sport. Its relationship to performance has been studied both in and out of the sport context through test anxiety research (Liebert & Morris, 1967) and anxiety research with athletes (Swain & Jones, 1996; Kais & Raudsepp, 2005; Chamberlain & Hale, 2007). Despite the large body of research on pre-competition anxiety, our understanding of its relationship to performance remains elusive.

Cortisol is a hormonal response to acute stress and has been measured to be higher before competition than at resting conditions (Salvador et al., 2003). Some researchers have found that athletes produce higher levels of cortisol before games than before non-competition situations (Salvador et al., 2003; Filaire et al., 2007; Haneishi et al., 2007). The results support previous findings of Filaire et al (2009) that athletes are more anxious before games than during off days. Because cortisol is secreted as a result of a threatening stimulus, and sports competition is considered an anxiety-arousing situation (Salvador et al., 2003). Research findings comparing the physiological and psychological markers of stress have been equivocal (Filaire et al., 2001).

Applied sport psychology, in its efforts to enhance the competitive performance of athletes, has traditionally

utilized cognitive behavioral methods and techniques with an emphasis on developing self-control of internal states, commonly referred to as psychological skills training (Whelan et al., 1991). Relaxation techniques have been used in sports primarily to enhance recovery from training and competition, manage anxiety and improve performance (Solberg et al., 2000). One mechanism through which music may impact on flow is by enhancing pre-performance mood. Indeed, in a recent review, presented a strong case for the mood-enhancing effects of music in a sport context. (Vlachopoulos et al., 2000). Studies support previous research that found music to be an effective tool for improving athletic performance (Karageorghis et al., 1996).

The present study focused on examining the relation of physiological response to skilled sport performance, and investigating the relevance of music therapy in pre-competition stress. For this purpose, physiological variable such as Salivary Cortisol (SC) were recorded during the training and pre-competition phase of actual shooting.

Materials and Methods

Subjects: A total of 110 healthy male elite level shooters aged (29.5±4.3years) selected for the study. Subjects were voluntarily recruited from national shooting team; permission was obtained from officials. Questionnaires administered prior to the experiment were indicated that no volunteers are included as per exclusion criteria such as any physical or mental illness, hearing impairment, and have been under going music therapies for last 3 months. All subjects were nonsmokers, medication-free and not habitual drinkers. The aims of the present study, the procedures

involved and potential risks of the study were explained carefully to subjects, and the written consent was obtained prior to the study. The study and all protocols were approved by research ethical committee of Punjabi University.

Participants were randomly allocated into two groups; experimental (Music Therapy) and Control by multiple blocked random sampling of 55 in each group, after the dropout 100 (50 ± 3) subjects could complete the study in each group. Heart Rate (70 ± 3 bpm), Respiratory Rate (15 ± 2 rpm), BMI (24 ± 1.04 kg/cm²) and Blood Pressure ($119\pm 4/79\pm 4$ mm of Hg) were recruited to participate in this study. Intervention trial was conducted to the experimental subjects one week prior to the study. Concerning impediments to effective practice, subjects were monitored by the researcher and experts during the interventions. The intervention was provided over the course of four weeks and one week follow-up, group sessions with a maximum of 8 participants each, 20 minutes session per day, 6 days a week and one day was off per week. Participants were asked not to consume caffeine or alcoholic beverages for 12 h, and not to exercise for 12 h prior to the experiment especially during testing.

Procedure: The all participants of each batch reported to the laboratory at 08:00AM, each session conducted in the morning (between 8 AM and 10 AM) and The subject changed into loose fitting clothing, and shoes removed then the participants were instructed to lie in the supine position on the floor mat in a quiet, light-attenuated electrically shielded room with the temperature between 24 and 28 °C with their eyes closed.

Interventions:

Music Therapy: CD of 30-40 music of Raga Darbari based Hindi songs given to the experimental subjects one week prior to the study and asked them to select 5-10 songs according to their choice from the songs given, after selection of individual choice of music made separate folder for each subjects. The music was delivered on Sony™ MP3 player by headphone with volume of 60-70 dB, 60 to 70 beats per minute.

The music therapy group was encouraged to assume a comfortable position in supine position on a floor mat during delivery of the music intervention, Advised subjects to clear their minds and allow their muscles to relax throughout the training session. The participants left the room after 20 minutes of session. Experimental group underwent music therapy along with the routine sports specific training and control group only with the routine sports specific training.

Testing: The testing sessions were conducted between 8 am and 10 am and the same researcher tested all subjects. Measurement day scheduled one day prior to beginning the 1st week, 29th day and 36th day, subjects were assessed for pre-test, post-test and follow-up data respectively, except Performance Test, in a quiet controlled room with ambient temperature (24–28°C). The performance score calculated by pre-scheduled a competition in a internationally standard shooting range on one day prior to beginning the 1st week, and on 29th day, subjects were assessed for pre-test, post-test Performance score respectively.

All the participants were instructed to avoid consuming stimulant beverages, tea, and coffee; exercising, in the 12 hours previous to the examination. All the participants of each batch reported

to the laboratory at 08:00AM, measurement procedure started between 09:00 am and 10:00 am, to control as much as possible for time of day, to avoid circadian variations. Prior to testing, Participants attended a detailed briefing session where they received full verbal instructions regarding the procedures of the study. Salivary Cortisol samples were taken been 9:00 am -10:00 am to minimize time of day effects. All subjects were tested individually.

Salivary Cortisol: For obtaining the free, unbound, biologically active moiety of cortisol, saliva samples were collected. To rid the mouth of contaminates, subjects rinsed thoroughly with water ten minutes before saliva collection. Subjects sat unrestrained in a comfortable chair with lumbar support, Subjects were then allowed to relax for five minutes, the experimenter then began each test session and collected minimum of 2 ml of saliva by tilting the head forward, allowing the saliva to pool on the floor of the mouth, then passing the saliva through a short straw into a polypropylene vial. The Salivary samples were labelled and sealed and refrigerated in an ice box within 30 minutes. After all procedures the sealed sample sends to the laboratory on the same day by 2:00 h to store under-15 degree centigrade to the laboratory for later analysis,

Free cortisol level data from the samples of saliva were analyzed in the laboratory by using Salimetric^{STM} salivary cortisol kit. On day of assay, samples brought at room temperature and thaw completely, vortex, and centrifuge at 1500 x g (@3000 rpm) for 15 minutes before adding to assay plate and cortisol was assessed in via enzyme-linked

immunosorbent assay as per manufacturer (SalimetricsTM) instructions.

Performance score: Measure of shooting accuracy or shooting score was calculated from the standard shooting scoring board and the final result of competition obtained from the chief coach after the completion of competition, in order to test shooting performance.

Results

Table: 1 Comparison of mean values of study variables in male shooters of study groups

Study Variable	Music Therapy		Control Group	
	Mean	± SD	Mean	± SD
Age	28.67	4.24	30.2	4.68
BMI	24.27	1.11	23.8	1
HR	69.54	4.14	70.02	4.12
RR	15.46	1.73	15.61	1.58
BPD	119.42	4.38	119.41	3.2
BPS	78.58	3.92	79.93	3.3

Table: 2 Comparison of mean values of outcome variables at 3 stages in male shooters of study groups

Outcome Variable	Music Therapy		Control Group	
	Mean	± SD	Mean	± SD
SC-0Day	1.33	0.06	1.33	0.06
SC-29 th Day	0.53	0.07	1.95	0.08
SC-36 th Day	0.91	0.11	1.6	0.11
PS-0Day	528	29	544	30
PS-29 th Day	522	31	518	28

Table: 3 Comparison of mean values of outcome variables at 3 stages in male shooters of study groups (One way Analysis of Variance)

	Sum of Squares	df	Mean Square	F	Sig.
SC 0- Between Groups	0.00	3	0.000	0.02	0.995
Within Groups	1.65	195	0.008		
Total	1.65	198			
SC 29- Between Groups	76.74	3	25.58	5.25	0.000
Within Groups	0.95	195	0.01		
Total	77.69	198			
SC 36- Between Groups	32.81	3	10.94	986.67	0.000
Within Groups	2.16	195	0.01		
Total	34.97	198			

Within Groups Total					
PS 0- Between Groups	923.33	3	307.78	0.40	0.756
Within Groups Total	151648.89 152572.21	195 198	777.69		
PS 29- Between Groups	28100.54	3	9366.85	13.69	0.000
Within Groups Total	133436.06 161536.59	195 198	684.29		

Descriptive statistics of study and outcome variables measured in 52 and 48 subjects in experimental and control group respectively. The comparison of base line mean values of study variables (Table-1) and outcome variables (Table-2) among the two study groups, that is male shooters who had interventions: as music and control, shows a non statistically significant difference in the mean values of Age (F= 1.15; p= 0.33), BMI (F= 3.57; p=0.02), heart rate (HR) (F=0.10; p=0.96), respiratory rate (RR) (F=2.44;p=0.07), diastolic blood pressure (BPD) (F=0.42; p=0.74), and systolic blood pressure (BPS) (F=1.11; p=0.35) and SC(F=0.02; p=0.99), PS (F=0.40; p= 0.756).

In Experimental group, the mean values of Salivary Cortisol (SC) had statistically significantly decreased from the baseline value of 1.33 to 0.53 at 29th day and 0.91 at 36th day which is statistically significant (F=1.20;p<0.001). The post hoc pair wise comparison of these three values indicates highly statistically significant difference among the three values. From this it can be infer that the effect of music in this group has decreased the SC values significantly from their base line values. The mean value of performance score has statistically significantly increased from 528 to 544(t-value=-9.67, p<0.001).

In control group, the mean values of Salivary Cortisol (SC) had statistically significantly increased from the baseline value of 1.33 to 1.95 at 29th day and 1.60 at 36th day which is statistically significant (F=577.48; p<0.001). The post hoc pair wise comparison of these three values indicates highly statistically significant difference among the three values. From this it can be infer that the effect of no music intervention in this group has increased the SC values significantly from their base line values. The mean value of performance score has statistically significantly decreased from 524 to 522 (t-value=0.65, p<0.001).

Discussion

In the current study, used Salivary Cortisol (SC) as physiological markers and Performance Score (PS) as one subjective marker to assess the changes with music intervention group and also assessed changes in control group during the same duration. These parameters are very much reliable to provide true picture of changes and they are also very much susceptible for changes in pre competition anxiety or stress. This fact is supported by (Filarie et al., 2007 and Hanesishi et al., 2004) and also supported by research findings comparing the physiological and psychological markers of stress have been equivocal (Filaire et al., 2001). Since the salivary cortisol assay has been proposed as the method of choice for assessing adrenocortical (endocrine) function and responses to competitive stress Thus in this study also included SC as a physiological marker.

Result have been proved, during intervention of music therapy, the cortisol level in saliva decreased in music group post-intervention 60% (.53) and follow-up 29% (.91). Whereas control group showed

an increase of 47% 1.95 and 26% 1.60 pre-competition and post competition respectively. Study also showed the pre and post competition performance score of experimental group has increased 3% (544) whereas control group showed a decrease of performance score 0.9% (518).

The result of the study indicated that there is an increase in post intervention and follow up values in experimental group was showing more effective whereas the control groups it was highly insignificant result. The reason for these changes might be supported by studies on competition stress have been observed (*Stephen D Mellalieu et. al., 2009*), supported that, prior to competing, sport performers encounter more stressors pertinent to performance. The level of anxiety automatically narrows perception restricting the focus of attention (*Fredrickson & Branigan, 2005; Most et al., 2005; Curry et al., 2006; Ashcraft & Krause, 2007*). Thus result of this study indicated that there is an decrease in control group and increase in post intervention performance score in music therapy group; the reason for these changes might be due to decrease in pre competition stress.

supported by studies on cortisol have been observed, Cortisol is a hormonal response to acute stress and has been measured to be higher before competition than at resting conditions (*Salvador et al., 2003*). In recent years, however, salivary cortisol has been shown to reliably reflect levels of unbound cortisol in the blood and raised levels have been found to be associated with stress in normal subjects (*Kirschbaum and Hellhammer, 1994*).

Music affects a reduction in sympathetic nervous control and therefore a reduction in heart and respiration rates, metabolism, oxygen consumption, muscle tension, (*Lee et al 2005*). Listening to classical music increases heart rate variability helps in stress reduction, whereas listening to noise or rock music decreases heart rate variability (reflecting greater stress) (*Chuang et al., 2010*). Also supported by reductions in autonomic activity and self-reported tension and improved performance of surgeons (*Allen and Blaskovich, 1994*). In the current study music therapy has also been given based on classical music that might have increased relaxation in groups which have under gone music interventions.

As repeated listening to music affects people's preference for it as well as their physiological responses to it (*Knight and Rickard, 2001*), Music appears to exert direct physiological effects through the autonomic nervous system (*Rakel et. al., 2003*). In our study we have given 20 minutes session for 4 weeks this could supports the more effect of music. In addition, lower anxiety is expected to promote psychological well being by decreasing plasma norepinephrine and cortisol (*Mockel et al., 1994*) and enhancing relaxation and calmness. Therefore, soothing music was expected to have a therapeutic effect on relaxation.

Result of the current study showed in experimental group have been shown some amount of follow up effects even after one week of intervention this is supported by studies such as, (*Caine, 1992*) found evidence that playing recorded music for infants in the neonatal intensive care unit increased weight gain and shortened lengths of stay. Moreover,

a follow-up study of the infants that participated in Caine's music listening study indicated that infants who participated in the music intervention were rated as calmer by their mothers at 6 months of age compared to infants without music intervention. The results concerning the affective component of symptom changes showed that the effect of music therapy was sustained. One week after the discontinuation of sessions (Guetin *et al.*, 2009).

Conclusion

The neuroendocrine scientific studies of music is clearly still in its infancy, but the initial findings reviewed earlier promise both to reveal the mechanisms by which such training might exert its effects on relaxation that underlie complex regulatory mental functions. Results of this study indicated that relaxation therapies such as music therapy may decrease pre-competition stress and will enhance sports performance. It is concluded that in four weeks of music training has an effect on HPA-Axis by decreasing the level of salivary cortisol as a reliable physiological marker of pre-competition stress.

The past empirical evidence has lent support to the view that psychophysiological recordings may even provide insight into the skill related aspects of a shooter's psychomotor strategies and determinants of successful shooting performance.

To our knowledge, the salivary cortisol has been little evaluated in young athletes and, in such conditions of pre-competitive stress and post relaxation therapies. This work was made possible to find out the changes on the

neuroendocrine (ANS and HPA axis) activity during intervention, or changes induced in pre-competition stress. Although short-term activations of the HPA axis are adaptive and necessary for everyday functioning, extreme, frequent or chronic activation of this system are associated with negative health outcomes. Existing research has implicated the HPA axis in the development of a variety of sub-clinical and clinical conditions including metabolic syndrome (Brunner *et al.*, 2002), depression (Belmaker and Agam, 2008), risk for cardiovascular disease (Smith *et al.*, 2005) and cognitive decline (Seeman *et al.*, 1997).

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Formulation of Integrated Proprioceptive Screening Scale and Testing of its Sensitivity, Reliability and Validity

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Abstract

Proprioception is the awareness of the body position, orientation, movement and sensation of force. Proprioception is necessary to establish an accurate, efficient and coordinated response of efferent system to the demands of environment. As an evaluation is important to establish the goal of intervention in any patient, so an integrated proprioceptive assessment tool is required to examine proprioception deficit qualitatively and quantitatively. There are no evidences found, regarding an integrated approach of evaluating proprioception. In this study an integrated proprioceptive assessment scale was formulated covering all possible and related proprioceptive testing methods. The mean and SD was taken for each quantitative testing procedure documented and furthermore the test-retest reliability for each new measurement procedure was tested. The sensitivity, validity and the reliability of the scale was examined.

Key words: Angular error, Distance error, Proprioception score, Integrated Scale, Reliability, Sensitivity, Validity

Introduction:

The sensory motor system covers the whole process from a sensory stimulus to muscle activation; proprioception is the process occurring along the afferent pathways of sensory motor system. (Lephart *et al*, 2000). It is the awareness of the body position, orientation, movement and sensation of force (Sherrington, 1906). Disturbances of somatic sensation, especially proprioception may have detrimental functional implication consequent upon poorly controlled posture and movement. Evaluation of proprioception as a part of routine neurological examination is generally qualitative in nature, and it precludes accurate and reliable identification of subtle sensory variation (Leibowitz *et al*, 2008). In order to provide most appropriate, client centered

care it is most of importance to use standardized outcome measure for research and clinical practice. Unfortunately there are limited somatosensory evaluation tools (especially proprioception) with established reliability and validity available for clinical practice. The motor control and recovery are influenced by sensory impairments, the poor proprioception functioning has been shown to impact a person's rehabilitation outcomes and daily activities, also may lead to unsafe situation in the home and in social settings. It is therefore useful to assess to determine functional limitation and establish intervention goals. There are many assessments being used in clinical setting but those are lacking sufficient supporting evidence. The clinician using the conventional evaluation format should use them in combination with other

proprioception assessment to obtain most accurate measure of proprioception. (Gandhi, 2000).

Many of the proprioception subscale are less reliable to use and having ceiling effect and no scale which covers all aspects of proprioception assessment has been found in the literature. Most of the scales still need further research to prove reliability and validity. The grading criteria's is not discussed till now in most of the available subscales which is important to know the functional recovery and prognosis of patients. As an evaluation of proprioception is important to establish the intervention goal in any patient so a new integrated proprioceptive scale is needed to measure proprioception deficit qualitatively and quantitatively covering most of the proprioceptive domains.

Methods

The study was done in two phases.

The first phase of the study was innovative and correlational in nature intended to formulate and integrate proprioceptive scale where the different possible techniques to assess proprioception were searched and analyzed. Then the reliability of each quantitative testing procedure was checked and final scale was formulated. Ten subjects were selected to test the reliability of the testing procedure and documentation of mean and standard deviation of the proprioceptive error (angular and distance error) in different quantitative testing procedures was done.

In the 2nd phase the sensitivity, reliability and validity of the scale was tested. The testing of sensitivity and construct validity were comparative in nature. The testing of the reliability and

criterion validity were correlational in nature. The total scoring and grading using the scale was given to each subject, according to their performance in each testing procedure included in the integrated scale (IPSS). To check the intergroup sensitivity the scale was applied in different age groups and patients. To check the reliability of the scale the inter-tester and test-retest reliability was checked in 10 young aged subjects (17-25 years). The criterion validity of the scale was checked by correlating the score of the integrated proprioceptive screening scale (IPSS) to the score of Fugl-Mayer sensory subscale in 5 normal subjects (17-25 years).

Testing equipments and procedures

Various qualitative and quantitative testing procedures/methods were included in the form of subscales, to formulate the integrated scale. The qualitative testing procedures/subscale was as follows:

1. Contra-lateral limb matching test:

In this the subject was shown the directions into which his or her limb was going to be moved and given full instructions about the procedure. Then he was asked to memorize the directions of movement of the moving limb thereafter do the same movement on his opposite side on contra-lateral limb within 5 seconds.

2. Distal joint positional sense test:

The subject was asked to identify the position of the finger or toe (whether 'up, middle, or down') with closed eyes. He or she was asked to tell the right answer within 5 seconds. This test was done for all MCP and MTP joints.

3. Perceived thumb localization test:

In this test the subject was asked, to quickly touch the index fingertip (with the

right hand) to his nose then (within 5 sec.) touch the tip of thumb (raised over head), while examiner passively places the raised arm into three different locations in space, The subject was asked to grasp or pinch the testing thumb with the other hand within 5 seconds.

4. *Perceived Synergy Sense Test:* is meant to determine the position of upper limb and lower limb (one extremity at a time) in the form of any synergy pattern. The subject was asked to assume the position, just demonstrated to him and asked him to do the position on the both sides and both limbs. If the subject was unable to duplicate the test position, the experimenter passively placed the subject's extremity into the test position and asked the subject to maintain this position. If the subject was able to assume or maintain the test position, the experimenter then asked him to hold the shoulder/hip component of the position for 5 seconds while attempting to reciprocate the most distal component of that position.

5. In multidirectional repositioning task the subject sat in a chair which was positioned as close as possible to a table. Many boxes of equal square cm over the table using chalk or micropore were made. The subject was blindfolded. The testing hand along with the coin was passively positioned by the examiner on the center box of the surface of table. The other hand was placed directly over the testing coin where it was placed in the box along with testing hand. Then during the test the examiner passively moved the testing hand from the center box to the 3 locations by gently guiding it, (target location predetermined by examiner) until the index finger of the testing (affected) hand coincided with the coin placed

within the target box. The subject was asked to place his hand holding the coin within the target box. Then the subject was asked to move the contra-lateral hand towards the target direction and place the index finger directly near to his/her perceived location of the testing index finger over the coin placed within target box. When the subject had completed the movement the examiner marked the position of the index fingers and then the target was shifted to the next testing location. The displacement of the contra-lateral index finger from the coin (target location) was determined.

The quantitative testing procedures were,

1. *Foot Placement Sense Test:* The subject was instructed to walk on 12 feet long paper with comfortable foot step. He was told to memorize the placing of his each foot step. Then with eyes fixed to a point in front or not looking down, he was told to walk on the same paper roll as before for once. Then the error was recorded by comparing between the taken target footprint and subject's original foot placement with visual fixation after walking. The average of the error was taken and grading was done as according to the performance of the test.

2. *Objective Positional Sense Test:* The subject was asked to move his testing limb to the predetermined target angle/position and let him feel that angle/position for 5 sec. Then the limb was taken to the starting position passively, the subject was then asked to move the limb to that target position actively from the starting position. The angular difference between the target angle and patient's perceived angle was measured. The angular error in each plane of a joint was recorded and was taken as

the actual angular error in one particular plane of a joint.

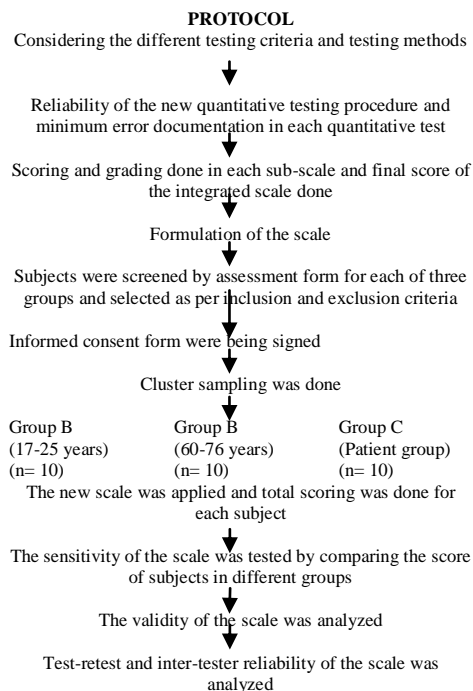
3. *Timed up and go test*: A 3 meters or 10 feet distance using tape was marked, the subject was informed about the test sequence and outcome. The subject was instructed to stand up from the chair walk to the mark on the floor, turn around, walk back to the chair and sit down. Timing was recorded using stop a watch.

4. *Motion tracking sense test*: This is an instrument designed to measure the proprioceptive error in an individual quantitatively. This instrument is made up of wood and has a slider to point out the reading on the scale and protractor fixed on the instrument. The subject was seated in front of a table on which the instrument was kept. The Subject was asked to slide the pointer in the instrument to a predetermined number on the scale over the instrument with opened eyes and maintain for 5 seconds there, so that the subject could memorize the position. Then with vision blocked the subject was asked to reposition in the target position. The distance and angular error in between the target angle/distance and subject’s perceived distance/angle respectively were recorded.

5. *Modified Romberg test*: In this test the subject was asked to close his eyes and stand on one leg for one minute and the number of times the subject lost balance in one minute was recorded.

6. *Timed Unilateral Stance Performance test*: Subject was asked to stand comfortably and fix his eyes further to a point. Thereafter the subject was asked to stand on the right and left foot separately as long as possible without losing balance or fall. The time duration

he could stand without losing balance was recorded.



Results:

Table 1: Reliability of the FPST-foot placement sense test (r value in between attempts)

FPST A Rt. SIDE	1 Vs 2	1 Vs 3	2 Vs 3
	r value	r value	r value
Rt. Foot Dist. Error	0.96*	0.87*	0.80*
Lt. Foot Dist. Error	0.86*	0.78*	0.95*

* P< 0.05

This table shows the r values between three attempts done in both two variables. There is highly significant correlation in between attempts taken on right and as well as left side foot. The r values in between three attempts were >0.80 and p values were <0.05 which shows the test was significant.

Table 2: Reliability of the MTST-Motion tracking sense test on right side upper limb

MTST RT. SIDE	1 Vs 2	1 Vs 3	2 Vs 3
	r value	r value	r value
SAGITTAL	0.89*	0.88*	0.77*
TRANSVERSE	0.78*	0.82*	0.78*
ANGULAR	0.82*	0.80*	0.86*

* P< 0.05

This table shows the r value in between three attempts done in all three variables. There is highly significant correlation in between attempts taken sagittal, transverse, angular error measurement in MTST on right side. The r value for all were >0.77 and p values were <0.05. These shows the testing procedure was significant to test proprioception.

Table 3: Reliability of the MTST-Motion tracking sense test on right side upper limb

(VARIABLE)	MTST	1 Vs 2	1 Vs 3	2 Vs 3
Lt. Side		r value	r value	r value
SAGITTAL		0.94*	0.75*	0.80*
TRANSVERSE		0.72*	0.76*	0.86*
ANGULAR		0.88*	0.77*	0.77*

This table shows the r value in between three attempts done in all three variables. There is highly significant correlation in between attempts taken sagittal, transverse, angular error measurement in MMTT on left side. R values were >0.75 and p values were <0.05 for all showing the testing procedure was significant.

Table 4: Mean and SD of proprioception score (%) in young (A), elderly (B) and patient (C) group obtained by IPSS

Variables	GROUP A		GROUP B		GROUP C	
	Mean	±SD	Mean	±SD	Mean	±SD
Age	22.60	2.54	65.70	3.65	43.70	14.53
Prop. Score	97.42%	0.75	91.79%	2.93	79.38%	13.56

The table shows the Mean and Standard Deviation scores for Proprioception score (%) in different groups (A, B, C). The mean and SD in group A were 97.42% and ±22.6, in group B 91.79% and ±2.93, in group C 79.38% and ±13.56.

Table 5: Inter-group sensitivity of IPSS

VARIABLE	GROUP A Vs B		GROUP A Vs C	
	U value	P value	U value	P value
PROP. SCORE	-3.788	P<0.05	-3.785	P<0.05

This table describes the difference of the scores of proprioception (%) by Mann Whitney U test in group A Vs B, B Vs C, C Vs A which shows the proprioception score (%) is significantly different in Group A Vs group B, Group A Vs Group C (p < 0.05).

VARIABLE	Group A Vs B Vs C	
	χ2 value	P value
Prop. Score	20.812	P < 0.05

This table describes the difference of proprioceptive scores (%) in between three groups (A, B, and C) by Kruskal-Wallis test, which shows the proprioception score (%) is significantly different in between three groups. The level of significance was high (p value <0.05).

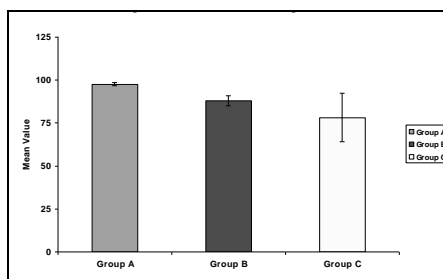


Figure 1 : Comparison of mean Prop. Score

Table 6: Test-retest reliability of IPSS

VARIABLES	Mean	±SD	R value	P value
PERCENT ME	97.42	0.75	0.84	<0.05
PERCENT ME2	97.88	0.62		Sig.

This table shows the test-retest reliability done by ICC, which describes that the scale having high test-retest reliability. The test-retest reliability was 0.84, which was highly significant.

Table 7: Inter-tester reliability of IPSS

VARIABLES	Mean	±SD	R value	P value
PERCENT ME	97.42%	0.75	0.843	<0.05
PERCENT PT 1	96.89%	1.18		Sig.

This table shows the inter-tester reliability done by ICC, which describes that the scale having high inter-tester reliability. The inter-tester reliability was 0.84, which was highly significant.

Table 8: Inter-tester reliability by ICC

VARIABLES	Mean	±SD	R value	P value
PERCENT ME	97.42%	0.75	0.854	<0.05
PERCENT PT2	97.61%	0.64		Sig.

This table shows the inter-tester reliability done by ICC, which describes that the scale having high inter-tester reliability. The inter-tester reliability was 0.85, which was highly significant.

Table 9: Inter-tester reliability by ICC

VARIABLES	Mean	±SD	R value	P value
PERCENT PT1	96.89%	1.18	0.730	<0.05
PERCENT PT2	97.61%	0.64		Sig.

This table shows the inter-tester reliability done by ICC, which describes that the scale having high inter-tester reliability. The inter-tester reliability was 0.73, which was significant.

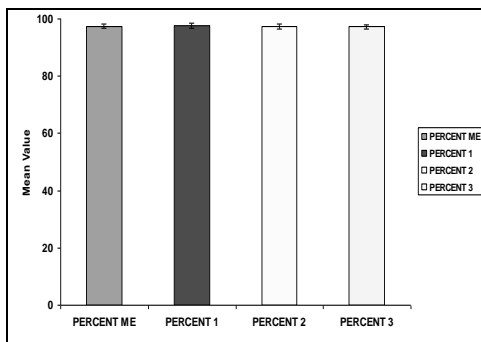


Figure 2: Mean comparison of percent scores

Fig 2 shows the test-retest and inter-tester reliability of the integrated proprioceptive screening scale.

Table 10: Construct validity of IPSS

GROUP A Vs B	
Test statistics T	P value
155	P < 0.05

This table shows the difference of proprioception acuity (mean proprioceptive score) in between two age groups by Mann Whitney test where statistics T value was 40 and difference of the mean score in between two age groups was highly significant (p< 0.05).

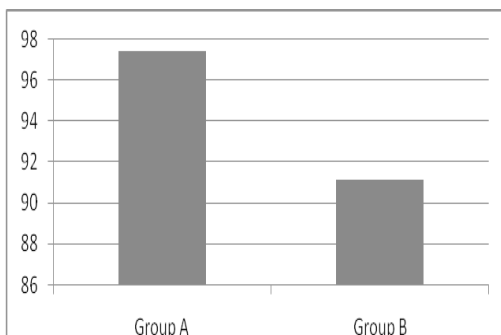


Figure 3: Comparison of construct validity of the integrated scale between the two age groups

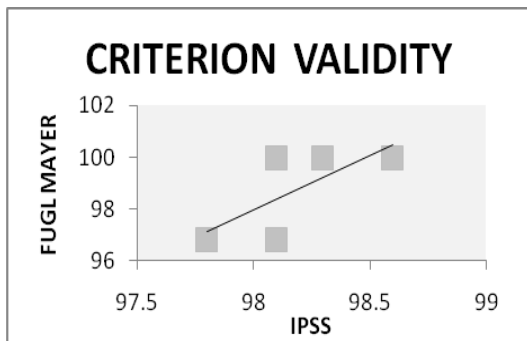


Figure 4: Criterion validity of IPSS by correlation of the proprioception score with Fugl-Mayer sensory sub-scale

Table 11: Criterion validity of IPSS

IPSS VS FUGL-MR	
R value	P value
0.71	P > 0.05

Table 11 & Fig 4 shows the correlation of proprioception score obtained by IPSS and Fugl Mayer on same subjects. The r value was 0.71.

Discussion:

Reliability of all of the quantitative procedures in this study was done before including the procedure within the integrated scale. The mean and standard deviation or proprioceptive error in normal healthy subjects was documented for further use as a reference to form the grading criteria in each subtest. The mean and standard deviation is mentioned below while discussing each subscales. This will help to make the sub-scales more reliable to examine proprioception and extent of proprioceptive deficit. All these tests and reliability made the scale more quantitative and qualitative.

Qualitative tests: Contralateral limb matching test is supported by Brunstrom S. who has mentioned the duplication of the joint position and

direction to test the proprioception in his book “Movement therapy in hemiplegia”. This test was done on all four extremities for shoulder, elbow, wrist, hip, knee and ankle joints. The thumb localization test was used by Redding and Potes (1988) who assessed upper limb position sense using a task in which the person was required to locate their thumb, blindfolded. For perception of joint synergy test, Leo and Soderberg (1981) have correlated the perception of joint synergy and joint position sense. In multidirectional repositioning task, Feedback from the muscle, tendon, joint and cutaneous receptor provides proprioceptive information regarding changes in the joint position and the muscle force. Muscle spindle information codes for both static and dynamic aspects of limb displacement which is important for goal directed movement, such information is critical in limb joint timing during multi joint movement (Bevan, Cordo 1994, Diane E Adamo 2007)

Quantitative tests: For foot placement sense test Riskowski et al (2005) has concluded that the proprioception acuity is related to gait kinematics during walking. Here in our study we have used the half of the step width during gait. For motion tracking sense test Leibowitz et al (2008) who stated in “Automated measurement of proprioception of upper limb” the cerebral processing of the hand position in space is based on the integration of the signals arriving actually from upper limb joints. In objective positional sense test by Paillard and Branchon who found that with passive re-positioning the error in matching the position of the outstretched arm is average 2 degree. Hurley et al in his study has found that there is a

correlation between the proprioception acuity and postural stability and he used monopodal stance time to check for the postural stability without losing balance. Muscle strength proprioception acuity and postural control contribute to mobility and confidence, enhancing the performance of common functional ADLs (Hurley and Joanne 1998).

Sensitivity, reliability, and validity:

There was significant difference between the three groups (χ^2 value = 20.812). The scores were highly different in between the different age group and patients. The intergroup sensitivity was statistically significant. This result is supported by the study of Hurley MV et al who stated that muscle strength, proprioception acuity, and postural stability contributes to mobility and confidence, these parameters deteriorated with age. Age related proprioception impairment is a generalized phenomenon not related to specific aspect of motor performance (Adamo et al). This result is supported by Riberio et al (2007) who found the evidence of proprioceptive deterioration with aging. Darling et al (2004) stated that, lesion in the parietal lobe causes the decrease in the kinesthesia in affected arm. Leibowitz et al (2008) found in his study that the distance and directional error was more in case of stroke patients in compared to control group subjects. The test-retest reliability of the scale is 0.80 to 0.84 and which statistically found to be significant. The inter-tester reliability of the scale is 0.83, 0.81, 0.82, and 0.81. This describe the scale is having statistically significant reliability. The criterion validity of the scale was checked by correlating the scores of the IPSS and fugl-Mayer. The correlation was significant (r value 0.71).

The mean score of IPSS was 98.18% (± 0.29), whereas the mean score of the Fugl Mayer was 98.72% (± 1.75). This shows that the scale (IPSS) is having adequate validity. The construct validity of the integrated scale, was examined by applying the scale in different age groups. The difference of score between group A and group B was significant (test statistics $T = 155$, p value < 0.05). The scores were highly different in between the different age groups (elderly and adolescent age group). This shows that the scale distinguishes the proprioception between the different groups of subject. This result was supported by Adamo et al (2007) who found greater matching error, more prolonged and irregular timed movement in case of elderly age group in compared to young adult age group, he also has mentioned the importance of inter-hemispheric transfer and retrieval of memory based proprioceptive information which needs the cognitive processing during complex sensory motor task.

In the end we can conclude that, the newly formulated proprioceptive screening scale was formed which is an integrated screening scale and it is also a sensitive, valid and reliable scale for measuring proprioception and proprioceptive deficit.

Conclusion

The newly formulated scale is an integrated, qualitative and quantitative scale which is a sensitive, valid and reliable tool to measure proprioception.

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Analysis of the Researches Completed in Physical Education in Indian Universities at Post-Graduate Level

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Abstract

The present study has been conducted with a view to investigate the trend of academic research in Physical Education in Indian Universities, submitted by Post-Graduate students during their master's programme. In this research, it was found that though the academic research made in various Indian Universities has been centered on individual practice, yet research title have been transformed from theoretical translation to step in an intensive study on objective facts. This study was conducted on master level dissertations submitted by the Post-Graduate students during their master's programme in various Indian Universities for their academic purposes.

Key words: Physiology, Psychology and Sports Training

Introduction

Greeks were the first civilized people to lay an equal emphasis on the cultivation of the "Man of Action" (Physically sound person) and the "Man of Wisdom" (Mentally sound person) through sports and vigorous physical activities. They were of the considered opinion that intellectual achievement could not be possible without physical efficiency (*Dalen at al., 1971*).

McKenzie (1979) explain that, when the renowned physiologist, *Bruno Balke*, was asked why he believed so strongly in Physical Education, he replied that it is essential to the living of a full life that one be acquainted with the broad variety of movement patterns that contribute to the development of intricate sub cortical and cortical functions and help measurably to prepare people for mental and psychological encounters.

The basic premise on which research rests is that through the scholarly investigation of specific subject matter the body of knowledge of the various disciplines will be revealed and developed. This is particularly true for Physical Education, where the extent for the academic discipline is not so widely popular outside the field. The most significant development in research today is the engagement of the Physical Educationists in scholarly study. The academic promotions depend largely upon how soon and how well the teachers are able to blend his/her teaching and research. Research has profoundly influenced the emergence and development of our civilization from the ancient discoveries to the present utilization of Science and Technology. Many educators and scientists have advocated taking stock of the research findings in physical education periodically (*Thomas, 1964; Clarke & Clarke, 1984; William, 1986;*

Thomas & Nelson, 1989; Bucher, 1993; Borg & Meredith, 1999; Best & Kehn 2000).

Materials & Methods

Researcher first collected the information’s regarding the institutions and universities conducting post-graduate courses in Physical Education, the researcher refereed the “Directory of Universities and Institution in India” prepared by Association of Indian Universities New Delhi. The institutions and universities were selected using the probable method of purposive sampling and survey type of descriptive method of research was adopted. The main sources of data were Dissertations, Thesis, Bibliographical Dissertation Abstract, Records, Journals, Bulletins and other Periodicals. The duration of forty nine years from 1961 to 2009 was considered as delimitation of the study.

The data collected were plotted in a master chart and attempt was made to find out the number of researches completed in the field of Physical Education at Post-Graduate level in Indian Universities. The analytical assessment of dissertations, subject-wise and even the comparison between the different methods of research work on the percentage basis of the total information have been prepared and the analysis and interpretation has been done systematically.

Results & Discussion

The data thus collected has been presented in Table 1. This table shows that a total of 1901 researches have been completed in various Indian Universities at Master’s level. Table also indicates that

a total of 987 (51.92%) studies have been completed following descriptive method of research and a total of 810 (42.61%) studies were found to be experimental in nature and only 104 (5.47%) studies were completed by following historical approach.

Table 1: Method wise Master’s level Researches completed in Indian University

S. No.	Method of Research	No. of Studies	%age
1.	Descriptive Method	987	51.92
2.	Experimental Method	810	42.61
3.	Historical Method	104	5.47
	Total	1901	100

Table 2: Subject wise Master level Researches completed in Indian University

S. No.	Subject	No. of Studies	%age
1.	Physiology	287	15.09
2.	Psychology / Sociology	259	13.63
3.	Sports Training	231	12.15
4.	Test, Measurement and Evaluation	96	5.05
5.	Sports Management	79	4.15
6.	Kinesiology / Bio-Mechanics	61	3.21
7.	Sports Medicine	53	2.79
8.	Kinanthropometry	62	3.27
9.	Others (Health Edu. Yoga, Recreation, etc.)	773	40.66
	Total	1901	100

Table 2 shows the number of research studies completed by the Post-Graduate students in various universities for their Master’s course. It was found that a total of 287 (15.09%) studies were related to the area of Sports Physiology followed by 259 (13.63%) studies related to Psychological/Sociological area. It was also found that 231 (12.15%) number of studies have been completed in Sports Training followed by 96 (5.05%) studies in Test, Measurement and Evaluation, 79 (4.15%) studies in Sports Management, 62 (3.27%) studies in Kin-anthropometry, 61 (3.21%) reports in Kinesiology / Bio-Mechanics, 53 (2.79%) studies in Sports Medicine and rest 773 (40.66%) completed in others area like Health

Education, Recreation, Dance and Yoga etc.

Findings

- It was found that the total 1901 research studies have been completed in Physical Education in various Indian Universities at Post-Graduate level.
- From the collected data, it was found that the first Master level dissertation was submitted to Punjab University, Chandigarh in the year 1961.
- These 1901 research studies have been completed during the span of forty nine years from 1961 to 2009.
- The investigator has also found while analyzing the data that other research methods were followed very negligible. Only 5.47% studies were related with historical method and not a single study was on philosophical method.

Conclusion and Recommendations

- In view of the present study it may be concluded that lot of research studies have been completed in Physical Education in various Indian Universities at Post-Graduate level.
- Qualitative evaluation of these research studies may be undertaken to know about the standard of these researches done in various Indian Universities at Post-Graduate level.

- It is recommended that there should be a Central Agency to compile every year the abstract of the Research studies completed in Physical Education in various Indian Universities at Post-Graduate level.

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Comparative Study of Cardio-Vascular Endurance, Flexibility and Body Composition Parameters of Male Physical Education Teachers of Different Districts in Gujarat

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Abstract

The present study has been conducted with a view to investigate the trend of academic research in Physical Education in Indian Universities, submitted by Post-Graduate students during their master's programme. In this research, it was found that though the academic research made in various Indian Universities has been centered on individual practice, yet research title have been transformed from theoretical translation to step in an intensive study on objective facts. This study was conducted on master's dissertations submitted by the Post-Graduate students during their master's programme in various Indian Universities for their academic purposes.

Key words: Physiology, Psychology and Sports Training

Introduction

Cardio-respiratory fitness is a major component of health-related fitness and depends on a large number of phenotypes associated primarily with cardiac, vascular and respiratory functions. Measurements of sub-maximal exercise capacity and maximal aerobic power are generally performed to assess cardio-respiratory fitness. Body mass index (BMI) is a statistical measure of an individual's weight scaled according to his height. It is a simple index of weight-for-height and is widely used by medical, health and fitness professionals to classify underweight, overweight and obesity in adults. BMI is a useful tool and for most individuals is an accurate way to classify weight, but it should be used along with other measurements as it does have limitations. However, individuals can calculate their BMI without the use of expensive equipment or special knowledge. BMI is calculated by dividing weight (in kilograms) by height (in

meters) squared. The World Health Organization defines overweight as a BMI of 25.0 to 29.9 and obesity as a BMI greater than 30. A BMI value of 19.5 to 24.9 is considered normal, and less than 18.5 is defined as underweight. For children and adolescents, weight status must be determined through comparison of the child's BMI with age- and gender-specific values (BMI growth curves). Our bodies are made up of a lot of different kinds of tissues (plus a lot of water). There is muscle, fat, bone, and specialized tissue such as is in our various organs. The body fat percentage is just that – the percentage of our weight which is made up of fat. Body fat percentage is similar to terms such as *body fat ratio* and *body composition*. The review of literature indicates that with an increase in age there is a decline Cardio respiratory fitness that is related to cardiovascular endurance, flexibility and body composition parameters of male physical education teachers of different districts in Gujarat.

Delimitations

The study was delimited to ninety physical education teachers those who came to attend the state level orientation course for physical education teachers, sponsored by Sports Authority of Gujarat and organized by Mahadev Desai Sharirik Shikshan Mahavidyalay, Gujarat Vidyapith, Sadra Dist. Gandhinagar, (Gujarat). Those who volunteered to participate in the study were selected randomly and divided into three groups districtwise respectively viz. Ahmedabad (N=30), Gandhinagar (N=30) and Sabarkantha (N=30) district.

Limitations

Previous abilities, individual’s capabilities and effect of individuals difference was considered as limitation of this study.

Materials & Methods

Initially selected ninety male physical education teachers who volunteered participated in this study. All the participants those who came in state level orientation course for physical education a teacher (granted by Sports Authority of Gujarat) that was organized by Mahadev Desai Sharirik Shikshan Mahavidyalay, Gujarat Vidyapith, Sadra

Dist. Gandhinagar, (Gujarat). All the important and required information was given to participants and age was checked by their service record. All the subjects were screened and homogenized for absence of any diseases like cardiovascular disease, cardio-respiratory disease and any serious diseases and then divided into three groups districtwise respectively viz. Ahmedabad (N=30), Gandhi nagar (N=30) and Sabarkantha (N=30), their cardiovascular endurance was measured by Cooper’s 12 minute run and walk test, flexibility measured by sit and reach test and body composition like Body mass index (BMI), Fat Mass (FM), Fat Percentage (Fat%), Total Body Water (TBW), Impedance(Ω) and Body Weight (W) measured by Body Composition Analyzer, height measured by stadiometer

Statistical Analysis

For statistical analysis of data to find out the comparison of cardiovascular endurance, flexibility and body composition parameters of male physical education teachers of different districts in Gujarat, One way analysis of variance (*ANOVA*) F-test was applied. The level of significance in the study was chosen at 0.05.

Table-1: Cardiovascular Endurance, Flexibility and Body Compositional Parameters Characteristics of the Physical Education teachers (PET) of different Districts in Gujarat

Sr. No.	Parameters	Ahmedabad District (PET)	Gandhinagar District (PET)	Sabarkantha District (PET)	F- Value
		Mean	Mean	Mean	
1	Cardiovascular Endurance	1713.8	1773	1763.9	0.28
2	Flexibility	25.7	20.86	23.96	3.62*
3	Body Mass Index	24.23	24.23	23.2	1.12
4	Body Weight	68.4	69.73	67	0.76
5	Fat Mass	14.39	14.27	13.18	0.49
6	Age	42.9	37.83	40.56	3.75*
7	Total Body Water	39.62	40.18	39.34	0.50
8	Impedance	532.3	538.26	549.76	0.66
9	Fat Percentage	20.68	20.04	19.21	0.58
10	Height	168	169.3667	169.03	0.54

Table 1 enlists the mean values of various health related measures and also

Results & Discussion

compares the means statistically using ANOVA. Findings of the study demonstrate significant difference between the three groups of physical education teachers of three districts of Gujrat in flexibility (Ahmedabad (Amd) = 25.7, Gandhinagar (GN) = 20.86 and Sabarkantha (SK)= 23.96 and f-value 3.62) and age parameter (Amd = 42.9, GN = 37.83 and SK = 40.56 and f-value was 3.75) but no significant differences were observed in cardio-vascular Endurance, Body Mass Index, Body Weight, Fat Mass, Total Body Water, Impedance, Fat Percentage and Height between physical education teachers of different districts in Gujarat.

The obtained result suggested that there was significant difference between Ahmedabad, Gandhinagar and Sabarkantha physical education teachers in flexibility and age parameters but there were non significant differences in cardio-vascular Endurance, Body Mass Index, Body Weight, Fat Mass, Impedance, Fat Percentage and Height between physical education teachers of different districts in Gujarat. The reason behind this was age factor because average of age was 38 to 43 when the age of all the physical education teachers was approximately same then all the parameter can be same that's why maximum body

composition parameters indicate no significant difference in all the groups. An other reason can be that, state government selected experienced middle age physical education teacher for orientation course. The Body Mass index, Body Weight, Fat Percentage, Total Body Water, Impedance and Fat Percentage of all the Physical Education Teachers was in normal range. So according to result of the study we can say that all the Physical Education Teachers of different districts in Gujarat neither have neither more Physical fitness nor less physical Fitness.

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The Effect of Specific Yogic Exercises and Combination of Specific Yogic Exercises with Autogenic Training On Selected Physiological, Psychological and Biochemical Variables of College Men Students

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Abstract

The purpose of the study is to find out the effect of specific yogic exercises programme and combination of specific yogic exercises with autogenic training programme on selected physiological variables such as pulse rate, vital capacity, percent body fat, psychological variables such as job anxiety, occupational stress and biochemical variables such as high density lipoprotein, low density lipoprotein and fasting blood sugar of the college men students. Sixty Men students in the age group of 20 to 30 years from the Alagappa University were randomly selected and served as the subjects for the purpose of this study. The study was formulated as a random group design consisting of specific yogic exercises and combination of specific yogic exercise with autogenic training groups. The subjects (N=60) were at random divided into three equal groups. Experimental group I - was administered specific yogic exercise group, Experimental group II- underwent combination of specific yogic exercises with autogenic training group and control group. All the groups were subjected to pre-test prior to the experimental treatment. The experimental groups participated in their respective duration of 12 weeks, six days in a week throughout the study. Analysis of Co-variance (ANACOVA) was applied to determine the significance of mean difference between the three groups. When F-ratio was found to be significant, the Scheffe's Post Hoc test was applied to test the significance of pairs of the adjusted final group means. Practice of the combination of specific yogic exercises with autogenic training and specific yogic exercises programme is significantly effective in promoting desirable changes in the dependent variables.

Keywords: Pulse rate, Vital capacity, Percent body fat, Job anxiety, Occupational stress, Fasting Blood sugar

Introduction

Human life focuses on physical, mental, social and spiritual aspects. Human health is divided into physical, mental and social dimensions. Autogenic training is a system of very specific auto suggestive formula with a purpose to relieve tension, stress and to eliminate psychosomatic disturbances including many cases of insomnia, obesity, inability to concentrate, high blood pressure, constipation, skin problems, etc. Some

people use autogenic training as an aid to meditation, to improve their mental concentration in a focused way.

Yoga and autogenic training are useful to the modern man in relieving stress and tension (Joshi *et al*, 1992; Sakai, 1997; Arambula *et al*, 2001; Malhotra *et al*, 2002; Steeter & Kupper, 2002). The purpose of any research should be to solve the existing complications of the human being. Research should help the society not only to create good health and happiness

among human beings, but also to improve the quality of life.

The purpose of the study is to find out the effect of specific yogic exercises programme and combination of specific yogic exercises with autogenic training programme on selected physiological variables such as pulse rate, vital capacity, percent body fat, psychological variables such as job anxiety, occupational stress and biochemical variables such as high density lipoprotein, low density lipoprotein and fasting blood sugar of the college men students.

Selection of subjects

Sixty Men Students from the Alagappa University were randomly selected and served as the subjects for the purpose of this study. The selected subjects were in the age group of 20 to 30 years.

Experimental design

The study was formulated as a random group design consisting of specific yogic exercises and combination of specific yogic exercise with autogenic training groups. The subjects (N=60) were at random divided into three equal groups. The groups were assigned the names as follows:

Experimental groups I-specific yogic exercises group, Experimental group II- combination of specific yogic exercises with autogenic training group and control group

All the groups were subjected to pre-test prior to the experimental treatment. The experimental groups participated in their respective duration of 12 weeks, six days in a week throughout the study. The various tests administered were: prior to training (pre test) and

twelfth week (post test) of the training schedule.

Selection of variables

The selected physiological variables are pulse rate; percent body fat and vital capacity. The selected psychological variables are job anxiety, occupational stress. The selected biochemical variables are high density lipoprotein, low density lipoprotein and fasting blood sugar.

Criterion measures

Physiological variables

Pulse rate was measured by manual method over a period of one minute and recorded in beats per minute.

Vital capacity was measured by using wetspirometer and each reading was recorded in millilitre.

Percent body fat was measured by using Harpenden skin fold caliper and each reading was recorded to the nearest millimeter.

Psychological variables

Level of job anxiety was measured by using standard questionnaire and recorded in points scored.

Level of occupational stress was measured by using standard questionnaire and recorded in points scored.

Biochemical variables

High density lipoprotein was tested in the biochemical laboratory and the results were recorded in mg.%.

Low density lipoprotein was tested in the biochemical laboratory and the results were recorded in mg%.

Fasting blood sugar was tested in the biochemical laboratory and the results were recorded in gm/dl.

Statistical technique

Analysis of Co-variance (ANACOVA) was applied to determine the significance of mean difference between the three groups. When F-ratio

was found to be significant, the Scheffe's Post Hoc test was applied to test the significance of pairs of the adjusted final group means.

Table – I: Analysis of Co-Variance for the Means Difference

Variables	Adjusted Post Test Means			Source	Sum Of Squares	Mean Square	F-Value	Tf
	Control group	SYEG	CSYATG					
Pulse Rate (Beats/minute)	83.30	81.28	78.41	Between	241.02	120.51	11.53	3.162
				With in	585.57	10.46		
Vital capacity (ml)	1074.34	1180.01	1260.65	Between	346963.49	173481.74	30.74	
				With in	316086.69	5644.41		
% Body Fat	21.75	20.67	20.08	Between	28.61	14.30	37.13	
				With in	21.57	0.39		
Job Anxiety (Points core'd)	32.15	28.57	26.53	Between	323.18	161.59	40.23	
				With in	224.91	4.02		
Occupational Stress (Points Score'd)	131.24	126.11	122.20	Between	816.92	408.46	62.32	
				With in	367.04	6.55		
High Density Lipoprot., mg%	45.79	48.05	49.47	Between	137.02	68.51	19.30	
				With in	198.78	3.55		
Low Density Lipoprot., mg%	116.42	112.62	110.75	Between	332.70	166.35	42.65	
				With in	218.45	3.90		
Fasting Blood Sugar (Mgs./dl)	110.28	106.09	100.97	Between	870.49	435.25	35.84	
				With in	680.09	12.15		

* Significant at 0.05 levels

Table value in df 2 and 56 was 3.162

Results of Adjusted Means

The corresponding F-values needed for significance at 0.05 level is 3.162. The calculated F-values on selected criterion variables are 11.53 (Pulse Rate), 30.74 (Vital capacity), 37.13 (Percent Body Fat), 40.23 (Job Anxiety), 62.32 (Occupational stress), 19.30 (High Density Lipoprotein), 42.65 (Low Density Lipoprotein and 35.84 (Fasting Blood Sugar). Since the obtained F-ratio on

criterion variables were higher than the required table value of 3.162 at 0.05 level of confidence it was found to be significant.

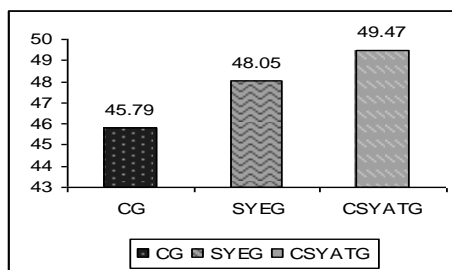
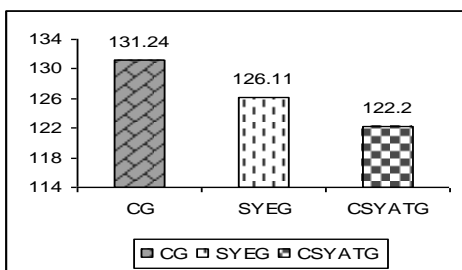
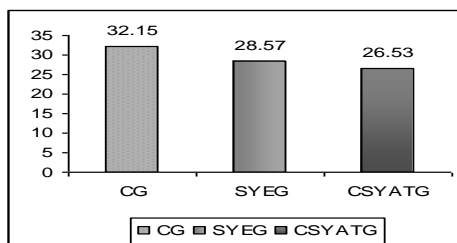
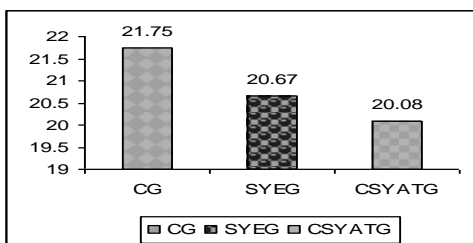
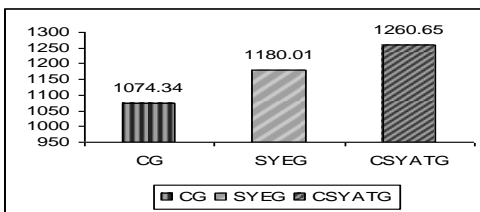
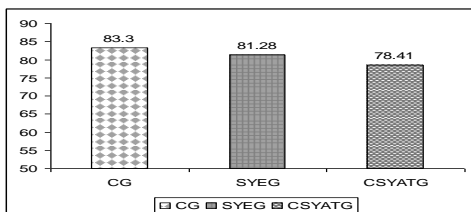
Since the observed mean difference among the three groups were found to be statistically significant, in order to find out which of the pairs of group means are significant, the Scheffe's Post Hoc test was applied.

Table – II: Scheffe's Test of Significance between Paired Adjusted Post Test Means

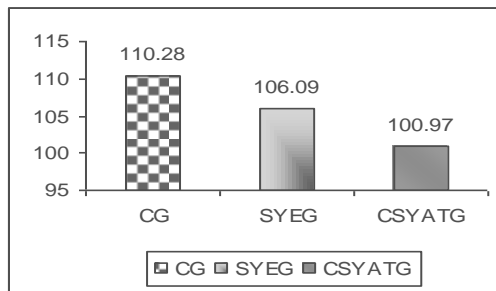
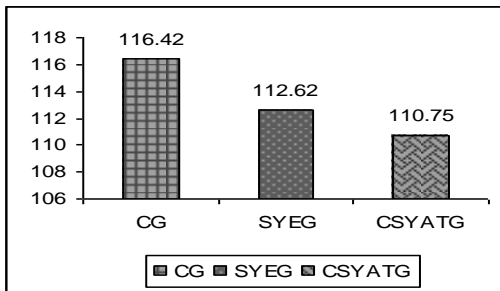
VARIABLES	Adjusted Post Test Means			Mean Difference	F-value
	CG	SYEG	CSYATG		
Pulse Rate (Beats per minute)	83.3	81.28		2.02	3.906
	83.3		78.41	4.89	22.876*
		81.28	78.41	2.87	7.877*
Vital capacity (Millilitre)	1074.34	1180.01		105.67	19.784*
	1074.34		1260.65	186.31	61.501*
		1180.01	1260.65	80.64	11.522*
Percent Body Fat	21.75	20.67		1.08	30.577*

	21.75		20.08	1.67	73.048*
		20.67	20.08	0.59	9.103*
Job Anxiety (Points Scored)	32.15	28.57		3.58	31.86*
	32.15		26.53	5.62	78.646*
		28.57	26.53	2.04	10.393*
Occupational Stress (Points Scored)	131.24	126.11		5.13	40.154*
	131.24		122.2	9.04	124.69*
		126.11	122.2	3.91	23.326*
High Density Lipoprotein (mg %)	45.79	48.05		2.26	14.311*
	45.79		49.47	3.68	38.189*
		48.05	49.47	1.42	5.744*
Low Density Lipoprotein (mg %)	116.42	112.62		3.8	37.114*
	116.42		110.75	5.67	82.499*
		112.62	110.75	1.87	8.945*
Fasting Blood Sugar (mgs./dl)	110.28	106.09		4.19	14.497*
	110.28		100.97	9.13	71.444*
		106.09	100.97	5.12	21.444*

Required value for significance at 0.05 level = 5.545



CG – Control group, SYEG – Specific yogic exercises group, CSYATG – Combination of Specific yogic exercises with autogenic training group



CG – Control group, SYEG – Specific yogic exercises group, CSUATG – Combination of Specific yogic exercises with autogenic training group

Discussion of Findings

The results of the study indicate that the selected physiological, psychological and biochemical variables of the subjects improved significantly after undergoing the combination of specific yogic exercises with autogenic training for a period of 12 weeks.

The analysis of co-variance and repeated measures of analysis of variance of pulse rate on combination of specific yogic exercises with autogenic training showed that there was significant improvement in pulse rate due to 12 weeks of the training. The finding of the study showed that there was a significant improvement in normalizing the pulse rate in combination of specific yogic exercises with autogenic training group better than the specific yogic exercises group and control group. Yoga and autogenic training is now practiced around the world for its physical, physiological, Psychological, biochemical and spiritual benefits. It reduces the stress and increases relaxation, which may have a favorable effect on heart rates. The present study confirmed with the results of Pawlow & Jones (2002), Arambula et al (2001) and Bhargava et al (1988).

The analysis of co-variance of vital capacity on combination of specific yogic exercises with autogenic training

group and specific yogic exercises group showed that there was significant improvement in vital capacity due to 12 weeks of the training. The finding of the study showed that there was significant improvement in increasing the vital capacity in combination of specific yogic exercises with autogenic training group and specific yogic exercises group better than the specific yogic exercises group and control group. Yoga and autogenic training also improves the lung capacity it was discovered that pranayama caused general health improvement through the enhancement of lung function and to improve respiratory capacity of the human being. Asans tone up the lungs. Pranayama is highly useful oxygenation being better, tissue hypoxia never comes. The finding of the study are in agreement with the studies reported by Cysarz. & Bussing (2005), Czamara & Michele (2003), Joshi et al (1992) and Birkel & Edgren (2000).

The finding of the study showed that there was a significant improvement in controlling the body fat level in combination of specific yogic exercises with autogenic training group and specific yogic exercises group was better than the specific yogic exercises group and control group. Health risk associated with too much body fat. The regular yoga practice

and autogenic training can help in weight management, some of the asanas stimulate sluggish glands to increase their hormonal secretions. especially, has a big effect on our weight because it affects body metabolism fat metabolism is also increased and hence fat is converted to muscle energy to losing fat one will have a better muscle tone and a higher vitality level. It reduces anxiety, and yoga deep breathing to increases the oxygen delivery to the body cells, including the fat cells.

The finding of the study showed that there was a significant improvement in controlling the job anxiety level in combination of specific yogic exercises with autogenic training group showed control in job anxiety level was better than the specific yogic exercises group and control group. yoga teacher how to relax mentally and physically and to manage stress reactions. Yoga promotes relaxation, improves circulation and reduces stress and anxiety, autogenic training provides a flexible approach to a wide variety of physical and psychological problems with surprisingly favourable results and to relieve the symptoms of anxiety, stress, fatigue and irritability. The present study agree with the findings of *Stetter and Kupper (2002)*, *Takeichi and Sato (2000)*, *Sakai (1997)* and *Khasky and Smith (1999)*.

The analysis of co-variance of occupational stress on combination of specific yogic exercises with autogenic training group and specific yogic exercises group showed that there was significant improvement in occupation stress due to 12 weeks of the training. The finding of the study showed that there was a significant improvement in controlling the occupational stress in combination of specific yogic exercises with autogenic training group showed control in the

occupational stress which was better than the specific yogic exercises group and control group. Autogenic training is probably one of the most powerful techniques for dealing with stress and consists of series of simple mental exercises. Many of the controlled medical trails on autogenic training have established to many of the commonly acknowledged stress related diseases. Yoga minimizes impact of stress on the individual. Yogic science believes that the regular practice of asana and pranayama strengthens the nervous system and helps people face stressful situations positively and yoga is highly recommended for people in stressful working environments. The findings of the present study are in agreement with the results *Johnson and Johnson (1984)*.

The analysis of co-variance of high density lipoprotein and low density lipoproteing on combination of specific yogic exercises with autogenic training group and specific yogic exercises group showed that there was significant improvement in controlling the high density lipoprotein and low density lipoprotein due to 12 weeks of the training. The finding of the study showed that there was a significant improvement in normalizing the high density lipoprotein and low density lipoprotein level in combination of specific yogic exercises with autogenic training group showed control the high density lipoprotein and low density lipoprotein level which was better than the specific yogic exercises group and control group. The biochemical benefits of yoga such as decrease of LDL cholesterol, glucose and catecholamine and triggers the resilience of the body. Yoga balances the weight of the person without losing its strength through the different stretching asanas.

Yoga lowers blood sugar and LDL cholesterol and boosts HDL cholesterol. The autogenic technique is one of self help which can enable the individual to manage health and other problems like blood sugar, LDL cholesterol etc., more successfully. The present study confirmed with the results of *Winter (1985) and Vyas & Dikshit (2002)*.

The analysis of co-variance and repeated measures of analysis of variance of fasting blood sugar on combination of specific yogic exercises with autogenic training group and specific yogic exercises group showed that there was significant improvement in reducing the blood sugar level due to 12 weeks of the training. The finding of the study showed that there was a significant improvement in controlling the blood sugar level in combination of specific yogic exercises with autogenic training group and specific yogic exercises group. Combination of specific yogic exercises with autogenic training group showed control in blood sugar level which was better than the specific yogic exercises group and control group. Ananas help normalize blood sugar due to the high intensity workout. Yogic exercises can on the clinical condition which will increase the cellular activity of the muscle, which needs more sugar. The advanced asanas require a lot of energy and this helps normalize blood sugar. Yoga and autogenic training is an effective treatment for diabetes. The present study confirmed with the results *Turtz (1986) and Malhotra et al (2005)*.

Conclusions

Practice of the combination of specific yogic exercises with autogenic training programme is significantly effective than the specific yogic exercises programme and control group in

promoting desirable changes in selected physiological variables such as pulse rate, vital capacity, percent body fat, psychological variables such as job anxiety, occupational stress and biochemical variables such as high density lipoprotein, low density lipoprotein and fasting blood sugar among the college men students.

Practice of the specific yogic exercises programme is significantly effective than the control group in promoting desirable changes in selected physiological variables such as vital capacity, percent body fat, psychological variables such as job anxiety, occupational stress and biochemical variables such as high density lipoprotein, low density lipoprotein, fasting blood sugar among the college men students.

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A Survey of Injuries Prevalence in Varsity Volleyball Players

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Abstract

The primary objectives of the study was to qualify the injuries of varsity volleyball players and to determine the nature, location, causes, outcome of injuries and the possible risk factors involved. Information on injuries was collected through a questionnaire from members of twelve Indian varsity teams participating in all India Inter Varsity tournament held in Dr. Babasaheb Ambedkar Marathwada University, Aurangabad Maharashtra in December 2007. The age range of the players was 18 to 25 years. 58% of players were in the age range of 22 to 25 years. The volleyball players were asked to recall injuries over the preceding one year period. A total of 121 out of 144 volleyball players sustained injuries. One hundred seventy eight injuries were recorded of which 36% injuries were of recurrent nature. Lower limb injuries were found to be predominant; the ankle and knee being the most commonly injured anatomical location. Most injuries involved soft tissue and related to the muscle and tendon. Most common circumstances giving rise to injuries were spiking (33.70%), blocking (24.15%), diving (17.41%) and setting (11.23%). It was further observed that volleyball players directly involved in attack or defense were found to be more susceptible to injury. Muscle injuries were observed to be the most common type. Spiking is the most common cause of injuries. The results of the research provide a useful insight into the nature, incidence and sites of injuries in varsity level volleyball players.

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

Introduction

Volleyball is a game that can be played by all ages and both sexes indoors and outdoors. It can be highly competitive, requiring a high level fitness, agility and co-ordination, or it can be a relaxing and highly enjoyable recreation. The players of the game require competitively concentration, quick thinking and a great deal of movement. In addition the speed of the game requires the players to take quick decisions because of the quick changing situations of attack and defense (*Nicholls 1978*).

Volleyball requires a variety of physical attributes and specific playing skills therefore participants need to train

and prepare to meet at least a minimum set of physical, physiological and psychological requirements to cope with the demands of the game and to reduce the risk the injuries.

Volleyball playing largely involves, jumping, stretching, twisting. Diving, spiking and turning movements' that place the players to greater risk of injuries. (*Waston A 1993*)

In the epidemiological studies, injury occurs in training or matches, interrupt or hampered play (*Sinku 2006a, b & 2007*). Special treatment is required in order to continue the game, or if the injury has made playing impossible.

Volleyball has received a little interest in the sphere of sports medicine. Volleyball is low risk sports, dominated by overuse injuries while recovery time from injuries is relatively long, but only a few working days are lost by the players to return back to play, thus leading to abuse of the injured sites. In volleyball overuse injuries are the most frequent occurrences of injury. In volleyball, injuries are traditionally divided into contact and non-contact mechanism in which case contact refers to player contact. Some of the forces involved in a non contact injury are transmitted from the playing surface to the injured body part.

Keeping in view the paucity of information about sports injures in general and volleyball playing in particular, an attempt has been made in this area to investigate the possible risk factors involved in volleyball.

Material and Methods:

Information on injuries was collected from twelve Indian varisty teams, which were participating in all India varsity volleyball tournament held in December 2007, in the city of Aurangabd, Maharashtra. A questionnaire prepared by Crombell and Gromely (2000) for elite Gaelic football players and modified by the investigator was given to the subjects for completion. The volleyball players were asked to recall injuries over the preceding one year period. The study was conducted on 144 volleyball players. Mean scores, standard deviation and percentage were calculated and utilized to identify the nature, location and cause of injury in volleyball players.

The investigator personally contacted with the team mangers and

coaches of the twelve teams and the purpose of the study was explained to them. Further instructions were given by the investigator to the players for the completion of the questionnaire. A total of 152 questionnaires were administered and 128 were returned by the players after completion thus giving an over all response rate of 84.21%.

Results and Discussion

Mean, age, weight and height of the volleyball players were 22.33 (SD± 2.66) years, 63.01 (SD± 9.12) kg and 179.54 (SD± 12.77) cm. respectively. Average training duration was 2.08 (SD±.89) hours.

A total of 121 out of 144 volleyball players reported of having sustained injures. A total of one hundred and seventy eight injuries were reported by the players.

The results of volleyball players with respect to their injury details are presented in figure 1.4

Figure - 1

Parentage of injuries of varsity volleyball players with respect to location

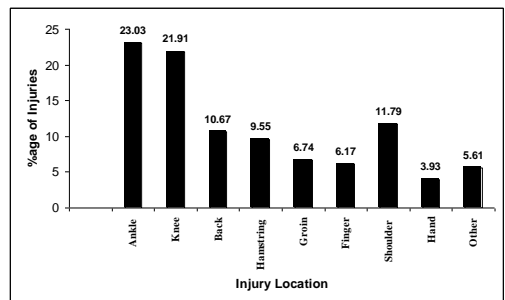


Figure – I illustrates the most commonly injured anatomical in volleyball players. Maximum injured site in volleyball players was found to be the region of Ankle (23.03%) followed by Knee (21.91%), Shoulder (11.79%), Back

(10.67%) Hamstring (9.55%), Groin (6.74%), Finger (6.17%), hand (3.93%) and other (5.61%). Figure shows that the ankle, knee and shoulder were the most involved sites of injury in volleyball players.

Figure-2: Percentage of injuries of volleyball Players due to causes

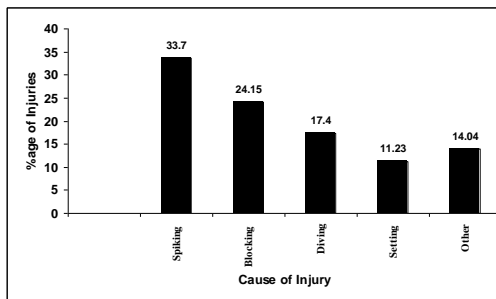


Figure – 2 depicts the common causes of injury in volleyball players. It can be observed that the most common cause was Spiking (33.70%), Blocking (24.15%), Diving (17.41%), Setting (11.23%) and others (14.04%)

Figure – 3: Percentage of injuries of volleyball players with respect to their Nature

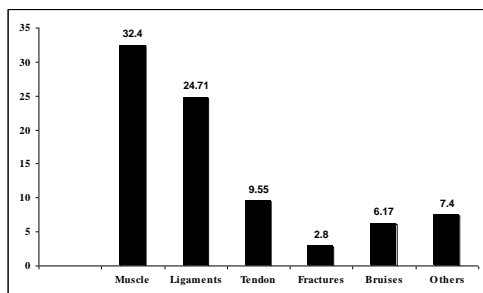


Figure 3 demonstrate the nature of injuries incurred by volleyball players. Maximum incidence of injuries reported by the volleyball players relate to the muscles (32.40%) followed by Ligaments (24.71%), Tendon (9.55%), Fracture (2.80%), Braises (6.17%), and other (7.40%) Muscle and Ligament injuries

were the most frequently occurring injuries in volleyball players.

Figure -4: Percentage of Recommendation of treatment of Volleyball injuries

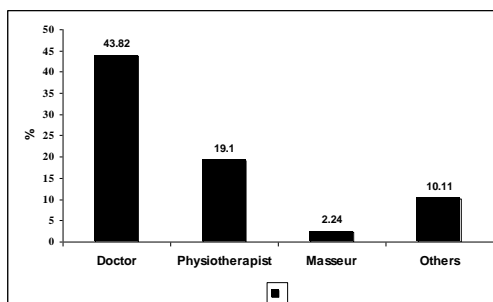


Figure 4 compares the method of treatment obtained by the volleyball players for the injuries incurred by them. It is observed that 57.33% of volleyball players got their injuries treated by a doctor followed by 24.71%, 2.24% of volleyball players who went to physiotherapist & sports masseur for treatment. It is observed that doctor treated maximum volleyball players than physiotherapist and sports masseur.

Discussion:

This study reveals that 67.33% injuries occurred during the competition while 32.22% were occurred during training. The relatively high incidence of injuries during competition was probably due to bad technique, low fitness, large amount of over training and competitive temperament by the volleyball players.

The players who are directly involved in attack or defence are most likely to be injured. This is event from the fact that most injuries were sustained by the volleyball players due to spiking and blocking.

In this study, most injuries were acquired in the lower limb of which 23.03% related to ankle and 17.59% to

knees. Waston (1993) also found that lower limb injuries were most common in sports. A significant proportion of injuries occurred in the upper limb region of which shoulder injuries, predominated (11.79%), relatively high incidence of shoulder injuries is due to fact that the shoulder charge is permitted while smashing in volleyball playing.

Muscle and ligament injuries were the most common types of injuries to the volleyball player. It may be due to bad technique, and low fitness level of volleyball players.

The least common injuries were of the most serious types and included fractures (2.80%). About 75.28% of injuries required treatment of which doctor treated 43.82% of the injuries. Finally it is concluded that injuries are a very serious problem for varsity volleyball players.

Conclusion:

Most of injuries of volleyball player are sustained in lower limb; ankle and knee injuries are the most commonly occurring injuries among volleyball players.

Study also commanded that

1. Most injuries were sustained to the spikers and blockers.

2. Regarding the nature of injuries, muscle and ligament injuries are the most commonly reported ones in volleyball players.
3. Upper limb injuries occurred in the shoulder and finger region.
4. Maximum injures occur during competition.
5. Regarding treatment of injuries, doctor is the most common attention provider of volleyball players.

This research provides a platform for further research in the field of physical education sports sciences and sports medicine.

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Spirometric Evaluation of Pulmonary Function Tests in Bronchial Asthma Patients

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Abstract

The present study was undertaken to assess the pulmonary function status of bronchial asthma patients. The results are based on a sample of 403 asthma patients and 347 healthy subjects (control group) in the age range of 20-70+ years. To study pulmonary functions of asthmatic patients, spirometric evaluation of FEV₁, FVC, FEV₁/FVC, have been recorded on each subject. The data have been subjected to statistical analysis viz. mean, standard deviation, standard error of mean and test of significance. All the pulmonary parameters in asthmatic patients showed significantly less observed values than the normal predicted values. The difference in the mean values of all the lung function parameters of bronchial asthma patients are lower as compared to normal healthy subjects with statistically significant differences in almost all the age groups.

Keywords: Pulmonary function test, bronchial asthma, spirometry

Introduction

Asthma is a complex, recurrent disease of the airways that causes shortness of breath, wheezing, and cough (particularly at night or early in the morning). Asthma is episodic in nature and usually reversible, either spontaneously or with treatment. However, chronic inflammation, associated with persistent symptoms, may contribute to airway remodeling that may not be completely reversible. Airflow limitation occurs as a result of varying degrees of airway hyperresponsiveness, airway edema, and bronchoconstriction

Pulmonary function test (PFT), is a non invasive test, used to detect air flow limitation and/or lung volume restriction. Assessment of ventilatory function is an important investigation because early detection of functional impairment and its appropriate treatment will help to reduce morbidity and mortality related to disease.

Long -term deterioration of lung function in asthmatic subjects has been

described in various studies. For a long time it has been believed that asthma is characterized by totally reversible airway obstruction. Now it is established that prolonged airway inflammation regulated by a variety of inflammatory cells and mediators is the central mechanism in the pathogenesis of asthma. Inflammation leads to injuries and repair including regeneration and replacement by connective tissue. It has been hypothesized that chronic airway inflammation can lead to airway remodeling and in the long term to irreversible airway obstruction. The consequence of this process could be deterioration in pulmonary function.

Asthma is characterized by the presence of reversible airflow obstruction; however, irreversible airflow obstruction develops in some patients. Moreover, accelerated loss of lung function over time has been reported in groups of patients with asthma in longitudinal prospective and retrospective studies (*Lange et al, 1998, Peat et al, 1987, Sears et al, 2003, Covar et al, 2004*) *Pascual et al (2005)* reported that clinically, airflow

obstruction in asthma often is not fully reversible, and many asthmatic subjects experience an accelerated and progressive loss of lung function over time. *Lange et al (1998)* proved that adults with asthma have substantially greater declines in forced expiratory volume in 1s (FEV₁) over time in comparison with healthy subjects.

Accelerated decline in lung function does not occur in all patients. The risk factors identified for accelerated decline in lung function include young age, male gender (*Covar et al 2004*), duration of disease (*Lee et al, 2007*) more prominent eosinophilic airway inflammation (*Covar et al, 2004*), asthma exacerbations (*Bai et al, 2007*), and smoking (*Lee et al, 2007*).

Recent studies of patients with asthma selected from the general population have shown increased mortality in subjects with reduced ventilatory function and have thus underlined the importance of preservation of normal lung function. (*Silverstein, 1994; Lange, 1996; Huovinen, 1997*).

In the present investigation an attempt has been made to study pulmonary function of bronchial asthma patients. Little is known about lung function of bronchial asthma patients in this part of the region as patients are treated on the basis of clinical history and sign and symptoms and their lung function is rarely assessed.

Materials & Methods

The present cross sectional study has been conducted on bronchial asthma patients to study their pulmonary function status. 403 bronchial asthma patients and 347 normal healthy subjects have been studied in the age range of 20-70+ years. Data on patients have been collected from

Civil Hospital, Hoshiarpur and Aggarwal Nursing Home and Chest Clinic, Hoshiarpur. Selected patients and normal subjects were explained the purpose of the study and need of cooperation was emphasized. All the subjects participated in the study voluntarily.

Pulmonary Function Tests (PFT): pulmonary function tests were done on all the subjects using Helios -401 *electronic spirometer*, which is a precalibrated and computerized spirometer. Following spirometric parameters were recorded for analysis.

1. Forced Vital Capacity (FVC)
2. FEV₁
3. FEV₁/FVC

In normal health subjects FVC & FEV₁ should be greater than or equal to 80% of predicted value. All PFT values have been expressed as percentage of predicted values. These have been compared age wise between patients and control group subjects. Lung function parameters have also been compared according to smoking status of asthma patients and control subjects.

Results & Discussion:

Table 1: Mean and standard deviation of forced vital capacity (FVC) in bronchial asthma and control subjects, classified as per age groups.

Age	PATIENT		CONTROL		t
	Mean	SD	Mean	SD	
Males					
20-29	95.80	19.05	101.39	13.91	1.01
30-39	92.14	23.77	100.27	14.35	1.60
40-49	87.42	21.43	101.21	20.725	2.65‡
50-59	83.43	24.32	101.91	14.09	3.63‡
60-69	81.41	24.45	98.43	27.88	2.13†
70+	76.86	25.24	100.13	24.69	3.05‡
Females					
20-29	93.97	21.90	109.65	13.56	3.36‡

30-39	93.58	22.24	102.97	15.44	2.11†
40-49	86.03	16.61	95.59	22.60	2.29†
50-59	82.80	25.53	100.54	27.76	2.61‡
60-69	71.85	22.37	92.73	19.18	3.72‡
70+	74.28	31.02	101.67	34.10	2.39†

† = p < 0.05, ‡ = p < 0.01

Table 1 presents mean values and comparison of FVC of male and female patients and controls. In patients FVC values show a decreasing trend with increasing age. In control males and females, FVC mean values remained almost constant in all the age groups. It did not show any decreasing trend with increase in age. When FVC mean values were compared among patients and controls, the differences were found to be statistically significant (p<0.01) in all the age groups in both the sexes except in 20-29 and 30-39 years age groups in males.

Forced expiratory volume in one second:

Table 2 also depicts the mean values and comparison of FEV₁ in patients and controls. In patient males and females, there is a continuous decrease in the mean value of FEV₁ from the age group of 20-29 years to the age of 70+ years except that in females slight increase in FEV₁ at the age group of 70+years has been observed in control group both in males and females, FEV₁ values remained almost stable and above 90 %.

Table 2: Mean and standard deviation of forced expiratory volume in first second (FEV1) in bronchial asthma and control

Age	PATIENT		CONTROL		t
	Mean	SD	Mean	SD	
Males					
20-29	78.13	26.09	91.67	15.10	1.86
30-39	70.72	31.36	94.67	12.95	3.83‡
40-49	61.21	27.22	96.39	19.84	6.00‡
50-59	57.47	23.87	91.09	16.31	6.43‡
60-69	54.41	26.04	53.57	23.24	5.66‡
70+	53.61	19.91	103.73	21.70	7.7‡

Females					
20-29	20-29	74.45	21.72	111.38	12.22
30-39	30-39	68.22	23.12	102.90	13.48
40-49	40-49	66.00	23.62	95.89	18.98
50-59	50-59	69.71	29.32	96.57	30.41
60-69	60-69	56.53	25.26	92.73	22.06
70+	70+	61.78	28.19	98.20	30.68

Statistically significant differences have been observed in the values of FEV1 in patient and control groups except in the age group of 20-29 and 30-39 years in the males and 70+ years in females

FEV₁/FVC

Table 3 shows changes in FEV1/FVC with age and comparison of FEV1/FVC in patient and control group. In patient males, FEV₁/FVC ratio decrease with increase in age. FEV₁/FVC mean value improved in 70+ years of age group. In patients' females, values of FEV₁/FVC show no decrease with increasing age as FVC values also decrease with increasing age and ratio improved in older age groups. In control males and females, no increasing or decreasing trend is seen and value remained above 90% in all the age groups. Comparison shows that patient males and females have lower values of FEV₁/FVC than control males and females and differences have been found to be statistically significant in all the age groups

Table 3: Mean and standard deviation of ratio of forced expiratory volume in first second to forced vital capacity (FEV₁/FVC) in bronchial asthma and control subjects, classified in age groups

Age	Patient		Control		t
	Mean	SD	Mean	SD	
Males					
20-29	82.00	22.35	91.16	14.43	1.45
30-39	72.48	16.77	118.97	13.87	1.92
40-49	67.61	18.57	96.88	13.89	7.25‡

50-59	66.93	22.03	90.00	15.27	4.76‡
60-69	66.75	22.33	97.79	15.52	6.33‡
70+	76.86	26.97	105.87	18.45	4.73‡
Females					
20-29	75.80	25.00	102.14	9.76	5.44‡
30-39	73.44	19.56	100.72	10.93	7.37‡
40-49	75.58	20.15	102.27	14.54	6.66‡
50-59	83.11	19.04	96.64	16.53	3.02‡
60-69	80.20	25.35	101.23	17.88	3.63‡
70+	85.89	25.56	99.47	18.74	1.76

† = $p < 0.05$, ‡ = $p < 0.01$

Very few female smokers in both patient and control groups except 20-29 and 30-39 years of age groups in males and in 70+ years age group in females. Table 4 presents mean values and comparison of FVC, FEV1 and EV1/FVC, in patient and control group males according to their smoking status. In patient smokers, the mean value of all the lung function parameters are control subjects, the difference in lung function parameters between smokers and nonsmokers are statistically insignificant. This shows that smoking in asthma patients accelerates lung function decline in asthma patients.

Table 4: Lung function profile of male bronchial asthma and control subjects according to smoking status

Parameter	Patients		T	CONTROL		T
	Smokers	Nonsmokers		Smokers	Nonsmokers	
	Mean ±S.D.	Mean ±S.D.		Mean ±S.D.	Mean ±S.D.	
FVC	77.96 ±21.82	87.8 ±24.64	3.02**	98.63 ±17.42	101.67 ±18.28	0.96
FEV1	50.73 ±22.63	64.48 ±27.56	3.98**	92.00 ±17	95.41 ±17.82	1.11
FEV1/FVC	65.67 ±22.56	72.53 ±21.66	2.17*	94.79 ±17.52	101.82 ±74.91	0.94

*= $p < 0.05$, **= $p < 0.01$

Discussion

Findings of the present study have shown that there is decline in all the lung normal healthy controls remained normal in all the age groups. The difference in all

the lung function parameters in patients and control group subjects are statistically significant in almost all the age groups. Present findings are thus in line with the perception that asthma is a chronic inflammatory disease in which ongoing tissue injury and repair may result in irreversible fibrotic changes in the airways leading to decline in lung functions. Conflicting results have been reported regarding the influence of bronchial asthma on the rate of decline of lung function. The results of previous studies of the decline in FEV1 in people with asthma are generally consistent with the present findings *Fletcher and co workers (1976)* mean unadjusted decline in FEV1 of 22ml. per year greater in men with asthma than in men without asthma. More recent studies have evaluated FEV1 delin in large population samples (*Ulrik et al, 1992 and Lange et al, 1998*) and the results suggest that asthma as a significant impact on lung function decline. However, in the Tucson lung study (*Burrows et al, 1987*) declines in FEV₁ of less than 5 ml. per year were observed in adults with asthma. In a recent report of 25-year follow-up data on adults from a Dutch asthma clinic, more than 75 percent of the patients had FEV₁ values below 90 percent of the predicted values at the final examination (*Panhuysen et al, 1997*). In a study by *Zeiger et al (1999)*, the unadjusted annual decline was 80.1 ml. per year of asthma duration for FEV1 and 20.5 ml. per year for FVC in the whole study group. Also, *Peat et al (1987)* found a mean loss of FEV1 in male nonsmokers suffering from asthma of about 50 ml .year compared with 35 ml./year in normal subjects. Studies by *Silverstein et al (1994) Lange et al (1996) Huovinen et al (1997)* show that a reduction in ventilatory function leads to

an increased mortality among asthmatic subjects. The preservation of normal lung function should be one of the aims of asthma therapy. Furthermore, in the present study findings, it is seen that smoking in asthma patients increases the severity and accelerates the decline in lung function. Thomson and Spears (2005) have reported that smoking and asthma are associated with poor symptom control and impaired therapeutic responses to anti asthma drugs. Higher levels of smoking are seen in patients with asthma who attend emergency departments with exacerbations (Silverman et al, 2003). Compared with asthmatic nonsmokers, smokers with asthma have worse symptom control (Althuis et al, 1999), an accelerated decline in lung function (Lange et al, 1998), and an increased mortality rate (Marquette et al, 1992). Asthmatic smokers have more severe asthmatic symptoms, greater need for rescue

medications, and worse indices of health status in comparison with asthmatics who have never smoked (Gallefoss and Bakke, 2003). With regard to the influence of age on lung function decay in asthma, conflicting results have previously been reported. Peat et al did not find any influence of age on the functional decline over several years in asthma, Whereas Ulrik et al.(1992) reported steeper decline in FEV1 with ageing. Cibella et al (2002) suggested that in older asthmatics the rate of pulmonary function loss may slow down. Aging unlike the duration of disease, may lower the intensity of the events of remodeling that characterize chronic asthma and thus produce a slower rate of decline in lung function. Therefore it is clearly evident from present finding that asthma patients show lower values of all lung functions. In addition to this smoking further aggravates the decline in lung functions of asthma patients.

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Comparison of Breathing Exercises and Aerobic Exercise in Asthmatic Children

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Abstract

Purpose- To determine the comparison of effects of breathing exercise with aerobic exercise training on lung volumes of asthmatic children. *Need of the Study-* Children suffering from asthma lead a less active lifestyle. Avoidance of day to day triggers such as exercise and cold air generally imposes inappropriate restriction on life. This results in weakness of primary respiratory muscles and overuse of accessory muscles in breathing. There are also abnormal changes in lung volumes. These impairments or abnormal changes are associated with decreased tolerance to exercise, frequent episodes of dyspnea, decreased walking speed and distance, and eventual inability to perform activities of daily living at home or in workplace or to remain active participant in the community. The present study was conducted to compare the role of breathing exercise with that of aerobic exercise in the patients of asthma. The study has also explored physiological capacities of lung in these patients. *Method-* The sample size of forty subjects was taken to perform the study. The subjects were divided in two groups of twenty each. One group was given breathing exercise intervention and other group was given aerobic exercise intervention. Before and after the intervention period, the child was investigated with spirometric analysis to find out the changes in the lung volumes after the effect of exercises in each group. Both exercises interventions were administered four 6 weeks period. *Results-* The overall improvement of lung function was significantly more in aerobic exercise interventions than breathing exercise interventions. *Conclusions-* The breathing exercise intervention was effective in improving the lung volumes in asthmatic children. The aerobic exercise intervention was also effective in improving the lung volumes in asthmatic children. However, the quantum of reduction in lung obstruction and therefore, the overall improvement in lung functions was found to be more significant with the aerobic exercise intervention than breathing exercise intervention.

Keywords: Asthma, Aerobic exercises, Breathing exercises, Spirometry, Lung Volumes

Introduction

Asthma is defined as a chronic inflammatory disorder of airways characterized by reversible airflow obstruction causing cough, wheeze, chest tightness and shortness of breath [Crompton et al](#) ⁽⁷⁾. Childhood Asthma begins at any age, and its clinical etiology and clinical course are variable. Children with early medical histories including low birth weight, bronchopulmonary dysplasia, respiratory syncytial and viral infection

may be at increased risk of developing asthma [Luo et al](#) (2003). Asthmatic attacks are set up by exposure to specific allergens such as house dust mite, pollen and animal dander. Some other factors are exercise particularly running, dyes, air pollution, infection, cigarette smoke, dry inhaled air, certain foods such as fish, eggs, yeast, and wheat which presumably reach the bronchi via blood stream. There is noticeable increase in healthcare burden from asthma in several areas of world. There is also a global concern on the change in asthma epidemiology and

clinical spectrum. Over 50 million people in Central and Southern Asia have asthma and many do not have access to the medications that control the disease. Due to rapid industrialization and urbanization throughout the region, the prevalence of asthma is predicted to increase rapidly in coming years. The increase is likely to be particularly dramatic in India, which is projected to become the world's most populous nation by 2050.

Cibella et al (2002) conducted a study on lung function decline in Bronchial asthma. Results showed that FEV1 had linear decay with ageing in each subject. FEV1 decay was significantly higher among younger asthmatics with poorer baseline functional condition. Farid et al. ⁽⁸⁾ conducted a study to examine the effects of course of aerobic exercise on pulmonary function and tolerance of activity in asthmatic patients. Significant changes were observed in FEV1, FVC, PEF, PEF25-75%, MVV, RF and 6MWT between asthmatic patients of the two groups ($P \leq 0.05$), but FEV1/FVC showed no significant changes.

Neder et al (1999) conducted a study on short term effects of aerobic training in the clinical management of moderate to severe asthma in children. Aerobic improvement with training was inversely related to baseline level of fitness and was independent of disease severity. Although the clinical score and occurrence of EIB did not change after training, aerobic improvement was associated with significant reduction in the medication score and the daily use of both inhaled and oral corticosteroids.

Saxena & Saxena (2009) studied the effect of various breathing exercises (pranayama) in patients with bronchial asthma of mild to moderate severity. 50

cases of bronchial asthma were studied for 12 weeks. They were trained to perform Omkara at high pitch with prolonged exhalation as compare to normal Omkara. Breathing exercises showed significant improvement in symptoms, FEV1, and PEF. It was concluded that breathing exercises (Pranayama), mainly expiratory exercises, improved lung function subjectively and objectively and should be regular part of therapy.

Children suffering from asthma lead a less active lifestyle. Avoidance of day to day triggers such as exercise and cold air generally imposes inappropriate restriction on life. This results in weakness of primary respiratory muscles and overuse of accessory muscles in breathing. There are also abnormal changes in lung volumes. These impairments or abnormal changes are associated with decreased tolerance to exercise, frequent episodes of dyspnea, decreased walking speed and distance, and eventual inability to perform activities of daily living at home or in workplace or to remain active participant in the community. Many studies have been conducted related to prevalence of asthma; few studies have tried to examine the efficacy of breathing exercise and aerobic exercise in a single study. Therefore, the present study was conducted to compare the role of breathing exercise with that of aerobic exercise in the patients of asthma. The study has also explored physiological capacities of lung in these patients.

Materials and Methods

The sample size of this study was forty subjects with twenty subjects in each group. The group A was given breathing exercises interventions and group B was

given aerobic exercises interventions. These forty subjects suffering with asthma were recruited for the study. A written consent was taken from each school and from the parents of the children before their participation into the study. The study was performed at four schools in Patiala, Ryan International School, Urban Estate, Patiala, Apollo Public School, Urban Estate, Patiala, Auro Mira Centre of Education, SST nagar Patiala and Modern Senior Secondary School near Guruduwara Dukhniwarn Sahib, Patiala. The study was also done in Rekhi Pediatrics' clinic. The baseline of spirometric analysis of both the groups was taken in 0 week and both groups were assigned treatment interventions and after 6 weeks the spirometric analysis was performed.

The independent variables in the study were Aerobic Exercises and Breathing Exercises. The dependent variable in the study was spirometric analysis. Dependent variable was measured initially at baseline and then at six weeks for both groups.



DEEP BREATHING



PAPER STRIP BLOWING



BALLOON BLOWING

Aerobic Exercise Intervention

- 1) *Warm up Phase-* to raise heart rate and temperature of muscles to provide adequate blood flow. This phase included general range of motion and flexibility exercises like arm circles, toe raises, half knee bend and running in place.
- 2) *Activity Phase-* included the rhythmic steps of aerobics with graceful dance movements with less jumping action, but more of footwork, which were coordinated with the rhythm of the music being

played.

3) *Cool down Phase-* to gradually bring down the heart rate and metabolism to near normal.

Duration Of Exercise – 5-7 mins of warm-up 20 mins of activity. 5-7 mins of cool down period.

Frequency Of Exercise- 5 times a week for 6 weeks.

Intensity Of Exercise - Moderate intensity exercise at 60% of MHR (Age Predicted) of the patient of activity phase.



Aerobic Exercises

RESULTS

All data was expressed as Mean± SD and statistical significance of difference between results was evaluated by Student's t-test. Paired t-test was used to examine the changes in dependent variables from base-line to after completion of intervention in each group. Unpaired t-test was used to compare and analyze the changes in the dependent variables between the groups. After calculating t value, p value was looked at appropriate degrees of freedom and hence the significance of the results was determined at appropriate level of significance. On the basis of overall reduction in the lung obstruction. The spirometric analysis provided the overall picture of obstruction to airways that was categorized in the form of grades as following:

- 4 – No obstruction
- 3 - Mild obstruction,
- 2 - Moderate obstruction and
- 1 - Severe obstruction

TABLE 1: The pre-post intervention comparison of lung obstruction of breathing exercise intervention.

Breathing Exercise	Pre-Intervention (MEAN±SD)	Post-Intervention (MEAN±SD)
	2.25±1.16	3.2±0.89
T-TEST	- 2.09	

Table 1 presents the Pre and Post intervention mean values of reduction in lung obstruction by breathing exercises interventions in the experimental groups 2. The calculated t value is 2.09 is more than the t critical value which is 1.729. This indicates that the differences between the scores obtained from the pre and post value interventions are highly significant indicating that there was improvement in lung function.

Table 2: The pre-post intervention comparison of lung obstruction of both aerobic exercise interventions

Aerobic Exercise	Pre-Intervention (MEAN±SD)	Post-Intervention (MEAN±SD)
	2.45±1.27	3.65±0.81
T-TEST	-3.64	

Table 2 presents the Pre and Post intervention mean values of reduction in lung obstruction by aerobic exercise intervention test in the experimental

Table 4: Shows Pre-Post Intervention of Comparison All the Five Lung Volumes within the Two Experimental Groups.

Variable	GROUP	Intervention		T	% Improvement
		Pre Mean±SD	Post Mean±SD		
FVC	Aerobic	1.6±0.12	1.8±0.10	0.90	12.5%
	Breathing	1.6±0.10	1.7±0.10	0.70	6.25%
PEFR	Aerobic	4.1±0.25	3.9±0.24	0.58	-5%
	Breathing	4.3±0.23	4.2±0.26	0.39	2.3%
FEV1/FVC	Aerobic	75.5±6	84.6±4.6	1.36	-8%
	Breathing	67±7	85±5.1	2.00	2.24%
SVC	Aerobic	4.03±0.35	4.26±0.36	0.88	5.7%
	Breathing	3.14±0.59	3.6±0.36	0.9	14.6%
MVV	Aerobic	54.4±2.85	50±4.6	1.24	-8%
	Breathing	31.2±6	31.9±3	0.10	2.24%

Table 4 presents the Pre and Post intervention mean values of the lung volumes in the two experimental groups 1 and 2. Six weeks of exercise resulted in insignificant results; however there was great scope of improvement in calculating the %age of improvement of the lung volumes.

Table 5: Comparison of five lung volumes between the two experimental groups of lung obstruction.

Parameters	Group	Pre-Post Mean±SD	T
FVC	Aerobics	0.10	NA

group- 2. The calculated t value is 3.64 is more than the t critical value which is 1.729. This indicates that the differences between the scores obtained from the pre and post value interventions are highly significant indicating that there was improvement in lung function.

Table 3: Comparison between the two experimental groups

	Breathing Exercise	Aerobic Exercise
T-TEST	-1.66	

Table 3 shows the comparison between the two experimental group interventions. The calculated t value between the two exercise interventions came out to be 1.66 and its critical value is 1.63. The differences between the scores statistical values are highly significant. This indicates that the improvement in the reduction of lung obstruction was better in the aerobic exercise intervention than the breathing exercise intervention.

PEFR	Breathing	0.10	0.16
	Aerobics	-0.19±1.35	
FEV1/FVC	Breathing	-0.12±1.35	0.21
	Aerobics	9±126.1	
SVC	Breathing	17.9±126.1	0.42
	Aerobics	0.2±2.21	
MVV	Breathing	0.5±2.21	4.1
	Aerobics	-4.3±16	
	Breathing	20.36±16	

Table 5 shows the comparison to all lung volumes between the two experimental groups, the values of the came out to statistically insignificant. This suggests that the data cannot be compared statistically.

DISCUSSION

Bronchial asthma, which has been increasing in incidence worldwide, is a morbid disease that can also be fatal. Pathologically there is mucosal inflammation, collection of inflammatory mediators, bronchial constriction with air trapping. Presently it is difficult to control all the triggers in a single patient, but it is always possible to improve the lung function by therapeutic interventions. Therefore, the present study was carried out in the asthmatic school children to compare the two different kinds of therapeutic interventions.

The results of the present investigation have been discussed in this chapter under the following subheadings:
Effects of breathing exercise intervention on lung volumes of asthmatic children:

Effects of aerobic exercise intervention on lung volumes of asthmatic children:

Comparison between breathing exercise intervention and aerobic exercise intervention in asthmatic children:

Effects of breathing exercise intervention on lung volumes of asthmatic children:

While analyzing the effects of breathing exercise intervention on the lung volumes, it was found that the FVC showed 6.25% improvement, while PEFR showed 2.3% increase from the baseline-value at 0 week. On examining SVC it was found that there was 14.6% improvement in asthmatic children undergoing breathing exercise intervention, the MVV showed 2.24% scope of improvement in lung volume. The FEV1/FVC ratio showed 2.24% of improvement from breathing exercise intervention. Thus, breathing exercises have helped in improving all the lung volumes of the asthmatic children. Breathing exercises in the present study were based on the expiratory phase of

respiration, this is because the expiration in the breathing process is greatly affected and it is also shallow in nature. The exercises that enhance expiration process were balloon blowing and paper strip blowing. Besides expiration exercises, the stretching of accessory respiratory muscles which followed diaphragmatic breathing exercises helped the patients to get back to their normal way of breathing process. It produced relaxation of accessory muscles.

Effects of aerobic exercise intervention on lung volumes of asthmatic children:

In the present study, the lung volume values in the group of aerobic exercise intervention also showed improvement. The FVC value was found to be 12.5% improved from the base line test performed at 0 week, while there were 5.7% increase in SVC values and 12% increase in FEV1/FVC ratio of the group doing aerobic exercises interventions. The results of present investigation also exhibited 5% decrease in the PEFR and 8% decrease in MVV values. The present finding that aerobic exercise reduced the obstructions in the bronchial pathways could be explained on the basis that it increases the ventilatory efficiency. Hence there is better exchange of gases in the alveoli. One more important advantage of aerobic exercise in asthmatic patients is their accumulative desensitization on fear of dyspnea. The physical exercises can increase the asthmatic patient's residual airflow and decrease the ventilation with reinforcement of bronchi expansion during exercise. The results of present study are well in line with the findings of *Farid et al. (2005)* who conducted a study to examine the effects of course of aerobic exercise on pulmonary function and tolerance of activity in asthmatic patients. This study showed that aerobic exercises

in asthmatic patients lead to an improvement in pulmonary functions.

Comparison between breathing exercise intervention and aerobic exercise intervention in asthmatic children:

Comparison between breathing exercise intervention and aerobic exercise intervention in the present study was made on the basis of improvement observed in the values of lung volumes.

Statistical analysis suggested that there was no significant difference in the level of improvement of different lung volumes namely FVC, PEFr, FEV1/FVC, SVC, and MVV. This indicates that both interventions are effective in improving the values of lung functions in asthmatic children on the basis of clinical significance. This is because most of the children who participated in the study gave less complains of breathlessness in their daily functional activities to their doctors and parents. However no scale was used to measure the above terms in this study. It is the well known fact that in the normal breathing pattern the diaphragm moves downward when the person inhales and moves upward when the person exhales. However, an asthmatic patient breathes in an abnormal way by using only the upper portion of the chest for breathing. Over the period of time the patient develops weakness of chest muscles as the muscles are not being used properly. The findings of the present study have demonstrated that for the asthma patients breathing exercises can really help in reducing the airways obstruction. In addition to this, the breathing exercises help the person to use the inspiratory muscles. This mechanism may have helped in overcoming the feeling of the suffocation and breathlessness in the children.

On the basis of overall lung reduction-

Statistical analysis within the groups suggested that there was significant reduction in the lung obstructions in both groups ($t=2.09$ breathing exercises intervention and $t=3.64$ in aerobic exercise intervention). Nevertheless, when the improvement score of both groups was compared it was found that quantum of reduction in lung obstruction was much more in group of aerobic exercise intervention than the breathing exercise interventions ($t=1.66$ between both the experimental groups). This suggests that the overall improvement of lung function was significantly more in aerobic exercise interventions than breathing exercise interventions. The improvement in aerobic exercises may have occurred because the regular exercises strengthen the respiratory muscles (diaphragm and intercostals), this may have further helped in better chest expansion and therefore, improving the chest cavity. Thus larger chest cavity means more air could be inspired and therefore increasing the vital capacity and more capillaries form around the alveoli, so more gaseous exchange can take place. During aerobic exercise, minute ventilation increases and an increased load is placed on the respiratory muscles. Both the frequency and the speed of contraction in the muscle are increased. Increased work of breathing during strenuous exercise in healthy subjects can limit exercise performance whereas unloading the respiratory muscles during the strenuous activity, using assisted ventilation, results in significantly longer exercise tolerance.

CONCLUSIONS- In the present study it was concluded that-

- 1) The breathing exercise intervention was effective in improving the lung volumes in asthmatic children.

- 2) The aerobic exercise intervention was also effective in improving the lung volumes in asthmatic children.
- 3) However, the quantum of reduction in lung obstruction and therefore, the overall improvement in lung functions was found to be more significant with the aerobic exercise intervention than breathing exercise intervention.

Thus, a combination of the breathing exercises and aerobic exercise should be incorporated into the pulmonary rehabilitation program of the asthmatic child

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Effects of Yoga Practices and Naturopathy Treatments on Blood Sugar and Blood Pressure of Diabetic Patients

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Abstract

The study was designed to investigate the effects of yoga practices and naturopathy treatments on selected blood sugar & blood pressure variables of diabetic patients. For this 45 diabetic patients were selected randomly from Annai Sakunthala Nature Cure Hospital & Yoga Centre, Karaikudi. Their age ranged from 35 to 55 years. They were divided into three equal groups' namely experimental group 1, experimental group 2 and control group. The treatment was given during the working days (except Saturdays and Sundays). The experimental group 1 underwent naturopathy treatment, experimental group 2 underwent yogic practices and control group was not given any specific training. The following criterion variables were chosen namely, blood sugar, blood pressure and were assessed before and after the training period of 12 weeks. The analysis of co-variance and Scheffe's Post_Hoc test were used to test the adjusted posttest mean difference among the experimental groups. The study revealed that the selected blood sugar and blood pressure were significantly reduced due to the influence of yogic practices and naturopathy treatments in diabetic patients.

Key Words: Yogic Practices, Naturopathy Treatments, Blood Sugar, Blood Pressure.

INTRODUCTION

Naturopathy is a healing system using the power of nature and it is considered an art, science and philosophy. The foundation of naturopathic medicine is based on the philosophy of "vis medicatrix naturae, the healing power of nature". The concept of holistic health or treating the body as a whole (using tools like water, earth, fire, air and weather) is given prime importance various drugless complementary medical sciences such as hydrotherapy, massage therapy, mud therapy, fasting therapy, nutrition and dietetics, chromo therapy, magneto therapy, yoga therapy, acupressure, acupuncture, chiropractics, osteopathy, aromatherapy, psychotherapy, physiotherapy, exercise therapy, Reiki and pranic healing are used (Smith & Logan, 2002; Shankar & Liao, 2004;

Standish et al, 2006; Barnes et al, 2008; Herman et al, 2008; Myers, 2009). The whole practice of nature cure is based on the following three principles

- Accumulation of morbid matter
- Abnormal composition of blood & lymph
- Lowered vitality.

Nature cure believes that all the diseases arise due to accumulation of morbid matter in the body and if scope is given for its removal, it provides cure or relief (Underwood, 1971; Stofen, 1974). It also believes that the human body possesses inherent self constructing and self healing powers.

Yoga means a holistic approach towards the cause and treatment of disease (Kirkwood et al, 2005). According to yoga most of the diseases mental, psychosomatic and physical originate in

mind through wrong way of thinking, living and eating which is caused by attachment. The basic approach of yoga is to correct the life style by cultivating a rational positive and spiritual attitude towards all life situations. All the systems of medicine at their best aim at curing the disease whereas yoga aims at preventing the disease and promoting health by reconditioning the psycho-physiological mechanism of the individual.

Methodology

In this study 45 diabetic patients were selected randomly from Annai Sakunthala Nature Cure Hospital & Yoga Centre, Karaikudi. Their age ranged from 35 to 55 years. They were divided into three equal groups namely experimental group 1, experimental group 2 and control

group. The treatment was given during the working days (except Saturdays and Sundays) the experimental group 1 underwent naturopathy treatment, experimental group 2 underwent yogic practices and control group was not given any specific training. The following criterion variables were chosen namely, blood sugar, blood pressure and were assessed before and after the training period of 12 weeks. The analysis of covariance was used to test the adjusted post-test mean difference among the experimental groups. If the adjusted post test result was significant the Scheffe's Post_Hoc test was used to determine the significance of the paired mean differences of the dependent variables.

Table –1: Computation of analysis of covariance of systolic pressure

	Control Group	Experimental Group –I	Experimental Group –II	SV	SS	DF	MS	F
Pre-Test Means, mm Hg	178.53	178.67	178.80	B 0.53	2567.47	2	0.27	0.004
Post-Test Means, mm Hg	178.73	170.27	164.93	B 1452.84	2580.80	2	726.42	11.82*
				W	436.68	41	10.65	
Adjusted Post –Test Means, mm Hg	178.86	170.27	164.81	B 1503.43	436.68	2	751.71	70.58*
				W				

*significant at 0.05 level table f ratio is 3.220 and the (df) is 2, 41

Results & Discussion

Table 1 shows the analyzed data on systolic pressure. The pre test, post test and adjusted post test means of the systolic pressure were (178.5, 178. 7, 178.8), (178.7, 170.3, 164.9) and (178.8, 170.3, 164.8) mmHg for the experimental group 1, 2 and control groups respectively. The obtained 'f' ratio of post and adjusted post test were 11.82 and 70.58. The table value is 3.35 at 5% level of significance for the degree of freedom (2,42 and 2,41). Therefore it is concluded that experimental group II was better than the other two groups.

Control Group	Experimental Group –I	Experimental Group –II	M.D.	CI
178.85	170.27		8.59	3.026
178.85		164.81	14.04	3.026
	170.27	164.81	5.45	3.026

Table 2 shows the scheffe's post hoc test of ordered adjusted final mean difference of systolic pressure of different groups. The mean difference between the control group and the experimental group I was 8.59, control group and experimental group II was 14.04, experimental group I and experimental group II was 5.45. The CI value 3.026 is greater than table f ratio value. Hence all the three comparisons were significant.

Table 2: Computation of Scheffe's post hoc test ordered adjusted final mean difference of systolic BP

The analysis of covariance of systolic blood pressure indicated that experimental group I (naturopathy group) and experimental group II (yoga group) were significantly reduced the systolic blood pressure. It may due to the nature of yoga and naturopathy exercise.

Berger (1982) supported that during exercise, 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 out put cause a greater systolic pressure, that more than counteracts the tendency toward reduced pressure caused by vasodilation in the working muscles, since only a slight fall in blood pressure. The finding of the above said study supports the present study.

Table- 2: Computation of Analysis of Covariance of Diastolic Pressure

	Cont Grp	Exp Grp I	Exp Grp II	SV	SS	DF	MS	OF
Pre-Test Means	106.60	106.67	106.53	B	0.13	2	0.07	0.007
				W	412.67	42	9.83	
Post-Test Means	106.73	97.33	93.47	B	1396.58	2	698.29	29.99*
				W	978.00	42	23.29	
Adjusted Post-Test Means	106.73	97.27	93.53	B	1389.64	2	694.82	44.62*
				W	638.44	41	15.57	

*Significant at 0.05 level table f ratio is 3.220 and the (df) is 2, 41.

Table 2 shows the analyzed data on diastolic pressure. The pre test, post test and adjusted post test means of the diastolic pressure were (106.60,106.67,106.53),(106.73,97.33,93.47)and(106.73,97.27,93.53) for the experimental group I, II and the control groups respectively. The obtained 'f' ratio for pre test 0.007, post test 29.99 and adjusted post test 44.62. The obtained 'f' ratio of post and adjusted post test were

29.99 and 44.62. The table value is 3.22 at 5% level of significance for the degree of freedom (2.42 and 2.41). Therefore it is accomplished that experimental group II has been better than the other two groups.

TABLE-II (A): Computation of Scheffe's post hoc test ordered adjusted final mean difference of diastolic pressure

Cont Grp	Exp Grp I	Exp Grp II	M.D.	CI
106.73	97.27		9.46	3.66
10.73		93.53	13.21	3.66
	97.27	93527	3.75	3.66

Table ii (a) shows the Scheffe's post hoc test of ordered adjusted final mean difference of diastolic pressure of different groups. The difference between control group and the experimental group I was 9.46, control group and experimental group II was 13.21, experimental group I and experimental group II was 3.75. The CI value 3.66 is greater than table f ratio value. Hence all the three comparisons were significant.

The analysis of covariance of diastolic pressure indicated that the experimental group I, the experimental group II exhibited significant reduction in the diastolic pressure. It may due to the treatment procedures.

William (1991) although the degree to which regular exercise can benefit a hypertensive condition is still unclear. It does appear that both systolic and diastolic blood pressure can be brought down to a modest degree with a program of exercise training. Aerobic exercise training in patients with documented coronary artery disease and in young, middle, aged and elderly "border line" hypertensive patients, the effects of exercise training on blood pressure of seven middle aged male patients decreased from 139 to 133 mm hg after 4 to 6 weeks of interval training. In

addition, at similar sub maximal exercise levels diastolic pressure fall from 173 to 155 mm Hg and diastolic pressure was also reduced from 92 to 76 mm Hg. The finding of the above said study supports the present study.

Table 3: Computation of analysis of covariance of diabetic –fasting

	Cont Grp	Exp Gr-I	Exp Grp-II	SV	SS	DF	MS	OF
PRE-TEST MEANS	161.13	161.53	161.667	B	2.31	2	1.16	0.02
				W	2898.80	42	69.02	
POST-TEST MEANS	160.93	135.40	145.867	B	4942.53	2	2471.27	20.06*
				W	5174.27	42	123.20	
ADJUSTED POST-TEST MEANS	161.25	135.31	145.642	B	5112.31	2	2556.16	47.12*
				W	2224.31	41	54.25	

*Significant at 0.05 level table f ratio is 3.220 and the (df) is 2, 41.

Table 3 shows the analyzed data on diabetic-fasting. The pre test, post test and adjusted post test means of the diabetic-fasting were (161.133,161.533,161.667), (160.933,135.400,145.867) and (161.247,135.310,145.642) for the experimental group I, II and the control groups respectively. The obtained ‘f’ ratio for pre test 0.02, post test 20.06 and adjusted post test 47.12. The obtained ‘f’ ratio of post and adjusted post test were 20.06 and 47.12. The table value is 3.22 at 5% level of significance for the degree of freedom (2 and 41). Therefore it is proved that experimental group I & II has been better than control group.

Table 3a: Computation of schaffe’s post hoc test ordered adjusted final mean difference of Diabetic – fasting

Cont Grp	Exp Grp –I	Exp Grp – II	M.D.	CI
161.247	135.310		25.94	6.83
161.247		145.642	15.61	6.83
	135.31	145.642	10.33	6.83

Table 3a shows the Scheffe’s post hoc test of ordered adjusted final mean difference of diabetic-fasting of different groups. The difference between control group and experimental group I was 25.94 control group and experimental group II was 15.61 experimental groups I and experimental group II was 10.33. The CI value 6.83 is greater than table f ratio value. Hence all the three comparisons were significant.

Discussion

1.normally, blood glucose levels are tightly controlled by insulin, a hormone produced by the pancreas. Insulin lowers the blood glucose level. When the blood glucose elevates (for example, after eating food) insulin is released from the pancreas to normalize the glucose level. *Lima (2008) and Fenicchia (2004)* study showed that yoga and naturopathy help to reduce blood sugar. The finding of the above said study supports the present study.

The present study was one fasting blood glucose measurement in the morning is sufficient for him to maintain a health daily routine of exercise, consuming meals/ snacks and leading a productive life with mental and physical activities.

Table- iv

Computation of analysis of covariance of post prandial of blood sugar

	Control Group	Exp Group –I	Exp Group –II	SV	SS	DF	MS	OF
Pre-Test Means	279.07	279.73	279.60	B	3.73	2	1.87	0.004
				W	20361.47	42	484.80	
Post-Test Means	278.20	25.27	265.53	B	3958.93	2	1979.47	3.95
				W	21045.07	42	501.07	

Adjusted Post – Test Means	278.60	255.00	265.40	B	4194.55	2	2097.27	91.32
				W	941.58	41	22.96	

*Significant at 0.05 level table f ratio is 3.220 and the (df) is 2, 41.

Table i shows the analyzed data on post period of blood sugar. The pre test, post test and adjusted post test means of the post period of blood sugar were (279.067, 279.733, 279.600), (278.200, 25.267, 265.533) and (278.597, 255.002, 265.40) for the experimental group i, ii and control group respectively. The obtained ‘f’ ratio for pre test 0.004, post test 3.950 and adjusted post test 91.324. The obtained ‘f’ ratio of post and adjusted post test were 3.950 and 91.324. The table value is 3.220 at 5% level of significance for the degree of freedom (2.42 and 2.41). Therefore it is proved that experimental group i has been better than the other two groups.

Table- iv (a): Computation of scheffe’s post hoc test ordered adjusted final mean difference of post period of blood sugar

Control Group	Exp Grp –I	Exp Grp –II	M.D.	CI
278.59	255.00		23.59	4.44
278.59		265.40	13.19	4.44
	255.00	265.40	10.39	4.44

Table ii (a) shows the scheffe’s post hoc test of ordered adjusted final mean difference of post period of blood sugar of different groups. The difference between control group and experimental group i was 23.596 control group and experimental group ii was 13.197 experimental group i and experimental group ii was 10.399. The ci value 4.444 is greater than table f ratio value. Hence all the three comparisons were significant.

Discussion

1.Hsin-iwu (2005) study on type 2 diabetic subjects indicate that the recovery time of the post-prandial blood glucose

level can adjusted to 4 hours, which is comparable to the typical time interval for non-diabetics: 3 to 4 hours. A moderate lifestyle adjustment of light supper coupled with morning swimming of 20 laps in a 25m pool for 40 minutes enabled the subject to reduce his ale level from 6.7 to 6.0 in six months and to maintain this level for the subsequent six months. *Sahay (2005)* reported significant reduction in fasting and postprandial blood glucose concentrations within three months of yoga exercise in type 2 diabetic patients

The subject has been able to keep post-prandial blood glucose levels within 200 mg/dl with the mean fasting reading of 90±20 mg/dl. I hour yogic practices and naturopathy treatments were given to the patients daily.

Conclusion

The blood pressure and blood sugar were significantly reduced due to the influence of yoga practices and naturopathy treatment than the control group. The blood sugar was significantly reduced due to the influence of naturopathy treatment than the yoga practice and control group. The blood pressure was significantly reduced due to the influence of yoga practice than the naturopathy and control group.

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Reimplantation of Avulsed Tooth – A case Study

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The purpose of clinical study is reimplantation technique used in the treatment of an avulsive teeth case. This case report is related to an avulsed tooth and its management in case of a 17 year old female gymnast player. A 17 year old girl reported to the dental clinic with swelling of upper lip and displacement of upper right central incisor and avulsion of left lateral incisor. She got the injury while she was doing gymnastics. She had lost her upper left central incisor at the gymnastic ground. Clinical examination showed swelling of upper lip, laceration on lower chin, displaced right upper central incisor, avulsed left lateral incisor and missing left central incisor. Tooth reimplantation was carried out by rinsing the avulsed tooth carefully with saline and all the contaminants were removed. The socket was then flushed with saline and the avulsed tooth was slowly reimplanted with digital pressure. Splinting of the avulsed tooth was done with a semi rigid splint for 4 weeks. Antibiotic coverage was given to the patient. Root canal treatment of the left lateral incisor and right central incisor was done. Splint was removed after 4 weeks. The avulsed teeth were placed back into the socket with the help of finger pressure. Patient was advised to avoid biting on the splinted teeth and continue to brush the other teeth, only soft foods were advised to be eaten and refrain from acidic beverage consumption. After 4 weeks the splint was removed. The results of the treatment were teeth remained symptomless and showed no sign of discoloration, gum abscesses, pulp death, teeth pain and root resorption.

Key words: Gymnast player, Avulsed tooth, Incisor, Reimplantation, Splinting

Introduction

Favorable healing subsequent to an avulsion injury requires immediate emergency interference followed by assessment and possible treatment at crucial times during the healing phase. The urgency of the emergency visit and the multidisciplinary nature of follow-up evaluations necessitate both the public and practitioners from different dental disciplines to possess knowledge of the treatment strategies involved. Dental emergency can take place with anyone. The athletes, both children and adults-are predominantly prone to injuries, including those on the face, mouth and teeth. An elbow blow on the mouth or a bad fall can occur all of a sudden, leading to broken teeth, a torn lip, or worse, a broken jaw. When participating in a sport, particularly contact sports, the risk of sports related dental injury is generally high (*Andreasen*

et al, 1993). Dental injuries suffered by professional athletes are treated slightly differently than an average person with the same type of injury.

Sports injuries to the mouth and oral environment can be disfiguring and costly, both financially and in terms of athletes' time away from school, work or training. Sports-related injuries to the mouth can become expensive, depending upon the nature and extent of the trauma. Fortunately, many sports-related injuries to the mouth can be easily prevented with properly designed mouth guard protection (*Tuskiboshi, 1996*). Sports injuries to the mouth and oral tissues are not necessarily treated any differently than other traumatic injuries to the oral tissues.

For instance, a sudden mishap while playing basketball could lead to injuries such as biting through the lip(s) and/or severely fracturing the front teeth. In

addition, playing football could result in injuries such as losing some of the teeth as a result of blunt trauma to the face, or fractures to the upper arch of the mouth (*American Academy of Paediatric Dentistry, 2002*).

When a tooth is avulsed, attachment damage and pulp necrosis occurs. The tooth is ‘separated’ from the socket, mainly due to the tearing of the periodontal ligament which leaves viable periodontal ligament cells on most of the root surface. In addition, due to the crushing of the tooth against the socket, small localized cemental damage also occurs (*Andreasen, 1981*). If the periodontal ligament left attached to the root surface does not dry out, the consequences of tooth avulsion are usually minimal (*Soder et al, 1977; Andreasen, 1981*). The hydrated periodontal ligament cells maintain their viability, allowing them to reattach on reimplantation with minimal destructive inflammation. In addition, since the crushing injury is contained within a localized area, inflammation stimulated by the damaged tissues is correspondingly limited, meaning that healing with new replacement cementum is likely to occur after the initial inflammation has subsided. Avulsion is defined as displacement of the tooth totally out of the socket (*Andreasen and Andreasen, 1994*). Clinically, the tooth socket is found empty or filled with a coagulum. The treatment of this is reimplantation of the tooth back into the socket with minimum extra-alveolar time. The patient is required to seek an emergency service or dental treatment, including splinting and antibiotic prophylaxis.

This case report is related to an avulsed tooth and its management in case of a 17 year old female gymnast player.

Materials & Methods

A 17 year old girl reported to the dental clinic with swelling of upper lip and displacement of upper right central incisor and avulsion of left lateral incisor. She got the injury while she was doing gymnastics. She had lost her upper left central incisor at the gymnastic ground. Clinical examination showed swelling of upper lip, laceration on lower chin, displaced right upper central incisor, avulsed left lateral incisor and missing left central incisor. (Figs. 1, 2)



Figure 1: Extraoral picture of the patient



Figure 2: Intraoral picture of the patient



Figure 3: Splinting done using semi rigid splint



Figure 4: Patient given periodontal pack



Figure 5: Splint removed after 4 weeks

Tooth reimplantation was carried out at dental department and consisted of the following steps:

- (1) The avulsed tooth was rinsed carefully with saline from a syringe. All the contaminants were removed.
- (2) The socket was flushed with saline and the avulsed tooth was slowly reimplanted with digital pressure.
- (3) Splinting of the avulsed tooth was done with a semi rigid splint for 4 weeks. (Figure 3)
- (4) Antibiotic coverage was given to the patient.
- (5) Root canal treatment of the left lateral incisor and right central incisor was done.
- (6) Splint was removed after 4 weeks. (Figure 5)

Conclusions

Avulsion is the most common dental injury experienced by the sportspersons.

The general public especially the sportspersons should be educated to know the basic steps to deal with such situations so as to save the avulsed tooth. The basic steps need to be educated are:

- (1) Reimplantation of the avulsed tooth should be preferably done at the site of injury in order to minimize the extraalveolar time. In these cases, the tooth should be immediately reimplanted in its socket or, if contaminated, rinsed for 10 seconds in cold running tap water.

If immediate reimplantation is not possible, the avulsed tooth should be restored in milk, or in the oral vestibule. Recently special storage media have been developed which offer excellent protection to the tooth (e.g. Vispan)

In conclusion, our study suggest that reimplantation of an avulsed tooth as soon as possible and using appropriate splint for such a case, and follow up after treatment by a dentist show good prognosis.

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INTRODUCTION

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DISCUSSION

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Thesis:

Özyener, F. 2000. *Effects of work intensity on dynamics of pulmonary gas exchange during exercise in humans*. Doctoral thesis, University of London, London. 79.

Thesis not in English:

Özer, Ö. 2001. *The effect of muscle exercise to oxygen kinetics in chronic smokers*. Doctoral thesis, University of Uludag, Bursa. 1-54. (In Turkish: English abstract).

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