ISSN 0973-2020

Journal of Exercise Science and Physiotherapy (JESP)

An official Peer Reviewed Journal of Exercise Fitness & Health Alliance, EFHA
(Published biannually in June & December, Indexed in IndMED)

Volume 7, No. 1: 2011

Contents

Editor's Page

Journal of Exercise Science and Physiotherapy
Volume 7, No.1: 2011
(Indexed in IndMed/MedIND a portal of Indian Medical journals)

An Official Publication Of
Exercise Fitness And Health Alliance
(Indexed with IndMed/MedINDIA a portal of Indian Medical journals)
www.efha.in

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

It gives me immense pleasure to inform the readers that Journal Selection Committee of ICMR in its meeting held on 3rd August, 2011 has recommended indexing of the **Journal of Exercise Science and Physiotherapy** ***(JESP)*** *in IndMED.* Henceforth full text journal articles can also be viewed at MedIND, a portal of Indian Medical Journals – http://medind.nic.in. I am happy that the **Volume 7, No. 1 issue of Journal of Exercise Science and Physiotherapy** ***(JESP)*** is out for the readers. This issue of JESP contains ten articles on diverse important aspects of exercise science. **Jagga et al** from Patiala presents a review of a total of fifty five research studies dealing with age, anthropometric measurements and nerve conduction properties in the literature reviewed up to 2011. **Kaur & Kaur** from Patiala, Punjab assessed the differences in nutritional profile and prevalence of anemia among rural girls and boys. They report that fifty per cent of female subjects in their study were suffering from disturbances in menstrual cycle. Clinical signs and ill effects of anemia were common. Consumption of tea was high and diets were inadequate in fruits, vegetables and milk products reflecting deficiencies in energy, protein, fat, iron and B vitamins. Overall female subjects showed poorer nutritional profile and higher prevalence of anemia as compared to male subjects. **Kasundra & Jethwa** from Gujrat determined the effect of 28 Days Rock Climbing Training Program on physical fitness components such as strength endurance of shoulder and abdominal muscles, speed and endurance during a rock climbing coaching course. They report that strength endurance of abdominal muscles and shoulder muscles, and endurance improved significantly while speed decreased. They recommend that improvement in climbing performance is best explained by trainable variables such as shoulder and forearm strength and endurance; furthermore strength and conditioning programs should not be viewed as a replacement of climbing but rather as supplementary during courses. **Sharma et al** from Patiala, Punjab explored the Electrical Muscle Stimulation through interferential currents to counter the problem of overweight as well as disturbed fat profiles in the people. In this context they conducted the study on females ranging in age from 20– 40 years to explore the impact of EMS-Interferential program on weight loss as well as the shedding of fat from the abdominal region, so as to reduce the health risks. They concluded that EMS technique was effective in reducing body weight and fat from the body to the same extent as aerobic exercise program. They further report that EMS becomes more effective if it is combined with hot water application in the body region where EMS is applied. **Sharma & Nigam** from Chattisgarh evaluated and compared the motor fitness in relation to Body Mass Index of school going children involved in physical activities. Group of children possessing Low BMI were reported to be better in muscular strength, speed, and agility and similar on flexibility as compared to the group of children having high BMI. **Gour et al** from Uttaranchal investigated the transdermal application of the steroids (iontophoresis) in addition to medical and physical therapy treatment on 36 patients with cervical & lumbar radiculitis. They report that medication, physiotherapy treatment and iontophoretic administration of mixture of anti-inflammatory (dexamethasone) & local anesthetic (lignocaine) was very effective in the treating cervical & lumbar radiculitis. **Juneja & co-workers** from Patiala, Punjab studied the Isometric Peak Force of Shoulder Rotators in Cricketers with and without History of Shoulder Pain. The results of their study indicate that Isometric strength and strength ratios of shoulder rotators can provide useful information in sportspersons with history of injury or pain in the shoulder. Isometric strength imbalances between the ER and IR may also guide the treating professional in correcting these discrepancies using objective methods. **Kaur & Narkeesh** from Patiala, Punjab formulated a structured protocol in the form of intervention technique called Combined Integrated Learning Programme (CILP) and tested its efficacy along with guidelines of Punjab School Education Board (PSEB) on 30 children having learning disability. They found CILP to be an effective tool in enhancing the learning outcomes than the conventional guidelines of PSEB. **Khurana et al** from New Delhi present a case report regarding evaluation, management, and rehabilitation of a multifactorial rotator cuff lesion in an elderly female. **Verma** from Chandigarh reported a case study of a 13 year old hockey player who met with a sports injury and reported to the dental clinic with the chief complaint of broken upper left central incisor. The treatment was carried out by doing Root canal treatment of the broken tooth followed by the crowning of the fractured tooth with porcelain fused to metal.

S.K. Verma

Effect of aging and anthropometric measurements on nerve conduction properties – A Review

Jagga, M., Lehri, A. & Verma, S.K.
Research Scholar, Dept of Sports Science, Punjabi University, Patiala-147001, Punjab
Assistant Professor, Dept of Sports Science, Punjabi University, Patiala-147001, Punjab
Professor, Dept of Sports Science, Punjabi University, Patiala-147001, Punjab

Abstract

Aging is a process that is often accompanied by physiological changes. These physiological changes include slowing in muscle contractility, alteration in muscle metabolism and neuromuscular junction, and reduction in nerve conduction velocity (NCV). Age has been widely accepted to have an influence on nerve velocity. It is well established that there is a decline in muscular performance with advancing age. Nerve conduction studies (NCS) are the most sensitive and reproducible measure of peripheral nerve functions. Nerve conduction studies (NCS) are performed to diagnose the disorders of the peripheral nervous system. These enable the clinicians to differentiate the two major groups of peripheral diseases: demyelination and axonal degeneration. These also help in localizing the site of the lesions. Majority of the available literature mentioning effects of age and anthropometric factors on nerve conduction measures have been referred in the present review. Various studies referred to are based on the data on healthy subjects. The references were further supplemented by systematic search on pubmed, google and Pedro with keywords age, temperature, height and nerve conduction. Several specific studies that had been dealt on anthropometric measures and nerve conduction on normal subjects were also included in this review. A total of fifty five research studies dealing with age, anthropometric measurements and nerve conduction properties have been found in the literature reviewed up to 2011.

KEY WORDS: nerve conduction velocity, anthropometric, Nervous System

Introduction

Aging describes changes that occur with advancing age. Normally physiological capacity of various systems attains a maximum level in 3rd decade of life between the late teens and thirty years of age. After 35 years there occurs a decline in physiologic and performance measures. Different systems change at different rates in different people. Chronological age does not necessarily correlate with biological age. For example, an 85 year old may be active and independent where as 65 year old may have many problems. With age there is decline in energy, faculties and tissues. Visible signs of aging include graying and coarseness of hair, loss of elasticity and dryness of the skin.

Age- related changes in musculoskeletal system

Age related changes in muscle system are directly related to limited mobility and increase of falls in the elderly. Aging is associated with decrease in total muscle cross-sectioned area amounting to approx 40% between the ages of 20 and 80 years. *Cummingham et.al in 1989 and 1982* conducted study on young and elderly men and found that this reduction in muscle cross-sectioned area is accompanied by increase in non contractive structures such as fat and connective tissue. Thus, the girth or volume of the muscle band on

anthropometric measurements may not show the actual reduction in excitable muscle mass. The total number of muscle fibers is significantly reduced with age beginning at about 25 years and progressing at an accelerated rate thereafter.

Grimby et al (1984), Lexell et al (1988) and Porter et al (1995) have concluded that type II fibers size of vastus lateralis, tibialis anterior and biceps brachii decreases with increasing age, whereas type I fiber size does not change with age. The most basic age related change in muscle morphology at the level of the Motor Unit (MU) is a decrease in the number of total Motor Units. *Tomlinson et al (1977)* in their study found that loss in MU number is approximately 1% of the total number per annum, beginning in the third decade of life and increasing rapidly in rate beyond the age of 60. Age-related decreases in strength have been well documented. A variety of limb muscles have been tested during isometric strength tasks in young, middle-aged, and older men and women. In general, results of several studies demonstrate that reductions in isometric and dynamic voluntary strength become substantial by the seventh decade of life, and may accelerate thereafter. Healthy men and women in their seventh and eighth decades of life demonstrates average reductions of 20-40% in maximal isometric strength in various muscles, when compared to young adults (*McDonagh et al, 1984, Young et al, 1984, Davies et al, 1986, Kallman et al, 1990).* These age-related reductions are relatively similar for both sexes and for proximal and distal muscles of various sizes, in both upper and lower limbs. Muscular strength is reported to be highest between the ages of 20 and 30 years. Though, there is progressive decline in maximum strength and which entirely leads to functional loss in activities of daily living.

Age- related changes in nervous system:

Research reports indicate that as brain ages or as people get older, there occurs a decrease in brain weight and brain volume, widening of the grooves on the surface of the brain and enlargement of the ventricular system. The decrease in brain weight and brain volume is probably due to the loss of neurons and extra cellular fluid. Man may have a 20% reduction in brain weight between the ages of forty -five and eighty -five and lose thirty to fifty thousand neurons a day from the brain and nervous system as they age. Enlargement of the ventricular system may be probably due to loss of cells surrounding the ventricles. In the first studies of the effects of age on the human Cortex, *Brody (1955, 1970)* concluded that as many as 50% of neurons are lost with age. Other investigators concurred with this conclusion and it was not until the 1980s that *Haug and Terry* and their colleagues produced contrary evidence. *Haug and his colleagues (Haug, 1984, 1985; Haug et al., 1984)* showed that many of the early reports of loss of cortical neurons with age could be attributed to the fact that upon fixation the brains of younger individuals shrink more than those of older ones, which have more myelin. Consequently, when sections of cortical tissue are examined, the young brains show higher neuronal packing densities than those of older individuals. After making corrections for this differential shrinkage, Haug and his colleagues concluded there is no significant loss of neurons from the human cerebral cortex

with age. *Terry et al (1987)* reached a similar conclusion and suggested that much of the neuronal loss recorded in earlier studies could be attributed to brains of some individuals with undiagnosed Alzheimer's disease being included among the older brains that were being evaluated and considered to be normal. In Alzheimer's disease there is a significant neuronal loss from cerebral cortex. According to *Peter (2002)* there is no evidence for a significant loss of cortical neurons during normal aging on the cerebral hemispheres, however there is widespread damage to the myelin sheaths that ensheath their axons, as evidenced by structurally altered myelin sheaths observed in electron microscopic preparations. Although there is no extensive loss of cortical neurons in normal aging, neurons do lose dendritic branches and spines, and there are alterations in the levels of some neurotransmitters and their receptors.

Aging is a process that is often accompanied by physiological changes. These physiological changes include slowing in muscle contractility, alteration in muscle metabolism and neuromuscular junction, and reduction in nerve conduction velocity (NCV). Age has been widely accepted to have an influence on nerve velocity. It is well established that there is a decline in muscular performance with advancing age. Common observations of muscle wasting in the elderly, particularly of proximal limb muscles as well as the small muscles of the hand are reported with aging. Undoubtedly many extraneous factors may contribute to neuromuscular disease in the elderly, of which the most important is probably malnutrition, disuse, circulatory impairment, etc.

Nerve conduction studies (NCS) are the most sensitive and reproducible measure of peripheral nerve functions. Nerve conduction studies (NCS) are performed to diagnose the disorders of the peripheral nervous system. These enable the clinicians to differentiate the two major groups of peripheral diseases: demyelination and axonal degeneration. These also help in localizing the site of the lesions. NCS consist primarily of the assessment of three types of nerves: motor, sensory and mixed. Motor NCS include the assessment of the compound muscle action potential (CMAP), whereas sensory NCS include the assessment of the sensory nerve action potentials (SNAP) of the accessible peripheral nerves in the upper and lower limbs. The median, ulnar, radial, common peroneal, tibial and the sural nerves are the commonly examined nerves. The commonly measured parameters of the CMAP include latency, amplitude, duration, conduction velocity and late response, e.g., F-waves. Similarly, for SNAP, latency, amplitude and conduction velocity are routinely measured. Nerve conduction parameters may be affected by anthropometric factors like age, sex, height, weight and BMI. As it has been reported that significant slowing of conduction velocities and sensory latencies occur with increasing age and more height. It was claimed further that the conduction velocity is 6 m/sec faster in females. *Flack et al (1994)* reported in their study that the conduction velocity in a newborn is approximately 50% of adult values and progressively increase, reaching the adult value at the age of

three. Later in adulthood, the nerve velocity decreases with age and this is more pronounced in the lower than in the upper limbs. *Rivner et al (2001)* studied that the correlation of NCV with height was stronger than with age. Regression equations using both factors account for 12-27% of the variance. Responses were seen in the majority of patients aged 70 years and older, but the percentage of normals who had no response increased with advancing age. Age was strongly inversely correlated with the amplitudes of both sensory and motor responses, accounting for 7-16% of the variance. Regression equations using both height and age improved this correlation and accounted for 7-22% of the variance.

Materials & Methods

Majority of the available literature mentioning effects of age and anthropometric factors on nerve conduction measures has been referred. Various studies referred to are based on the data on healthy subjects. The references were further supplemented by systematic search on pubmed, google and Pedro with keywords age, temperature, height and nerve conduction. Several specific studies that had been dealt on anthropometric measures and nerve conduction on normal subjects were also included in this review. The search was further refined by restricting search to English language publications and to papers that included specified epidemiological terms. Irrelevant references were eliminated in this review by the researchers. To test the adequacy of our search strategy the outcome for the period up to 2011 was included in this review.

Results

A total of fifty five research studies dealing with age, anthropometric measurements and nerve conduction properties have been found in the literature reviewed up to 2011.

Saeed (2008) reported that sural nerve conduction velocity had significant inverse correlation with age. It had also weak inverse relation with height, while sural sensory latency had insignificant direct relationship with age and height. Both neurological parameters have been reported to vary more with change in age than the change in height so necessitating adjustments for height and age must be considered while developing normal standard values in (40-70 years) age range of the subjects. According to him, more research on wider data base is required to develop norms and standards in this context. In the age range of 40-70 years there is no gender specific difference in the conduction measures of the sural nerve. *Mohamed in 2007* revealed that The mean velocities for the median and ulnar nerves, both motor and sensory, were 54.71±5.69 m/s (motor) and 54.04±7.02 m/s for the median nerve and 60.57±5.00 m/s (motor) and 52.92±5.89 m/s for the ulnar nerve. The mean velocity for the sural nerve was 47.97±4.48 m/s. Only median motor conduction velocity showed a significant reduction with increasing age (p=0.000) & concluded that there is no significant effect of age on nerve conduction velocities except for median motor conduction velocity. *Falco et al in 1992* reported that age had a statistically significant but low strength effect on all ulnar nerve conduction velocities and distal latencies as well as the distal sensory amplitudes of all three nerves. They also explored that gender had a greater effect than age on these

parameters as well as on median sensory distal latency. Other median motor and sensory conduction parameters along with radial sensory distal latency were not significantly related to age or gender. *Dilip in 2010* studied that gender has definite effects on NCS variables. Males had higher CMAP amplitude, longer latencies and duration. SNAP latencies and duration were longer in males whereas amplitude was higher in female whereas *Robinson et al (1993)* concluded that most gender differences in nerve conduction velocity can be largely explained by height, whereas amplitude differences persist despite correction for height, temperature, and age.

Diana et al in 1992 found that height was negatively associated with sensory amplitude in all nerves tested *(P* < 0.001), and positively associated with median and ulnar sensory distal latencies *(P* < 0.01) and sural latency *(P* < 0.001). She also reported that index finger circumference was negatively associated with median and ulnar sensory amplitudes *(P* < 0.05) and sex, in isolation from highly correlated anthropometric factors such as height, was not a significant predictor of median or ulnar nerve conduction measures. *Michael et al in 2001* reported the correlation of NCV with height was stronger than with age. Regression equations using both factors account for 12–27% of the variance. He had seen responses in the majority of patients aged 70 years and older, He also found that percentage of normal that had no response increased with advancing age and age was strongly inversely correlated with the amplitudes of both sensory and motor responses, accounting for 7–16% of the variance. Regression equations using both height and age improved this correlation, accounting for 7–22% of the variance. *Thakur et al (2010)* explored that the height showed a significant correlation with the nerve conduction parameters of most of the motor nerves and a few sensory nerves. They also concluded that diagnoses which were made from the nerve conduction data without making corrections for height may be invalid in patients who are taller and shorter than average individuals. This must be also considered while developing standard/reference normative data for different nerves.

David et al (1989) investigated that temperature has a profound inverse effect on SNAP latency and must be accounted for during clinical electrophysiological examinations. Conversely, temperature has a direct effect on SNAP amplitude and must also be considered during EMG examinations.

According to *Rabben (1995)* values of CV along the segment wrist to elbow in newborns (CVo) and after maturation (CVmax) were found to be significantly higher than those along the distal fingers to wrist segment of both median and ulnar nerves ($p < 0.001$). The main reason for this is probably temperature difference between these two segments. Secondly Smaller variations of CV values found in different nerves along the same nerve segment can be caused by measurement or other technical error. Besides, in case of infants it is also very important that age-groups are identical.

Ralph (1999) stated that there is no significant difference between blacks and whites in normal nerve conduction study findings in healthy adults. *Tong et al*

(2004) reported the rate of change over time was not affected by hand (dominant versus non-dominant hand), gender, age, or BMI at baseline. The rate of change seen with some of the median nerve parameters was significantly greater than that with the ulnar nerve.

Discussion

The results of various literatures describe the statistical significance of associations.

Age:

The conclusion of 55 research studies revealed that nerve conduction velocity decreases with age. The decrease in nerve conduction velocity may be because of decreased number of nerve fiber, a reduction in fiber diameter and changes in the fiber membrane The study done by Dorfman and Bosley of 30 normal subjects (15 young and 15 older adults) estimated a decrease of 0.16 m/s per year of age, that by *Stetson (1982)* of 105 normal workers (excluding workers on jobs thought to involve repetitive or forceful hand exertions) estimated a decrease of 0.13 m/s per year, and that by Letz and Gerr of over 4000 veterans estimated a decrease of 0.13m/s per year. The 1.3 m/s decrease in median sensory distal conduction velocity and the 0.8 m/s decrease in motor conduction velocity per decade of aging were found in study done by *Diana et al*. But *Mitchael et al* in there study found a less correlation between age and nerve conduction velocity. In an another study done by *Mohamed et al (2007)* it was also concluded that there is not any significant effect of age on nerve conduction velocities except for median nerve.

Like nerve conduction velocity responses amplitude and distal latencies show a stronger inverse correlation with age. The distribution of amplitude values in the young is much wider than in elderly. Fewer higher amplitude values are seen after the age of 60 years. A study done by Diana et al showed an average loss of about 5 IJ.V per decade for wrist-digit **I1** sensory amplitude. This was somewhat larger than the 1.5 IJ.V per decade loss in digit **111-** wrist sensory amplitude reported by *Buchthal et a1 (1974)* .6 or the 3.8 IJ.V per decade loss in wrist-di it **111** sensory amplitude reported by Tackmann. The reduced nerve amplitude is best related to loss of axons. The increase in oedema found in elderly along with increased skin resistance may also play a role in the reduction of amplitude seen with ageing.

Temperature

Over relatively wide temperature ranges, motor and sensory nerve conduction velocities have a positive linear relationship with body temperature. With cooling, motor and sensory amplitudes increase and conduction values decrease. Cooling is thought to affect muscle and nerve membrane function, particularly the sodium ion channel. A direct relationship was observed between the distal sensory amplitude of sural sensory nerve action potential and the temperature of the leg. *Henriksen (1956)* studied the temperature effects from 12° to 40°C on the motor conduction of human nerves. He found that between 29° and 38°C the motor conduction velocity decreased 2.4 m/sec for each 1°C decrease in temperature. Similar decreases in neural conduction as a function of a 1°C decrease in limb temperature were reported by *Buchthal and Rosenfalck (1971)* (2.0 m/sec), McLeod (2.6 m/sec), deJesus et al (2.1

m/sec), *Ludin and Beyeler (1977)* (1.51 m/sec), and *Bolton et al (1981)* (2.1 m/sec). *Ludin and Beyeler (1977)* have repotted that between 22° and 26°C the amplitude of SNAPs decreased with lowering temperatures of the limb. *Oh (1982)* and *Ludin and Beyeler (1977)* attributed an increase in SNAP amplitude with a concomitant increase in limb temperature to a smaller temporal dispersion of the SNAPs for different fibers and to a sequential shortening of the SNAP spike. As temporal dispersion diminishes with an increase in limb temperature, the SNAP amplitude increases. *Bolton et al (1981)* however, found that between limb temperatures of 21° to 31°C, the amplitude of the SNAP showed a progressive linear increase with decreasing temperature. This increase in SNAP amplitude with decreasing temperatures may be explained by a decrease in temporal dispersion rather than a real increase in height (amplitude) of the SNAP.

Height

The negative relationship between height and sensory amplitudes was a consistent finding in sensory nerves tested in most of the studies. While controlling for age and surface temperature, height explained much of the sensory amplitude variation (partial R2 in 0.20 to 0.25 ranges). Our results duplicated those of others who have found a strong negative correlation between height and either sural or peroneal conduction velocity. *Soudmand et al (1982)* studied the effect of height on nerve conduction velocity (NCV) on 41 normal subjects and found that peroneal and sural NCV correlated inversely with height and with estimated axonal length, whereas median motor and sensory NCV failed to show any significant relationship to height. *Thakur (2011)* in there study on 34 healthy subjects also supported result of various studies that height has a negative correlation with the sensory nerve action potential amplitudes.

Race

The findings of various research studies show that there is no significant difference between race and nerve conduction. In a comparative study done by Ralph et al on 50 Blacks and 50 Whites it was concluded that there was no significant difference between blacks and whites in normal nerve conduction study findings in healthy adults.

Gender difference

The results of various literatures revealed that there is no significant difference between gender and median or ulnar nerve conduction measures in healthy subjects. The results was supported by study done by *Stetson (1982)* on 105 asymptomatic healthy adults in which it was found that there is no association between sex and median or ulnar nerve conduction measures. For the sural nerve, using a model which also included age, midcalf temperature, and height, women were found to have significantly smaller amplitude and slower conduction velocity then men. The most plausible hypothesis is that both sex and sural nerve conduction and amplitude are correlated with an anatomical or physiological factor which we did not measure. Our results were also supported by study done by *Greathouse (1989)* on 22 healthy subjects which also explains that there is no significance difference between gender and nerve conduction

measures. But *Thakur (2010, 2011)* in a gender based study on 34 healthy subjects concluded that gender has definite effects on NCS variables. Males had higher CMAP amplitude, longer latencies and duration. Sensory nerve action potential latencies and duration were longer in males whereas amplitude was higher in females. Without adjustment for these factors, the sensitivity and specificity of NCS will decrease when using the same reference data in patients with different gender.

BMI:

Our findings explore that the sural sensory conduction velocity had a non significant negative relationship with BMI. The inverse correlation of sensory conduction velocity and direct relation of sensory latency with BMI indicated the sole effect of height among these relationships. So it is quite obvious that weight and obesity do not have any significant impact on nerve conduction parameters. The findings were supported by study done by *Stetson (1982)* on 105 asymptomatic healthy adults.

References

Akataki, K., Mita, K., Watakabe, M., Ito, K. 2002. Age-Related Change in Motor Unit Activation Strategy In force Production: A Mechanomyographic Investigation. *Muscle Nerve*, **25:** 505–12.

Awang, M.S, 2007. Nerve conduction study of healthy Asian Malays: The influence of age on median, ulnar, and sural nerves, *Med. Sci. Monit.*, **13(7):** CR330-332.

Bolton, C.F., Sawa, G.M., Carter, K. 1981. The effects of temperature on human compound action potentials. *J. Neur. Neurosurg. Psych*., **44:** 407-13.

Brody, H. D. 1955. Organization of the cerebral cortex. III. A study of aging in the human cerebral cortex. *J. Comp. Neurol.* **102:** 511–516.

Brody, H. D. 1970. Structural changes in the aging nervous system. *Interdisciplinary Topics in Gerontology*. **7:** 9–21.

Buchthal, F., Rosenfalck, A., Trojaborg, W. 1974. Electrophysiological findings in entrapment of the median nerve at wrist and elbow. *J. Neur. Neurosurg. Psych*., **37:** 340-360.

Buchthal, F., Rosenfalck, A. 1971. Sensory conduction from digit to palm and from palm to wrist in the carpal tunnel syn.drome. *J. Neur. Neurosurg. Psych*., **34:** 243-252.

Buschbacher, R.M., Koch, J. 1999. Race effect on nerve conduction studies: a comparison between 50 blacks and 50 whites. *Arch. Phys. Med. Rehabil.*, **80:** 536-539.

Campbell, M.J., McComas, A.J., Petito, F. 1973. Physiological changes in ageing muscles. *J. Neur. Neurosurg. Psych*., **36:** 174–82.

Cannon, L.J., Bernacki, E.J., Walter, S.D. 1981. Personal and occupational factors associated with carpal tunnel syndrome. *J. Occup. Med*. **23:** 255-258.

Cunningham, D.A., Morrison, D., Rice, C.L., Cooke, C. 1987. Ageing and isokinetic plantar flexion. *Eur. J. Appl. Physiol.* **56:** 24–29.

Davies, C.T.M., Thomas, D.O., White, M.J. 1986. Mechanical properties of young and elderly human muscle. *Acta. Med. Scand.*, **711:** 219–226.

de Jesus, P.V., Hausmanowa-Petrusewicz, I., Baschi, R.L. 1973. The effect of cold on nerve conduction of human slow and fast nerve fibers. *Neurology*, **23:**1182-1189.

Eklund, G. 1975. A new electrodiagnostic procedure for measuring sensory nerve conduction across the carpal tunnel. *Upsala J. Med. Sci*., **80:** 63-64.

Falco, F.J., Hennessey, W.J., Braddom, R.L., Goldberg, G. 1992. Standardized nerve conduction studies in the upper limb of the healthy elderly. *Am. J. Phys. Med. Rehabil.*, **71(5):** 263-71.

Flack, B., Stålberg, E., Bischoff, C. 1994. Sensory nerve conduction studies with surface electrodes. *Methods In: Clinical Neurophysiology*. **5:** 1–20.

Greathouse, D.G. 1989. Electrophysiologic Responses of Human Sural Nerve to Temperature. *Physical Therapy* **69(11):** 34-42.

Grimby, G., Aniansson, A., Zetterberg, C., Saltin, B. 1984. Is there a change in relative muscle fiber composition with age? *Clin. Physiol.*, **4:** 189–194

Haug, H. 1984 Macroscopic and microscopic morphometry of the human brain and cortex. A survey in the light of new results. *Brain Pathology.* **1:** 123–149.

Haug, H. 1985. Are neurons of the human cerebral cortex really lost during aging? A morphometric examination. In *Senile dementia of the Alzheimer type* (edited by TABER, J. & GISPEN, W.) pp. 150–156. Berlin:Springer-Verlag.

Haug, H., Kuhl, S., Mecke, E., Sass, N. & Wasner, K. 1984. The significance of morphometric procedures in the investigation of age changes in cytoarchitectonic structures of human brain. *J. fur Hirnforschung*, **25:** 353–374.

Henriksen, J.D. 1956. Conduction Velocity of Motor Nerves in Normal Subjects and Patients with Neuromuscular Disorders. Master's Thesis. Minneapolis, MN, University of Minnesota.

Jackson, D.A.; Clifford, J.C. 1989. Electrodiagnosis of mild carpal tunnel syndrome. *Arch. Phys. Med. Rehabil.* **70:** 199-204.

Kallman, D.A., Plato, C.C., Tobin, J.D. 1990. The role of muscle loss in age-related decline in grip strength: cross-sectional and longitudinal perspectives. *J. Geront.*, **45:** M82–M88.

Lexell, J., Taylor, C.C., Sjostrom, M. 1988. What is the cause of the ageing atrophy? Total number, size and proportion of different fiber types studied in whole vastus lateralis muscle from 15- to 83-year-old men. *J. Neurol. Sci.*, **84:** 275–294.

Loong, S.C., Seah, C.S. 1971. Comparison of median and ulnar sensory nerve action potentials in the diagnosis of the carpal tunnel syndrome. *J. Neur. Neurosurg. Psych***.,** **34:** 750-754.

Ludin, H.P., Beyeler, F. 1977. Temperature dependence of normal sensory nerve action potentials. *J. Neur. Neurosurg. Psych***.,** **216:** 173-180.

McDonagh, M.J.N., White, M.J., Davies, C.T.M.1984. Different effects of aging on the mechanical properties of human arm and leg muscles. *Geront.*, **30:** 49–54.

McLeod, J.G. 1966. Digital nerve conduction in the carpal tunnel syndrome after mechanical stimulation of the finger. *J. Neur. Neurosurg. Psych***.,** **29:** 12-22.

Mills, KR. 1985. Orthodromic sensory action potentials from palmar stimulation in the diagnosis of carpal tunnel syndrome. *J. Neur. Neurosurg. Psych***.,** **48:** 250-255.

Monga, T.N., Shanks, G.L., Poole, B.J. 1985. Sensory palmar stimulation in the diagnosis of carpal tunnel syndrome. *Arch. Phys. Med. Rehabil.*, **66:** 598-600.

Oh, S.J. 1984. Clinical Electromyography and Nerve Conduction Studies. Baltimore, MD, University Park Press.

Peters, A 2002, The effects of normal aging on myelin and nerve fibers: A review. *Journal of Neurocytology.* **31:** 581–593

Peters, A., Morrison, J. H., Rosene, D. L. &Hyman, B. T. 1998 Are neurons lost from the primate cerebral cortex during aging? *Cerebral Cortex* **8:** 295–300.

Porter, M.M., Vandervoort, A.A., Lexell, J. 1995. Aging of human muscle: structure, function and adaptability. *Scand. J. Med. Sci. Sports*, **5:** 129–142.

Rabben, O.K. 1995. Sensory nerve conduction studies in children. Age-related changes of conduction velocities. *Neuropediatrics*. **26(1):** 26-32.

Rivner, M.H., Swift, T.R., Malik, K. 2001. Influence of age and height on nerve conduction. *Muscle Nerve*, **24(9):** 1134–41.

Roos, M.R., Rice, C.L., Vandervoort, A.A. 1997. Age-related changes in motor unit function. *Muscle Nerve*, **20:** 679–90.

Robinson, L.R., Rubner, D.E., Wahl, P.W., et al. 1993. Influences of height and gender on normal nerve conduction studies. *Arch. Phys. Med. Rehabil.*, **74:**1134-8.

Saeed, S. Akram. M. 2008. Impact of anthropometric measures on sural nerve conduction in healthy subjects. *J. Ayub. Med. Coll. Abbottabad*, **20(4):** 112-114.

Salerno, D.F., Werner, R.A., Albers, J.W. 1999. Reliability of nerve conduction studies among active workers. *Muscle Nerve*, **22:** 1372–79.

Silverstein, B.A., Fine, L.J., Armstrong, T.A. 1987. Occupational factors and carpal tunnel syndrome. *Am. J. Indust. Med.*, **11:** 343-358.

Soudmand, R., Ward, L.C., Swift, T.R.1982. Effect of height on nerve conduction velocity. *Neurology*. **32(4):** 407-10.

Stalberg, E., Flack, B. 1993. Clinical motor nerve conduction studies. *Methods. In: Clinical Neurophysiology*, **4:** 61–80.

Stetson, D.S 1982. Effects of age, sex, and anthropometric factors on nerve conduction

measures, *Muscle & Nerve* **15(10):** 1095–1104.

Tackmann, W, Keaser, He, Magun, H.G. 1981. Comparison of orthodromic and antidromic sensory nerve conduction velocity measurements in the carpal tunnel syndrome. *J. Neur. Neurosurg. Psych.*, **224:** 257-266.

Terry, R. D., Deteresa, R. & Hansen, L. A. 1987 Neocortical cell counts in normal human adult aging. *Annals of Neurology*, **21**: 530–539.

Thakur, D. 2010. Nerve Conduction Study in Healthy Individuals: a Gender Based Study, *Health Renaissance*, **8 (3);** 169-175.

Thakur, D. 2011. Influence of height on the nerve conduction study parameters of the peripheral nerves, *J. Clin. Diag. Res*. **5(2):** 260-263.

Tomlinson, B.E., Irving, D. 1977. The numbers of limb motor neurons in the human lumbosacral cord throughout life. *J. Neurol. Sci.* **34:** 213–219.

Tong, H.C., Werner, R.A., Franblau, A. 2004. Effect of aging on sensory nerve conduction study parameters. *Muscle Nerve*, **29(5):** 716–20.

Wieslander, G., Norback, D., Ljuhlin, C.l.C. 1989. Carpal tunnel syndrome (CTS) and exposure to vibration, repetitive wrist movements, and heavy manual work: a case-refinement study. *Brit. Lndus. Med*., **46:** 43-47.

Young, A., Stokes, M., Crowe, M. 1984. Size and strength of the quadriceps muscles of old and young women. *Eur. J. Clin. Invest.*, **14:** 282–287.

A Comparison of Nutritional Profile and Prevalence of Anemia among Rural Girls and Boys

Kaur[1], I. P. and Kaur[2], S.
[1]Assoc. Prof., Department of Nutrition & Dietetics, Govt. College for Girls, Patiala-147001, Punjab, India
[2]Department of Nutrition & Dietetics, Govt. College for Girls, Patiala-147001, Punjab, India

Abstract

The present study has been conducted to assess the differences in nutritional profile and prevalence of anemia among rural girls and boys. The group comprised of 50 girls and 50 boys aged 16-18 years studying in government schools. Relevant data on general information, dietary information, biochemical investigations, clinical examination, anthropometric measurements and menstruation was collected. The average hemoglobin levels were found to be 8.9 and 10.77 g /dl in female and male subjects, respectively and were positively correlated with anthropometric parameters of height, weight and BMI. Fifty per cent of female subjects were suffering from disturbances in menstrual cycle. Clinical signs and ill effects of anemia were common. Consumption of tea was high and diets were inadequate in fruits, vegetables and milk products reflecting deficiencies in energy, protein, fat, iron and B vitamins. Overall female subjects showed poorer nutritional profile and higher prevalence of anemia as compared to male subjects.

KEY WORDS: Hemoglobin, Menstrual Disturbances, Clinical Signs, Food Habits, Dietary Intake

Introduction

Anemia due to iron deficiency is perhaps the most widespread clinical nutritional deficiency disease in the world today. Nearly 50 per cent of women of reproductive age and 26 per cent of men in the age group of 15-59 years are anemic *(ACC / SCN, 1987 and Beard, 2005).* The effects of severe anemia are well established, as compromising work performance and health, others are suggested, such as links with immune competence and resistance to infection *(ACC/ SCN, 1987).* Adolescence is a crucial phase of growth since it offers the second and last chance for the catch up growth in life cycle. Adolescents who eat less than three meals daily tend to have inadequate intakes of nutrients especially iron. Adolescent girls are particularly prone to iron deficiency anemia because of increased demand of iron for hemoglobin, myoglobin and to make up the loss of iron due to menstruation and poor dietary habits *(Beard, 2000).* Early menarche is also one of the reasons for high prevalence of anemia *(Kaur et al, 2005).* The present study is conducted to assess the dietary adequacy and prevalence of anemia among rural adolescent girls and boys of 16-18 years.

Methods

The data for the present study have been collected from 100 students, 50 girls & 50 boys in the age group of 16-18 years belonging to different villages and studying in government senior secondary school, Chanarthal Kalan, district Fatehgarh Sahib, Punjab. Questionnaire-cum –interview method was used to elicit general and dietary information of the respondents. Assessment of prevalence of

anemia was done by biochemical investigation of hemoglobin levels. Clinical examination and ill effects of anemia were recorded with the help of a physician. Anthropometric measurements of height, weight and BMI were taken using standard methods of *Jelliffe (1966).*

Results & Discussion

It was observed that majority of the subjects belonged to Sikh community and general category caste wise. 58 % of female subjects and 60% of male subjects belonged to nuclear families. 60% female subjects and 48% male subjects belonged to families with income less than Rs 5000 per month, 28% of both had family income of Rs. 5000-10000 per month and 12% of female and 24% of male subjects belonged to income group of more than Rs 10000 per month. Majority of the subjects had pucca houses and were engaged in farming. Majority were growing green leafy vegetables in their kitchen gardens.

Biochemical Assessment

Table 1: Mean hemoglobin levels of subjects

Hemoglobin level, g/dl	Girls	Boys
Mean±S. D.	8.9±1.4	10.77±1.71
Hemoglobin Range g/dl	6 – 12	7.5 – 14

Table 2: Distribution of subjects according to category of anemia as per *WHO (1972)* classification

Category	Hb level (g/dl)	Girls(N=50)		Boys (N=50)	
		Number	%	Number	%
Anemic	<12	49	98	28	56
Non-anemic	≥12	1	2	22	44

Data in table 1 indicates that blood hemoglobin levels of the female subjects ranged from 6-12 g / dl with the mean value of 8.9 ± 1.46 g / dl where as blood hemoglobin of male subjects ranged from 7.5 -14 g / dl with the mean value of 10.77 ±1.71 g /dl. When compared with *WHO (1972)* classification, most of the female subjects (98%) and 56% of male subjects were anemic with hemoglobin levels less than 12 g/dl (Table 2). When compared with *NIN (1986)* classification, 56% of the female subjects and 30% of male subjects were found to be moderately anemic, 18% of female and 12% of male subjects were found to be mildly anemic. 10% of female subjects and 14% of male subjects were marginally anemic. Only 2% of female and 44% of the male subjects belonged to non -anemic category and 14% of female subjects and none of the male subjects were found to be severely anemic (Table 3).

Table 3: Distribution of subjects according to the category of anemia as per *NIN (1986)* classification

Category	Hb level (g/dl)	Girls (N=50)		Boys (N=50)	
		N	%	N	%
Severely anemic	≤7.0	7	14	--	--
Moderately anemic	8.0 – 9.9	28	56	15	30
Mildly anemic	10.0 – 10.9	9	18	6	12
Marginally anemic	11.0 – 11.9	5	10	7	14
Non-anemic	≥12.0	1	2	22	44

The results were in accordance with studies conducted by *Kumari and Singh (2003), Palta and Gurwara (2003) and Shekhar (2004).*

Clinical Assessment

Table 4. Distribution of subjects according to prevalence of clinical signs of anemia*

Clinical signs of anemia	Girls (N=50)		Boys (N=50)	
	N	%	N	%
Paleness of skin	34	68	12	30
Pale conjuctiva	13	26	12	24
Pigmentation of nails	27	54	17	34

Clinical signs of skin pallor, pale conjunctiva and pigmentation of nails indicating prevalence of anemia among the subjects were observed (Table 4). 68% of female subjects and 30% of male

subjects depicted skin pallor. 26% of female and 24% of male subjects showed pale conjunctiva. Pigmentation of nails was observed in 54% of female subjects and 34% of male subjects. *Jaishree et al (2001), Gosh et al (2002) and Kumari and Singh (2003)* also reported similar results among adolescents.

Table 5: Distribution of subjects according to the ill effects of anemia on health*

Ill effects of anemia	Girls (N=50)		Boys (N=50)	
	N	%	N	%
Weakness	17	34	11	22
Easy fatigability	32	64	16	32
Dizziness	5	10	1	2
Frequent headache	22	44	2	4
Reduced physical work capacity	25	50	5	10
Shortness of breath	25	50	5	10
Poor appetite	2	4	2	4

Distribution of subjects according to the ill effects of anemia on health showed that 64% of female and 32% of male subjects were suffering from easy fatigability. Frequent headache was reported by 44% of female subjects and 4% of male subjects. An equal number of female subjects (50% each) showed reduced physical work capacity and shortness of breath while 10% and 30% of male subjects, respectively showed reduced physical work capacity and shortness of breath. Loss of appetite was reported by 4% each of both female and male subjects. Feeling of weakness was reported by 34% of female and 22% of male subjects while dizziness was reported by 10% of female subjects and 2% of male subjects (Table 5). *Tiwari and Seshadri (2000) and Beard (2005)* also reported similar ill effects of anemia in adolescent girls.

Anthropometric Data

Table 6: Mean height and weight of subjects

Parameter	Girls (N=50)	NCHS Standard	Boys (N=50)	NCHS Standard
Height,cm	161±5.45	163	170±3.93	174.33
Weight,kg	49±5.60	53.8	62±7.79	61.9

The results of anthropometric measurements revealed that the average height of female and male subjects ranged from 150-170 cm and 162.5-189.0 cm; respectively with mean values of 161.0±5.45 cm in female subjects and 170.0±3.93 cm in male subjects'. The height was almost comparable to NCHS standards (Table 6).

Average weight of female and male subjects ranged from 38-61 kg and 51-89 kg with mean value of 49.0±5.6 kg and 62.0±7.8 kg, respectively. Weight of male subjects was comparable to NCHS standards while results showed lower weight values in female subjects when compared with NCHS values (Table 6).

Table 7. Distribution of subjects as per criteria of BMI (James and Liuizzi, 1988)

Category/Presumptive Diagnosis	BMI (kg/m^2)	Girls (N=50)		Boys (N=50)	
		N	%	N	%
Obese Grade 11	>30	-	-	-	-
Obese Grade 1	25-30	-	-	-	-
Normal	20-25	20	40	28	56
Marginal Malnutrition	18.5-20	15	30	15	30
Mild Malnutrition	17-18.5	8	16	2	4
Moderate Malnutrition	16-17	5	10	-	-
Severe Malnutrition	<16	2	4	-	-

Anthropometric data on BMI showed that 40% of female subjects and 56% of male subjects had normal BMI values where as 30% of both female and male

subjects were mildly malnourished, 10% of female subjects were under the category of moderate malnutrition and 4% were severely malnourished. None of the male subjects were moderately or severely malnourished while 10% had grade 1 obesity (Table 7). Results of BMI were in accordance with the studies conducted by *Jaishree et al (2001), Srijaya and Jhansi (2003) and Mishra (2004)* on school going adolescents.

Information Regarding Menstruation

Data in table 8 indicates that majority of the subjects had attained menarche at the age of 13-15 years. It was observed that majority (78%) of the subjects had menstrual bleeding period of 3-5 days, very few (4%) had it for less than 3 days and 18% had it for more than 5 days.

Table 8: Distribution of female subjects according to age of menarche

Age of menarche (years)	Girls (N=50)	
	N	%
<12	1	2
12-13	9	18
13-14	18	36
14-15	22	44

Table 9: Distribution of female subjects according to type of menstrual disturbances (Sembulingam, 2003)

Menstrual disturbance	Girls (N=50)	
	N	%
Amenorrhea	6	12
Menorrahagia	9	18
Oligomenorrhea	9	18
Polymenorrhea	2	4
Dysmenorrhea	25	50

The results showed that 50% of female subjects had normal menstrual cycle where as the other 50% were suffering from various menstrual disturbances. Among the latter 50% was suffering from dysmenorrhea. An equal number (18% each) were suffering from menorrhagia and oligomenorrhea. 12% were suffering from amenorrhea with the gap of 1½ – 2 months between two menstrual periods and 4% subjects were suffering from polymenorrhea. One of the subjects was found to be suffering from both menorrhagia and polymenorrhea in addition to dysmenorrhea (Table 9). *Shardha and Matheen (1996), Joseph and Senehlata (1997) and Jain (2005)* have reported similar findings among rural and urban girls.

Dietary Assessment

Food Habits

It was observed that 70% of female subjects were lacto-vegetarian, 16% female and 56% male subjects were ova-lacto-vegetarian and 14% female and 44% male subjects were found to have non-vegetarian dietary habits. None of the male subjects was lacto-vegetarian. The general meal pattern showed that majority of subjects consumed 3 major meals, breakfast, lunch and dinner. Only 16% of the female subjects and 14% of the male subjects were consuming 2 meals a day, they were missing their breakfast. None of the male subjects and 12% of female subjects carried packed lunch to school. Consumption of tea was observed to be high among both female and male subjects of the study. Majority of them consumed tea in the evening. 24% of female and 32% male subjects took tea with breakfast where as 10% female and 16% male subjects took tea with lunch. Higher intake of tea and its consumption along with the meals hinder iron absorption in the body and could be the reason for low hemoglobin levels in the subjects.

Food Intake

Data on daily intake of different food groups (Table 10) shows that consumption of cereals, pulses, other vegetables, fruits, milk and milk products,

meat and poultry was inadequate among the subjects which was reflected in their low nutritional profiles. The intake of green leafy vegetables was adequate among male subjects and close to adequate levels in female subjects as consumption of preparations like Saag (mustard leaves and spinach) and methi (fenugreek leaves) was high during the period of survey in winter months. The intake of roots and tubers and sugar and jaggery was adequate in female subjects but was inadequate in male subjects. Fruits and meat and poultry group, being expensive were consumed in negligible amounts as most of the subjects belonged to low income groups. *Akkamahadevi et al (1998), Kumari and Singh (2003) and Prabhakaran (2003)* also revealed inadequate intake of these food groups in adolescents.

Table 10: Daily food intake of the subject

Food group(g)	Girls (N=50)			Boys (N=50)		
	Average intake Mean±S.D	Suggested intake*	% adequacy	Average intake Mean±S.D	Suggested intake*	% adequacy
Cereals	200±28.38	300	66.66	327±83.76	420	77.85
Pulses	28±11.96	60	46.63	31±8.46	60	51.67
Green leafy vegetables	83±70.41	100	83.00	102±86.33	100	102.00
Roots & tubers	104±59.34	100	104.00	113±50.73	200	56.50
Other vegetables	25±24.64	100	25.00	44±31.54	100	44.00
Fruits	8±20.95	100	8.00	8±20.44	100	8.00
Milk	272±117.30	500	54.32	425±234.4	500	85.00
Meat & poultry	0.66±2.35	50	1.32	5±16.85	50	10.00
Fats & oils	28±6.52	25	112.00	40±8.69	25	160.00
Sugar & jaggery	32±16.48	30	106.67	29±5.06	35	82.85

*ICMR (2003)

Table 11: Daily nutrient intake of the subjects

Nutrient	Girls (N=50)			Boys (N=50)		
	Average intake Mean±S.D.	RDA*	Per cent Adequacy	Average intake Mean±S.D	RDA*	Per cent Adequacy
Energy (kcal)	1647.29±376.34	2060	79.50	2128.59±369.14	2640	80.62
Protein (g)	47.46±9.80	63	75.49	69.76±11.01	78	89.43
Total fat(g)	52.29±13.09	69**	76.15	78.20±12.12	88**	88.86
Iron (mg)	22.93±5.04	30	76.66	27.43±4.13	50	54.86
Calcium (mg)	624.24±211.50	500	122.84	1250.7±88.41	500	250.00
Vitamin A (µg)	1034±637	600	172.33	1400±432	600	233.30
Thiamine (mg)	1.49±0.29	1.0	149.00	2.06±0.31	1.3	158.12
Riboflavin (mg)	0.89±0.48	1.2	74.15	1.16±0.52	1.6	72.50
Niacin (mg)	11.26±1.88	14	80.40	16.36±2.11	17	96.23
Folic acid (µg)	55.70±13.05	100	55.70	75.02±13.56	100	75.00
Vitamin B_{12} (µg)	0.31±0.007	0.2-1.0	50.00	0.51±0.003	0.2-1.0	83.60
Ascorbic acid (mg)	98.89±28.70	40	250.00	111.72±22.74	40	279.50

*ICMR (1989) **Based on 30% of energy from fats

Nutrient Intake

Table 11 shows data on daily energy and nutrient intake by the subjects'. The average daily intake of energy, protein, total fat, iron, riboflavin, folic acid and vitamin B_{12} were found to be inadequate as compared to recommended dietary allowances *(ICMR, 1989)*. The average intake of calcium, vitamin A, thiamine and ascorbic acid were adequate while that of niacin was marginally inadequate. The inadequate intake of protein, iron, folic acid and vitamin B_{12} could be linked to high prevalence rate of anemia as these are the elements required for hemoglobin formation. *Bains and Mann (2000), Bains et al (2003), Kumari and Singh (2003) and Shekhar (2004)* also reported lower intake of these nutrients.

Comparison and interrelationships among various parameters

Table 12: Comparison of anthropometric measurements of different income groups

Income per month (Rs)	Girls (N=50)				Boys (N=50)			
	N	Ht cm	Wt kg	BMI kg/m^2	N	Ht cm	Wt kg	BMI kg/m^2
<5000	30	159.8	46	17.5	24	169.3	58.8	20.76
5000 – 10,000	14	160.3	49	19.4	14	170.5	61.3	21.09
>10,000	6	161.0	53.2	20.9	12	171.3	68.6	23.08

Table 13: Comparison of hemoglobin levels of different income groups

Income per month (Rs)	Girls (N=50)		Boys (N=50)	
	N	Mean Hb (g/dl)	N	Mean Hb (g/dl)
<5000	30	8.84	24	10.12
5000 – 10,000	14	9.17	14	11.79
>10,000	6	9.0	12	10.90

Table 14: Comparison of hemoglobin levels with the prevalence of menstrual disturbances in female subjects

Menstrual disturbance	Girls (N=50)	
	N	Mean Hb (g/dl)
Normal	25	9.0
Dysmenorrhea	25	8.83
Menorrhagia	9	8.34
Polymenorrhea	2	9.5
Amenorrhea	6	8.6
Oligomenorrhea	9	8.83

Table 15: Relationship between hemoglobin levels and various anthropometric measurements

Anthropometric measurement vs	Girls (N=50) r	Boys (N=50) r
Height (cm)	+0.072	+0.732
Weight (kg)	+0.293	+0.366
BMI (kg/m^2)	+0.281	+0.078

The comparative data on anthropometric measurements (Table 12) and biochemical investigations (Table 13) revealed that mean height, weight, BMI and hemoglobin levels of the low income groups were lower than the middle and upper income groups.

The results on comparison between hemoglobin levels and menstrual disturbances (Table 14) revealed that female subjects having normal menstrual cycle had higher hemoglobin levels (9.0 g/dl) than the females with menstrual disturbances (8.83 g/dl).

The coefficient of correlation (r) between anthropometric measurements and hemoglobin levels (Table 15) showed that hemoglobin levels were positively correlated with anthropometric parameters of height, weight and BMI.

Table 16: Relationship between hemoglobin levels and food intake

Food group	Girls (N=50) r	Boys (N=50) r
Cereals	+0.641	+0.692
Pulses	+0.229	+0.373
Green leafy vegetables	+0.412	+0.520
Milk and milk products	+0.038	+0.210

Table 17: Relationship between hemoglobin levels and nutrient intake

Nutrients	Girls (N=50) r	Boys (N=50) r
Energy	+0.436	+0.662
Protein	+0.517	+0.651
Iron	+0.319	+0.439
Vitamin C	+0.365	+0.601
Folic acid	+0.017	+0.224
Vitamin B_{12}	+0.013	+0.581

A positive correlation was found between hemoglobin levels and intakes of

cereals, pulses, green leafy vegetables and milk and milk products (Table 16). The hemoglobin levels were also positively correlated with the intakes of energy, protein, iron, vitamin C, folic acid and vitamin B_{12} (Table 17).

Conclusion

The present study shows a positive correlation between hemoglobin levels and anthropometric measurements, food intakes and nutrient intakes. Anthropometric parameters of height, weight, BMI and hemoglobin levels of low income groups are lower than middle and upper income groups. Females with normal menstrual cycle have higher hemoglobin levels than females with menstrual disturbances. Overall females show poorer nutritional profile and higher prevalence of anemia as compared to the males. There is an urgent need for improving overall nutritional status of adolescents through nutrition education, community awareness and supplementation programmes. The need for regular blood tests to check hemoglobin levels is emphasized. Nutrition component needs to be included in the school curriculum.

References

ACC/SCN 1987. First report on the world nutrition situation.36-39.A report compiled from information available to UN agencies.

Bains, K. and Maan, S. K. 2000. Sub-clinical iron deficiency – A major factor in reducing physical fitness of young women. *Ind. J. Nutr. Dietet.* **37:** 296 – 300.

Bains, K., Singh, I. and Kaur, R. 2003. Impact of nutrition education on nutrition of rural adolescent girls belonging to western plain zone of Punjab. *J. Res. PAU* **40:** 126 – 131.

Beard, J. L. 2000. Iron requirements in adolescent females. *J. Nutr.* **130:** 440S – 442S.

Beard, J. L. 2005. Maternal iron deficiency anemia: Post partum emotions and cognition. *J. Nutr.* **135:** 267 – 274.

Gopalan, C., Ramasastri, B. V. and Balasubramaniam, S. C. 1989. Nutritive value of Indian Foods. 47 - 67. *Indian Council of Medical Research,* National Institute of Nutrition, Hyderabad, India.

Ghosh, K., Mukherjee, M.B, Shankar, U., Kote, S.L., Nagtilak, S.B., Kolah, R.B., Surve, R.R., Tamankar, A.A., Mohanty, S.S. 2002. Clinical examination and hematological data in asymptomatic apparently healthy school children in a boarding school in a tribal area of Maharashtra. *Ind. J. Pub. Health.* **46:** 61 – 65.

ICMR. 1989. Nutrient requirements and recommended dietary allowances for Indians. A report of expert group of *Indian Council of Medical Research.* **129.** National Institute of Nutrition, Hyderabad, India.

ICMR. 2003. Dietary Guidelines for Indians. A manual of Indian Council of Medical Research. 12. *National Institute of Nutrition, Hyderabad, India.*

Jain, S. 2005. Menstrual disorders in adolescents. *Zonal Conference of NOGSI on Adolescence.* 23 – 25. Government Medical College, Patiala, India.

Jaishree, P. J., Reddy, S. and Vijaya, N. M. 2001. Nutritional status of school going adolescent girls of Parbhani. *Ind. J. Nutr. Dietet.* **38:** 262 – 267.

Jelliffe, D. B. 1966. The assessment of nutritional status of the community. 50 – 84. *WHO Monograph Series* **No. 53.** Geneva.

Joseph, G. A. and Senehlata. 1997. General and reproductive health of adolescent girls in rural South India. *Ind. Pediatr.* **34:** 243 – 251.

Kaur, P., Kaur, G. and Sarita. 2005. Changing trends and factors affecting age of menarche at Patiala. *Zonal Conference of NOGSI on Adolescence*. 58. Government Medical College, Patiala, India.

Kumari, S. and Singh, S. 2003. Nutritional status of schedule caste adolescents from deprived section of society. *Ind. J. Nutr. Dietet.* **40:** 147 – 152.

NCHS. 1987. Anthropometric reference data and prevalence of overweight. 87 – 88. *US Vital and Health Statistics, Series* ***11:*** No. 238.

NIN. 1986. Anemia and endurance capacity. Annual Report. *Indian Council of Medical Research.* National Institute of Nutrition, Hyderabad, India.

Palta, A. and Gurwara, N. 2003. Hemoglobin and cardiovascular efficiency of adolescent girls. *Ind. J. Nutr. Dietet.* **40:** 327 – 332.

Prabhakaran, S. 2003. Nutritonal status of adolescent girls residing in a University Hostel. *Ind. J. Nutr. Dietet.* **40:** 274 – 279.

Shardha, R. V. and Matheen, S. 1996. Nutritional status of adolescent girls and food craving during menstruation. *Ind. J. Nutr. Dietet.* **33:** 266 – 269.

Shekhar, A. 2004. Current iron status of girls and its effect on work performance. XXXVII Annual National Convention. **103:** *Indian Dietetic Association, AIIMS*, New Delhi, India.

Srijaya, M. and Jhansi, R. P. 2003. Energy balance in selected anemic adolescent girls. *Ind. J. Nutr. Dietet.* **40:** 84 – 90.

Tewari, K. and Seshadri, S. 2000. The prevalence of anemia and morbidity profile among school going adolescent girls of urban Kathmandu, *Nepal. J. Nep. Med. Assoc.* **39:** 319 – 325.

WHO, 1972. Nutritional anemias. *Tech. Rep. Ser.* **503:** 21. World Health Organisation. Geneva.

Effect of Rock Climbing Training on Strength, Speed and Endurance

Kasundra[1] P. M., Jethwa, Y. L.[2]

[1]Associate Professor. Mahadev Desai Sharirik Shikshan Mahavidyalaya – Sadra Gujarat Vidyapith, Gujarat.
[2]Mahadev Desai Sharirik Shikshan Mahavidyalaya – Sadra, (Honorary Instructor) SVIM Mount Abu, Rajsthan.

Abstract

The aim of this study was to determine the effect of 28 Days Rock Climbing Training Program on physical fitness components such as strength endurance of shoulder and abdominal muscles, speed and endurance. Trainees of 72-Coaching Course (N=22, Male, Age Range = 16-27 yrs) were selected as the subjects for the study. Pull Ups, Sit Ups, 50 Yard Dash and $1\frac{1}{2}$ Mile Run/Walk tests were respectively used to measure selected variables. By comparing pre and post test data, at 0.05 level; significant differences were found in strength endurance of shoulder muscles ('t'= 2.19), strength endurance of abdominal muscles ('t'= 10.25), speed ('t'= 9.82), and endurance ('t'= 6.83). Here strength endurance of abdominal muscles and shoulder muscles, and endurance improved significantly while speed decreased. It is recommended that improvement in climbing performance is best explained by trainable variables such as shoulder and forearm strength and endurance; furthermore strength and conditioning programs should not be viewed as a replacement of climbing but rather as supplementary during courses.

Key Words: **Rock Climbing Training, Strength Endurance, Shoulder & Abdominal Muscles,**

Introduction

Mountaineering as a sport consists of ascending and descending mountains under the climber's own power. At one end are the relatively gentle climbs for which climbers need little of equipment; at the other are ascents of the world's highest and most daunting peaks, involving months and years of preparation. Mountaineering and its companion sport, rock climbing is simultaneously recreational and competitive. They are recreational in the sense that most climbers climb for love of the sport, but competitive when climbers seek to climb first, highest, or by a new route. In recent years, both men and women have adapted mountaineering and rock-climbing techniques to indoor-sport climbing on vertical surface.

The sport of rock climbing evolved from this ancient tradition of climbing mountains. Climbing skills and techniques were developed by mountaineers attempting to climb the lower, steeper mountains and cliffs. Safety equipment was finally introduced in the early 1900's, and the development of light weight shoes, improvements in equipment design, and artificial climbing aids during the 1960's enabled climbers to focus more on style and technique. To meet the demands of this growing sport, climber needs some sort of physical and mental toughness like other sports.

A sport performance depends on at least 5 components: energetic capacity, consisting of an anaerobic and aerobic part, tactics, technique, and motivation of the sportsmen for maximum use of their potentials on the sporting field *(Balabinis et al, 2003; Rodio et al, 2008; Gacesa et al, 2009).* All these components represent complex functional systems, which are created and modified during physical activities. The quality of these interactions determines sport result. Because of the different influences that each component

has on sport performance and results, every sport discipline must be observed individually. When it comes to physical fitness required for climbing, strength and power are two vital factors for successful performance. Researches have shown that success in climbing performance is best explained by trainable variables such as shoulder strength and endurance, forearm strength and endurance, and maximum grip strength, rather than anthropometric characteristics such as height and weight. To achieve this level of physical fitness one require increase in the duration of a specific exercise movement i.e. pull-ups slowly and concentrate on duration rather than the number of pull-ups.

Materials and Methods

Trainees of 72 Coaching Course were studied at baseline and after the completion of training. The core of the study was to determine the effects of 28 days of Rock Climbing Training Program on Strength Endurance of Shoulder Muscles and Abdominal Muscles, Speed and Endurance. Twenty two male trainees (age range 16 to 27 years) were selected as the subjects for the study who joined the Rock Climbing Coaching Course during the summer of 2010. Selected variables were assessed respectively by Pull ups test; 1 min Sit ups test, 50 Yard Dash and $1\frac{1}{2}$ Mile Run/Walk Test. Life style and health related habits of an individual were the limitations of the study. Rocks climbing being an adventurous sport, subjects were likely to be prone to physical hazards. Injury or ill health during tests was uncontrolled which might affect the performance. It was hypothesized that 28 days training program affects Strength Endurance of Abdominal Muscles and Shoulder Muscles, Speed and Endurance.

Training Schedule

No	Day/ Session		Part of Training Session its contents	Remark
1	Day 1st	1st	Jogging for 20 minutes & acclimatization walk	
		2nd	Climbing practice	Basic level
		3rd	Rappelling practice	Basic level
2	2-3-4	1st	Jogging & running for 25 minutes. Warm up exercises & climbing practice	Basic level
		2nd	Climbing practice	Basic/ Advance level
		3rd	Rappelling practice	Basic level
3	5-10	1st & 2nd	Conditioning & team-climbing on Arbuda Wall	Advance level
		3rd	Over hang – Rappelling practice	Basic/advance
4	11	-	One day night halt	
5	12	1st & 2nd	Climbing unknown rocks	
		3rd	Knots practice & night track	
6	13-14		Alternate leading on Arbuda Wall	Advance
		3rd	Over hang Rappelling (Toad Rock)	Advance
7	15	1st & 2nd	Rest & lecture	
		3rd	Rappelling	Advance
8	16-18		Night Halt	
9	19		Climbing unknown rocks	
10	20-21		Artificial climbing	Advance/Technical
11	22-24		Arbuda wall climbing	Advance
12	25		Building Climbing, Penetration, & Building Rescue	Advance/Technical
13	26-27		Climbing & Rappelling practice	
14	28		Climbing practice & Examination	

Generally, training schedule was divided into three sessions, two in the morning; each of two hrs and one in the evening of two and half hrs duration. From 22-26 selected trainees were assigned for apprenticeship. Each regular morning session consisted of warm-up exercises for 20 to 30 minutes.

Analysis of Data

For the statistical procedure paired t-test (one tailed test) was used to test the hypothesis. The significance level was 0.05.

Test Criteria:

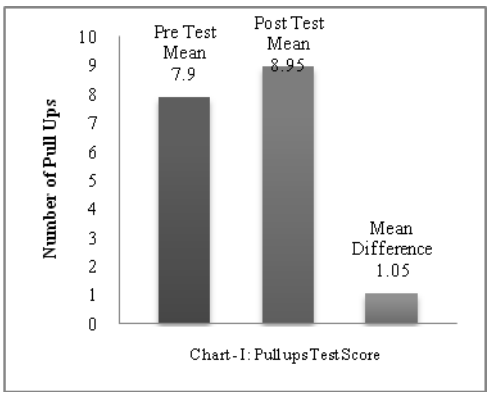
No	Test	Variable	Unit of Measurement
1	Pull Ups	Strength Endurance of Shoulder Muscles	Number of Pull Ups in one attempt
2	Sit Ups	Strength Endurance of Abdominal Muscles	Number of Sit Ups in 6o Sec.
3	50 Yard Dash	Speed	Sec.
4	1½ Mile Run/Walk Test	Endurance	Minutes:Secs

Results & Discussion

Table 1: Effects of 28 days of Rock Climbing Training Program on Strength Endurance of Shoulder, Abdominal Muscles, Speed and Endurance

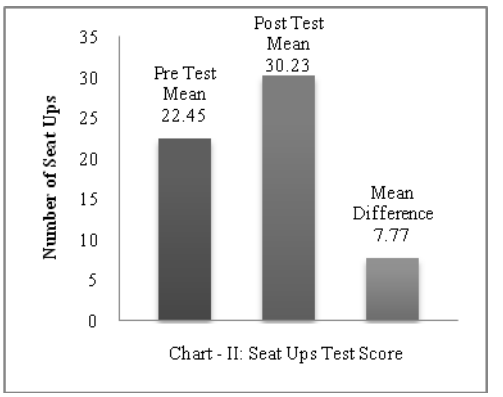
Test	Pre Test Mean	Post Test Mean	Mean Difference	SD	't' Ratio
Pull Ups	7.90	8.95	1.05	2.24	2.19*
Sit Ups	22.45	30.23	7.77	3.55	10.25*
50 Yard Dash	7.25	8.18	0.94	0.45	9.82*
1½ Mile Run/Walk Test	12.20	10.52	1.68	1.15	6.83*

t 0.05 (21) = 1.721

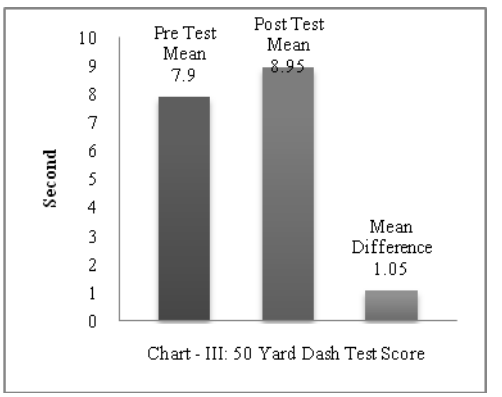


Analysis of the pretesting and post testing performance score showed significant improvement in Pull Ups test. t is observed to be 2.19 with the mean difference of 1.05 (chart I).

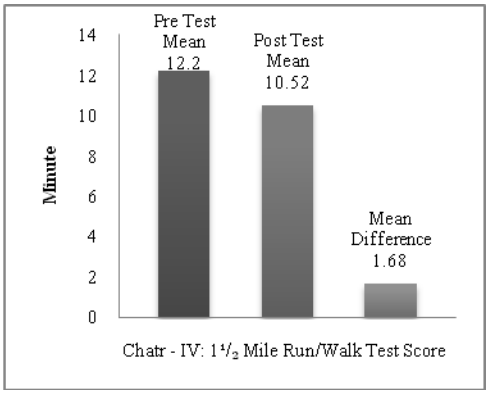
Analysis of the pretesting and post testing performance score showed significant improvement in Sit Ups test. t was found to be 10.25 that is highly significant in statistical terms with the mean difference of 7.77 (chart II).



Analysis of the pretesting and post testing performance score showed significant improvement in 1½ Mile Run/Walk test. t is observed to be 6.83 with the mean difference of 1.68 significant statistically (chart IV).



There was a significant decline in speed test performance from pre test to post test. t value was observed to be 9.82 with mean difference of 0.45 (chart III).



The results of the study reveal that 28 days of Rock Climbing Training Program lead to significant improvements in strength-endurance of shoulder and abdominal muscles, while speed decreased significantly. Concurrent strength and endurance training seems to have caused compromise between strength gains and the ability to produce explosive movements. Possible reasons for compromise in strength-power adoptions with concurrent training are an increased likelihood of differences in the organization of neuromuscular recruitment patterns; alterations in the concentrations of various hormones and differences in activation or repression of various anabolic-catabolic processes at the muscular level; and shifts in protein isozymes such as myosin. Some researches suggest that strength training may enhance endurance performance, although there are reasons to believe that resistance training can also be detrimental. Further research is necessary to determine the extent to which strength adaptations are compromised with concurrent training, and the mechanisms by which combined training negatively affects strength. It is recommended that improvement in climbing performance is best explained by trainable variables such as shoulder and forearm strength and endurance; furthermore strength and conditioning programs should not be viewed as a replacement of climbing but rather as supplementary during courses.

Practical Applications

The muscles that tend to get tight after long hikes with a loaded pack are hips, lower back, calves, quads, glutes, hip flexors, shoulders and hamstrings, all to the varying degrees depending on individual body types. The forearms and fingers tend to experience the most exertion and fatigue during vertical climbing, particularly the flexors. Good muscular-endurance and strength of the arms and shoulders are beneficial for climbing. Results of the study may be helpful to the rock climbing coaches to evaluate the training program. Furthermore the study may be helpful to redesign the training program in accordance with the required level of physical fitness for this particular activity. The study may be helpful to motivate and guide new comers for such activity.

Acknowledgement

The researchers wish to thank the Swami Vivekananda Institute of Mountaineering, Mount Abu for the grant of permission to conduct this research. The researchers are also indebted to the faculty members of Mahadev Desai Sharirik Shikshan Mahavidyalaya – Sadra, Gandhinagar, Gujarat for their guidance and encouragement.

References

Balabinis, C.P., Psarakis, C.H., Markos Moukas, M., Vassiliou, M.P., Behrakis, P.K. 2003: Early Phase Changes by Concurrent

Endurance and Strength Training. *J. of Str. & Cond. Res*. **17(2):** 393-401

Green, Jaxkson G and Stannard, Stephen R. June 2010: Active Recovery Strategies and Handgrip Performance in Trained vs. untrained climbers. *J. Stren. & Condit. Res*. **24(6):** 1705

Gacesa, P.; Jelena Z; Barak, O. F; Grujic, Nikola, G. 2009: Maximal Anaerobic Power Test in Athletes of Different Sport Disciplines. *J. Stren. & Condit. Res*. **23(3):**751-755.

Christensen, K., Guttmann, A., Pfister, G. 2001: *International Encyclopedia of Women and Sports – Volume II*, Macmillan Reference. USA pg no – 760

Martino, M., Myers, K., & Bishop, P. 1995: Effects of 21 days training at altitude on sea-level anaerobic performance in competitive swimmers. *Med. and Sci. Sports and Exerc*., 27 Supplement, (Abstract 37)

Rodio, A.; Fattorini, L.; Rosponi, A.; Quattrini, Fi. M. & Marchetti, M. 2008: Physiological Adaptation in Noncompetitive Rock Climbers: Good for Aerobic Fitness? *J. Stren. & Condit. Res*. **22(2):** 359-364.

Effect of Electrical Muscle Stimulation on Reducing Fat from the Body

Sharma[1], P., Lehri[2], A. & Verma[3], S.K.
[1]Research Scholar, Department of Sports Science, Punjabi University, Patiala-147002, Punjab
[2]Assistant Professor, Department of Sports Science, Punjabi University, Patiala-147002, Punjab
[3]Professor, Department of Sports Science, Punjabi University, Patiala-147002, Punjab

Abstract

The study was conducted on 120 healthy female volunteer subjects. The volunteers were taken from Patran city of Punjab and the various departments of Punjabi University, Patiala, Punjab. All volunteers were adults within the age range of 20 to 40 years who have Body Mass Index (BMI) >27. All the anthropometric measurements like Weight, height, thickness of skinfold from biceps, triceps, subscapular, suprailiac and abdominal sites were measured on the subjects belonging to four groups, following standard techniques given by *Weiner & Lourie (1969)* before the start of the program, after two weeks and at the end of the four weeks. To the first group of females that was used as the control of the study, no intervention was given to these subjects. To the second group of females was given Interferential Therapy (IFT) only, while the third group of females was given both hot water application and (IFT). Fourth group of females was administered supervised aerobic exercise programme on treadmill / brisk walking in the laboratory. Interferential therapy (Intensity-as tolerated by the subject, Frequency- 4000 Hz ; Beat Frequency –swing mode, time of swing-12 secs, Pattern of swing; method 4Pole vector; Total treatment time-20-30 min) was given to the second and third groups. It was concluded that Fat deposition and Skinfold thickness was reported minimum in Group-IV followed by Group -III and Group-II and maximum in Group - I After given treatment body fat was decreased in Group-II, Group-III, and Group- IV. Maximum fat reduction was seen by IFT machine and IFT + hot water application. The results have shown significant differences among four groups. It has been concluded that % body fat was found less after the treatment.

Key words: Body Mass Index, Skinfold Thickness, Interferential Therapy, Hot Water Application, Aerobic Exercise Program

Introduction:

Obesity is defined as a condition in which excess body fat is accumulated. The practical and clinical definition of obesity is based on the Body Mass Index (BMI expressed as weight (in kg)/height (in m^2). It is generally agreed that a BMI of greater than 30 is indicative of obesity, while a BMI of 25.0-29.9 is suggestive of overweight in an individual. BMI ranging from 18.5 to 24.99 is considered normal. Obesity is increasing at an alarming rate throughout the world and has become a global problem.

In the public health arena, obesity constitutes one of the important medical and public health problems *(Berke and Morden, 2000).* Modernisation has led to over abundance of foods rich in fats along with decrease in physical activity of people leading to conditions that favour obesity. By definition, obesity refers to a condition of building up of body fat beyond that deemed normal for the age, sex, body type of a given individual. Obesity is not only related with a number of health problems but with psychological problems also *(Wadden and Foster, 1992; NIH, 1992; Bray et al, 1996; Food and Drug Administration, 1996; Centers for Disease Control and Prevention, 1997; Connolly et al, 1997).*

Obese people suffer from guilt, depression, anxiety and low self-esteem. In addition to this there is increased

incidence of high blood pressure, increased level of cholesterol and other lipids in the blood, increased diabetes and colon cancer, liver ailments, mechanical difficulties particularly back and foot problems in obese and overweight subjects *(Lew and Garfinkel, 1979; Larsson et al, 1981; Hubert et al, 1983; Dyer and Elliott, 1989; Chute et al, 1991; Stampfer et al, 1992).*

Various electrotherapy modalities e.g. ultrasound, short wave diathermy and interferential therapy are also used by the health and obesity clinics world over to counter obesity *(Anderson & Wadden 1999; Klein 2000; Jakicic et.al, 2001).* These clinics are commercially exploiting the people by assuring them fast fat reductions. It is claimed by these professionals that Electrical Muscle Stimulation (EMS) leads to faster and greater weight loss form the fat compartments of the body. The scientific validity of such claims direly needs to be ascertained. Electrical stimulation is effectively used in physiotherapy clinics to provide a situation whereby there is an electrical generation of action potentials; giving rise to therapeutically significant physiological responses e.g. increased muscle strength, stimulated lymph and blood flow, analgesia, kinesthetic awareness and autonomic nervous system responses. It is believed by these clinics that EMS initially breaks the fatty capsule that covers the muscle, improves blood supply to the muscles, and then helps it to gain the lost tone to return to its original size. This return to size and tone gives the abdominal muscles the strength to crumble the fatty capsule from the inside, through their contractions *(Bailey, 1976).* There are four different types of electrical muscle stimulations. These are regular EMS, transdermal electrical neural stimulation (TENS), interferential (IFT) and Russian muscle stimulation. Out of these, IFT has the ability to stimulate (a) large number of muscle fibers for greater muscular work (b) parasympathetic nerve fibers for causing increased blood flow in the region and (c) deeper tissues at the stimulated sites. According to *Gersh (1992)* and *Hayes (2000)* neuromuscular electrical stimulation increases metabolic demand through activating the muscle pump around the circulation network. They recommend that a low frequency of 20-30 pps with 10- 30% of maximal effort up to 10- 30 minutes duration is most effective.

It is thus pertinent to explore the EMS through interferential currents to counter the problem of overweight as well as disturbed fat profiles in the people. In this context the present study has been undertaken on females ranging in age 20–40 years to explore the impact of EMS-Interferential program on weight loss as well as the shedding of fat from the abdominal region, so as to reduce the health risks.

Material & Methods

The study was conducted on 120 obese females possessing BMI greater than 27. The subjects were selected in the age range of 20 to 40 years and divided into four equal groups. The subjects were divided into four different groups. The subjects were taken from the Patiala district. Anthropometric measurements were taken before starting the treatment, after two weeks and then after four weeks from the treatment.

Group I - Control (N=30)

Group II - IFT (N=30)

Group III - IFT+Hot application (N=30)

Group IV - Aerobic Exercises (N=30)

To the first group no intervention was given, it acted as a control group of the study. To the second group was given Interferential Therapy (IFT) only, while the third group of females was given both hot water application and (IFT). Fourth group of females were administered supervised aerobic exercise programme on treadmill/brisk walking in the laboratory 4 days/week. Interferential therapy (Intensity-as tolerated by the subject to produce observable contractions; Frequency- 4000 Hz ; Beat Frequency – swing mode, time of swing-12 secs, Pattern of swing; method 4 Pole vector; Total treatment time-20-30 min.) was given to the second and third groups for 3 days/week. The aerobic group of females was administered 30 minutes of aerobic exercise on treadmill at 50-70% of the individual's maximum heart rate as per Karvonen's procedure described by *Verma & Mokha (1993).*

At a time, only 12 subjects were selected and longitudinally followed for four weeks time. Weight, height, thickness of skinfold from biceps, triceps, subscapular, suprailiac and abdominal sites were measured on the subjects following standard techniques given by *Weiner & Lourie (1969)* before the start of the program, after two weeks and at the end of the four weeks. Of the 12 subjects, three were given only interferential therapy at abdominal region for 20 minutes, and another three subjects were first given 10 minutes of hot water bottle application in the abdominal region at 40 degree C followed by 20 minutes of IFT in the same area. The IFT treatment was administered to the subjects three times a week. Yet, another three subjects were given aerobic exercise programme three times a week for four weeks duration. Rest of the three subjects acted as control for study. The statistical test viz., mean, standard deviation, standard error of mean were applied on the data, Anova was applied on the data, Post hoc test for significant mean differences and Paired 't' test have also been applied.

Results & Discussion

Table 1 shows the Mean, SD and SEM of % body fat before starting the programme, after two weeks and after four weeks from the programme which was given to the subjects for fat reduction. Before starting the programme maximum mean value of % body fat was found in (IFT i.e. Group-II) (41.07%) followed by (Control Group i.e. Group – I) and (IFT + Hot water group i.e. Group-III) and minimum in (Aerobic group i.e. Group-IV) (37.71). After two weeks from the programme maximum mean value was found in Group-I (41.12%) and lower mean values of % body fat were observed in all the experimental groups but in case of the control group the mean value was found to increase. After four weeks mean value of % body fat was observed to decrease nearly 2 to 3% in Group - II (39.34), Group III. (38.04) and Group IV (36.48). The mean changes in % body fat after the programme were found to be significant in the Interferential therapy group and support the finding of *Bailey, (1976)* and similarly the effect of IFT+ hot application and Aerobic Exercises on percent body fat has also been found to be statistically significant.

It is evident from the results enlisted in tables 1 & 2, that four weeks of intervention may it be aerobic; IFT or IFT+ hot application was able to reduce % body fat. However IFT+ hot

application intervention was successful in reducing fat % to a relatively greater degree than the other interventions namely the aerobic or the IFT. The study necessitates future explorations on individuals possessing varying amounts of body fat.

Table-1: Comparison of % body fat among four different females group before staring the programme, after two weeks and after four weeks

	Group	N	Mean	SD	SEM
% body fat before starting programme	Control	30	40.61	1.43	0.26
	IFT	30	41.07	1.61	0.29
	IFT+ hot water application	30	39.24	1.67	0.31
	Aerobic exercises	30	37.71	1.46	0.27
	Total	120	39.66	2.02	0.18
% body fat After two weeks	Control	30	41.12	1.35	0.25
	IFT	30	40.57	1.56	0.28
	IFT+ hot water application	30	38.51	1.75	0.32
	Aerobic exercises	30	37.07	1.56	0.28
	Total	120	39.32	2.24	0.20
% body fat after four weeks	Control	30	40.96	1.41	0.26
	IFT	30	39.34	2.34	0.43
	IFT+ hot water application	30	38.04	1.85	0.34
	Aerobic exercises	30	36.48	1.56	0.29
	Total	120	38.70	2.45	0.22

Table-2: Paired' test results for the different groups

GROUP	Before V/S After Two Weeks			Before V/S After Four Weeks			After Two Weeks V/S After Four Weeks		
	Mean Diff	SD	't'	Mean Diff	SD	't'	Mean Diff	SD	't'
Control	0.51	0.98	2.84	0.35	1.24	1.53	0.16	0.82	1.06
IFT	0.50	0.57	4.83*	0.50	1.50	6.33*	1.23	1.45	4.65*
IFT + hot water application	0.73	0.39	10.23*	1.20	0.56	11.72*	0.47	0.28	9.18*
Group Aerobic	0.64	0.37	9.47*	1.23	0.32	20.91*	0.60	0.36	9.16*

*significant at 0.05 % level

References

Anderson, D.A. & Wadden, T. A. 1999. Treating the obese patient. *J. Am. Med. Assoc.* **8:** 156-167

Bailey, H. R. 1976. Localized tissue reduction. *Med. J. Australia*, **1:** 7

Berke, E.M., Morden, N.E. 2000. Medical management of obesity. *Am. Fam. Phys.*, **62:** 419–26

Bray, G.A., Ryan, D.H., Gordon, D., Heidingsfelder, S., Cerise, F., Wilson, K. A 1996. Double-blind randomized placebocontrolled trial of sibutramine. *Obes. Res.*, **4:** 263-270

Centers for Disease Control and Prevention. 1997. Cardiac valvulopathy associated with exposure to fenfluramine or dexfenfluramine: U.S. Department of Health and Human Services interim public health recommendation, *MMWR Morb. Mortal. Wkly Rep.*, **46:** 1061-1066

Chute, C.G., Willett, W.C., Colditz, G.A., Stampfer, M.J., Baron, J.A., Rosner, B. et al 1991. A prospective study of body mass, height, and smoking on the risk of colorectal cancer in women. *Cancer Cause Control.* **2:**117-124.

Connolly, H.M., Crary, J.L., McGoon, M.D., Donald, D., Hensrud, M.D. et al. 1997.

Valvular heart disease associated with fenfluramine-phentermine. *N. Engl. J. Med.*, **337:** 581-588.

Dyer, A.R., Elliott, P. 1989. The INTERSALT study: relations of body mass index to blood pressure. INTERSALT Co-operative Research Group. *J. Hum. Hypertens.*; 3:299-308.

Food and Drug Administration. 1996. Draft guidance clinical evaluation of weight control drug. Rockville, MD: FDA.

Gersh MR. 1992. Electrotherapy in Rehabilitation. FA Davis, Philadelphia.

Hayes K W. Manual for physical Agents. Upper Saddle River, NJ: Prentice Hall 2000.

Hubert, H.B., Feinleib, M., McNamara, P.M., Castelli, W.P. 1983. Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-up of participants in the Framingham Heart Study. *Circulation*, **67:** 968-977.

Jakicic, J. M.; Clark, K., Coleman, E., Donnelly, J.E., Foreyt, J., Melanson, E., Volek, J., Volpe, S, L. 2001. Appropriate intervention strategies for weight loss and prevention of weight regain for adults. Am. Collg. Sports Med., **33:** 2145-2156

Klein, S. 2000. Medical treatment of obesity. *Problems in General Surgery*, **17(2):** 1-6

Larsson, B., Bjorntorp, P., Tibblin, G. 1981. The health consequences of moderate obesity. *Int. J. Obes.*, **5:** 97-116.

Lew, E.A., Garfinkel, L. 1979. Variations in mortality by weight among 750,000 men and women. *J. Chronic Dis.*, **32:** 563-576

NIH Technology Assessment Conference Panel. 1992. Methods for voluntary weight loss and control. *Ann. Intern. Med.*, **116:** 942-949.

Stampfer, M.J., Maclure, K.M., Colditz, G.A., Manson, J.E., Willett, W.C. 1992. Risk of symptomatic gallstones in women with severe obesity. *Am. J. Clin. Nutr.*, **55:** 652-658

Verma, S. K. & Mokha, R. Your Exercise Programme HLS-Vol. II. ESPS, Patiala.

Wadden, T.A., Foster, G.D. 1992. Behavioral assessment and treatment of markedly obese patients. *In:* Wadden, T.A., VanItallie, T.B., eds. *Treatment of the Seriously Obese Patient.* New York: Guilford Press., 290-330.

Weiner, J.S. and Lourie. 1969. Human Biology–A guide to Field method Handbook No. 9. Blackwell Scientific Publications, Oxford, Edin.

A Study of Body Mass Index in Relation to Motor Fitness Components of School Going Children Involved in Physical Activities

Sharma[1], R. and Nigam[2], A. K.
[1]Grade-I Gymnastic-Coach, S.A.I Traning Centre, Department of Sports and Youth Welfare, District Sports Complex, Bilapur (C.G.), India.
[2]Assistant Professor Department of Physical Education, Guru Ghasidas Central University Bilaspur (CG), India.

Abstract

The purpose of the study was to evaluate and compare the motor fitness in relation to Body Mass Index of school going children involved in physical activities. One hundred school going male children of 9th and 10th grade were selected to serve as subjects for this study. The researcher divided the entire 100 sample into three groups. i.e. Low BMI (N=25), middle BMI (N=50) and High BMI (N=25) groups, which were compared with each other. All the subjects were tested on Chin ups, Vertical Jump, Shuttle Run, Sit and Reach and BMI (Body Mass Index). In order to find out the significance of differences between the three BMI groups male children, mean, standard deviation, quartile deviation (Q1 and Q3) and t-ratio were computed. The results of the study revealed non significant differences between Low BMI and High BMI groups in their vertical jump, flexibility, chin-ups components of motor fitness. Low BMI group children were however found to be better in muscular strength, speed, and agility and similar on flexibility compared to high BMI group children. Low BMI group was also better on speed and agility components of motor fitness than the middle BMI group children and was similar in other components of fitness. Whereas, middle BMI group children were superior on muscular strength, speed, and agility and similar on vertical jump and flexibility components of fitness in comparison to high BMI group children.

Key words: Body Mass Index, Motor Fitness Components

Introduction

The term motor fitness is most often used synonymously with physical fitness by the coaches but it is very important for the physical education students to understand the basic difference between physical fitness and motor fitness. Physical fitness is used to denote only the five basic fitness components (muscular strength, muscular endurance, cardiovascular endurance, freedom from obesity and flexibility), whereas motor fitness is a more comprehensive term, which includes all the ten fitness components including additional five motor performance components (power, speed, agility, balance and reaction time), important mainly for success in sports. In other word, motor fitness refers to the efficiency of basic movements in additional to the physical fitness *(Kansal, 1996).*

Physical educators, exercise physiologists, and physicians have proposed many tests to demonstrate the effect of such programs. These tests have generally been labeled "Motor Fitness Test" "Physical Fitness Tests" and

"Cardiovascular Tests". Additional tests have been developed by many colleges and universities. With so many groups and individuals promoting different fitness test, the practitioner my easily become confused especially when the same items appears in both motor and physical fitness tests. Thus one might ask whether there is a difference between motor fitness and physical fitness. Are the dimensions of fitness equally relevant to all the people of all ages? Obviously, the nature of fitness- what it means to the participant the type of fitness activities selected, the intensity and duration of exercise- vanes with aging among school children through adulthood, the middle age, and old age. In other words, finesses is specific to the needs of different populations. This is reflected in the perennial question. "Fitness for what?"

The importance of an optimal level of physical fitness as a reflection of certain aspects of health was demonstrated by the work of *Kraus and Raab (1961)* on hypo-kinetic diseases, or diseases directly related to a lack of exercise. These physicians identified low back pain, foot problems, abdominal posies, obesity, hypertension, and degenerative cardiovascular diseases as conditions produced by sedentary life-styles in our affluent, tension-producing society. Thus the concept of physical fitness does convey a meaning of healthful living. Because heart disease, stroke and circulatory disorders are still primary causes of poor fitness is highly relevant for all people. Sedentary people suffer a higher incidence of coronary heart diseases than active persons *(Morris et. al. 1973., Paffenbarger & Hale 1991).* Thus attaining a desirable level of physical fitness is an important aspect of preventive medicine because physical inactivity appears to be related to the coronary heart disease. Recent longitudinal data shows that Harvard alumni who expend 2000 calories a week in vigorous exercise during their life span will increase the quality of life as well as live one or more years longer than sedentary persons. For most young participants however a physical fitness test is one that attempts to measure the efficiency of both the muscular and cardiovascular systems.

Body Mass Index (BMI) is a ratio of total body weight to height. Several ratios have been proposed, but one used most frequently. Weight (in kilograms) divided by height (in meters) square [$weight, kg/ht, m^2$ (kg/m^2)]. Calculated BMI can then be compared against standard value to determine whether the individual has acceptable body weight, is overweight, or is obese. Risk of increased mortality from high values of body mass index (BMI) is described by a J – shaped curve. BMI value from 15 to 25 represents no excess mortality risk and over 40 a high risk of great mortality. *(Brary, 1985).*

The purpose of the present study was to evaluate and compare the motor fitness and Body Mass Index of school going children of D.P.S. Public school"

Materials & Methods

One hundred school going male children of 9th and 10th grade who volunteered to participate in this study, were selected to serve as subjects for this study. The subjects were in age group of 13 to 16 years. All the subjects' were selected from the 9th and 10th grades of Delhi Public School, Bilaspur (CG). The subjects were explained about the purpose of study in the

presence of their school physical education teachers and Principal to elicit active cooperation from the subject. All the subjects were tested on Chin ups, Vertical Jump, Shuttle Run, Sit and Reach and BMI (Body Mass Index) and scoring of data for each test was done following standard techniques as described by *Kansal (1996)*.

All the tests were administered at Delhi public school, Bilaspur (CG) playground.

Results & Discussion

To verify the hypotheses, Q1 and Q3 of BMI were calculated. Q1 score of BMI is 19.57, it means subject were having > 19.57 or 19.57 and < 24.56 or 24.56 for high BMI group and the subject whose BMI calculated between Q1 and Q3 were in middle BMI group.

The researcher divided the entire 100 sample into three groups on basis of calculated quartile deviations (Q1 and Q3). Subjects having BMI values between Q_1 and Q_3 were put in the middle BMI group (N=50). Subjects possessing BMI values > Q_3 were put in High BMI group (N=25) while those having BMI values < Q_1 were assigned to the low BMI group (N=25).

In order to find out the significance of differences between middle BMI and high BMI of school going children means, standard deviations, quartile deviation (Q1 and Q3) and t-ratios were computed. To check the obtained F-ratio and t-ratio, the level of significance was set at 0.05 level and data pertaining to this have been presented in Tables 1 to 4.

Table No. 1: Descriptive Statistics of Body Mass Index (BMI) on various components of motor fitness of school going male children of IX and X Grade

	LOW BMI (N=25)		AVERAGE BMI (N=50)		HIGH BMI (N=25)	
	Mean	SD	Mean	SD	Mean	SD
Vertical Jump	35.10	7.51	35.76	7.49	35.54	8.21
Chin ups	7.88	1.70	7.1	2.66	5.00	1.66
Shuttle run	12.44	0.89	12.90	0.70	13.72	0.89
Sit and Reach	2.96	1.81	3.00	1.87	2.76	1.71

Table No. 2: Significance of differences between mean scores of middle and high BMI of school going male children on various components of motor fitness

MOTOR FITNESS	BMI GROUPS	MEAN	MD	DM	T-RATIO
Vertical Jump	Middle	35.76	0.22	0.024	0.11
	High	35.54			
Chin ups	Middle	7.10	2.10	7.603	3.62*
	High	5.00			
Sit and Reach	Middle	3.00	0.24	0.125	0.54
	High	2.76			
Shuttle Run	Middle	12.90	0.82	3.952	4.82*
	High	13.72			

Significant at .05 level, $t_{.05}(73) = 1.99$

Table 3: Significance of differences between mean scores of low and high BMI of school going male children on various component of motor fitness

MOTOR FITNESS	BMI GROUPS	MEAN	MD	DM	T-RATIO
Vertical Jump	Low	35.10	0.44	0.094	0.19
	High	35.54			
Chin ups	Low	7.88	2.88	17.51	6.08*
	High	5.00			
Sit and Reach	Low	2.96	0.20	0.08	0.40
	High	2.76			
Shuttle Run	Low	12.44	1.28	7.43	5.81*
	High	13.72			

Significant at .05 level, $t_{.05}(48) = 2.01$

It is evident from table 2, that there statistically significant differences were observed between middle BMI – high BMI groups on chin ups and shuttle run components of motor fitness, as the obtained t-values of 3.62 and 4.82 respectively were higher than the required t-value of t.05 (73) =199.

Similarly, statistically significant differences were observed between low BMI – high BMI on chin ups and shuttle run components of motor fitness, as the obtained t-values of 6.08 and 5.81 respectively were higher than the required t-value of t.05 (48) =2.01 (table 3).

Table 4: Significance of differences between mean scores of low and middle BMI of school going male children on various component of motor fitness

MOTOR FITNESS	BMI GROUPS	MEAN	MD	DM	T-RATIO
Vertical Jump	Low	35.10	0.66	0.231	0.35
	Middle	35.76			
Chin ups	Low	7.88	0.78	1.021	1.32
	Middle	7.10			
Sit and Reach	Low	2.96	0.04	0.003	0.08
	Middle	3.00			
Shuttle Run	Low	12.44	0.46	1.266	2.70*
	Middle	12.90			

Significant at .05 level, $t_{.05}(73)= 1.99$

Table 4, reveals statistically significant differences between Low BMI - middle BMI groups on shuttle run component of motor fitness, as the obtained t-value of 2.70 was higher than the required t-value of t.05 (73) =199.

Discussion

Findings of descriptive data of school going children belonging to IXth and Xth grade (Boys) of BMI (low, middle and high) on Vertical Jump, Chin ups, Sit and Reach, Shuttle Run components of motor fitness indicated that difference exists among different BMI children of school on various components of motor fitness and performance of the subjects on various components shows more improvement with middle BMI and less with Low and high BMI.

When the male school going children were compared between Middle BMI – high BMI on together on various components of motor fitness, they had significant differences in their fitness components for the chin ups and shuttle run.

When the male school going children were compared between low BMI – high BMI on together on various components of motor fitness, they had also significant differences in their fitness components for the chin ups and shuttle run. Furthermore, male school going children were compared between low BMI –middle BMI on together on various components of motor fitness, they had also significant differences in their fitness component for the shuttle run only.

It was also hypothesized that **"**The students with Less Body Mass Index would show high level of motor fitness" is partially accepted, as male school going children were high on chin ups in comparison with middle and high BMI. Middle Body Mass Index students showed high level of motor fitness on vertical jump and sit and reach chin ups in comparison with low and high BMI male school going children, whereas, students with high Body Mass Index showed high level of motor fitness high only on chin ups in comparison with low and high BMI male school going children.

Conclusions

1. Middle BMI group and high BMI group were equal on vertical jump (explosive leg strength).
2. Middle BMI group having more muscular strength compare to high BMI group.
3. Middle BMI group and high BMI group having equal flexibility.
4. Middle BMI group are having more speed and agility compare to high BMI group.

5. There was no significant of difference on vertical jump between low BMI group and high BMI group.
6. High BMI group having low muscular strength compare to low BMI group.
7. There was no difference on flexibility between low and high BMI group.
8. Low BMI group having more speed and agility compare to high BMI group.
9. Low BMI group and middle BMI group are equal on vertical jump.
10. There was no difference on chin up between low and high BMI group.
11. On flexibility component, low BMI group and high BMI group are equal.

Low BMI group are superior on speed agility compare to middle BMI group.

References

Bray. G.A. 1985. Complications of obesity. *J. Med.* 103**:** 1059

Kansal, D. K. 1996. Test and Measurement Delhi: D. V. S. Publication,

Kraus H. and Rabb, W. 1961. Hypokinetic Disease, Illinosis: Thomas Springfield.

Morris, J. N., Adam, C., Shave, S.P.W., Strey, C., Epstiein L. and Sheehan, D. J. 1973. Vigrous Exercise in Leisure Time and the Incidence of Coronary Heart Disease Lancet", *J. Med.*, 333-339.

Paffenbarger R. S. and Hale, W. E. 1991. Work Activity and Coronary Heart Mortality. *J. Med*., 292: 545-550.

Rothstein, Anne L. 1985. Research Design and Statistics for Physical Education Englewood Cliffs, New Jersey: Prentice Hall.

Effects of Transdermal Application of Steroids in Radiculitis

Gour[1], S., Narkeesh[2], A. & Raghuveer[3]
[1]Post graduate student of Neurological Physiotherapy, Sardar Bhagwan Singh Post Graduate Institude, Dehradun, Uttaranchal, India
[2]Reader, Department of Physiotherapy, Punjabi University, Patiala, Punjab, India
[3]Assistant. Professor, Department of Physiotherapy, SBSPGI, Dehradun, Uttaranchal Pradesh, India

Abstract:
Iontophoresis is used as a means of delivering drugs across the skin for the management of a variety of medical conditions, most often, for localized inflammation and pain. There are many previous studies indicating that this mode of drug delivery can be useful, and iontophoresis with dexamethasone phosphate (DEX-P), sodium diclofenac, and acetic acid appears to be effective in treating inflammations in several areas of the body. The objectives of such research explorations were to see if local iontophoretic administration of an antiinflammatory drug to patients with tendonitis at the shoulder joint would achieve results similar to those obtained by local injection of the drug. Results were positive for iontophoretic delivery. Transdermal application of the steroids (iontophoresis) in addition to medical and physical therapy treatment was done in 36 patients with cervical & lumbar radiculitis. The protocol was followed for 1 week with outcome measures of VAS score, Dallas Pain Questionnaire score, Neck Pain & Disability Index score, and Modified Oswestry Disability Index score. The mean, standard deviations were calculated for all variables. Further Willcoxon Signed Rank Test was used within the group and Kruskalwallis Test & Jonkheere-Terpstra were applied between the groups to find the most effective one. On analysis test results were found significant within the group and between all the three groups. It was concluded that on comparison between the groups, the third group in which iontophoresis was used along with medication and other physical therapy modalities showed the best results.

Key words: Iontophoresis, Cervical & Lumbar Radiculitis

Introduction

Radiculitis is also termed as radicular pain syndrome, which means alterations of sensation or of muscle power which show that the primary disease-process producing them is in the spinal roots and not in the tracts and nuclei of the spinal cord *(Hubeny, 1933)*. Cervical radiculopathy is a common condition that usually results from compression and inflammation of the cervical nerve root or roots in the region of the neural foramen. It is frequently caused by cervical disc herniation and cervical spondylosis. It occurs annually in 85 out of 100,000 people *(Khalid et al., 2007)*. Clinical symptoms of cervical radiculopathy include pain and paresthesias radiating along the distribution of a nerve root, often associated with sensory loss and motor dysfunction *(Kyoung & Young 2010)*. Lumbar radiculopathy is a condition in which disease process affects the function of one or more lumbosacral nerve roots *(Taruli et al, 2007)*. The nerve root pathology arises primarily from direct neural compression irrespective of whether the etiology is an acute herniated or displaced disc, bony spurs, foraminal stenosis, central stenosis, or hypermobil ity of a vertebral segment. The prevalence of lumbar radiculopathy varies from about 2.2% to 8% and the incidence ranges from 0.7% to 9.6%. However in patients with radiculopathy and stenosis usually present with low back pain and unilateral more than bilateral leg pains, numbness, and

weakness *(Ayse & Aaron, 2010).* Diagnostic imaging (Magnetic Resonance Imaging) and electrophysiological tests (Nerve Conduction Velocity, Electromyography) are commonly used to confirm a diagnosis of Cervical Radiculitis. Provocative maneuvers may be observed that stretch the nerve root, such as coughing, sneezing, Valsalva, cervical distraction, and the Spurling's maneuver *(Whalen, 2007).* In lumbar radiculitis the most applied investigation is the straight leg raising test or Lasegue's sign. Patients with sciatica may also have low back pain but this is usually less severe than the leg pain *(Koes et al, 2007).*

Main objectives of treatment are to relieve pain and improve neurologic function and prevent recurrences *(Simon Fehlings, 2005).* Initially patients were treated conservatively, which generally includes nonsteroidal anti-inflammatory medication, activity modification, traction, epidural injections, and physical therapy modalities *(Whalen, 2008).* Superficial heat therapy is used to relieve muscular and joint pain, either alone or as an adjunct to other pain treatments *(Meryl, 2004).* The main action of AL-TENS is extra segmental analgesia mediated by ergo receptor activity *(Kitchen, 2008).* Continuous or intermittent traction has been regarded as an effective treatment for herniated cervical disks (HCDs) because it facilitates widening of the disk spaces. The traction induces pain relief and regression of the herniated disks *(Tae-Sub Chung et al., 2002).*

Current treatment strategies typically involve a gradual progression in the aggressiveness of intervention, progressing from less to more invasive interventions only in refractory cases *(Christopher, 2009).* Iontophoresis is the application of an electrical potential that maintains a constant electric current across the skin or barrier that enhances the delivery of ionized as well as unionized moieties. Iontophoresis increases the absorption of EMLA (eutectic mixture of local anaesthetics) and renders it effective for analgesia within five to fifteen minutes *(Miller et al., 2001).* Anti-inflammatory drugs used to treat tendinitis and bursitis when delivered by iontophoresis was described as successful by several workers *(Cummings, 1987).* The advantages of this method of delivery over conventional injection are the painless and sterility of the treatment: absolute sterility is clearly very important for the introduction of anti-inflammatory agents, prevents the variation in the absorption and metabolism seen with oral administration. The objectives of the present study are to evaluate the effectiveness of transdermal administration of mixture of 0.4% dexamethasone and 4% lidocaine in patients of radiculitis along with medication and other physical therapy modalities. This study also puts efforts to compare its effects with the other treatment protocols which include medication and physical therapy modalities.

Materials and Methods:-

This study was performed on 36 radiculitis patients in the outpatient department of SBSPGI, Dehradun. This is an experimental randomized control trial study, which is comparative in nature. Prior to the study, an approval was taken from the subjects included for conducting the study. Patients were taken on first

come first basis and randomly by using lottery method; they were divided into three groups: (a) 36 subjects (18 patients of lumbar radiculitis & 18 patients' cervical radiculitis), (b) 12 patients (6 lumbar & 6 cervical radiculitis each) in each group. On the basis of inclusion and exclusion criteria patients were chosen for the study. Inclusion criteria was; Patients with acute neck and low back pain persisting for less than 3 months, Unilateral or bilateral radiating type of pain till hands in UL and toes in LL. In UL (upper limb), distraction test, quadrant test, spurling's test was positive and SLR positive in lower limb. If any one of the ULTT or LLTT is positive. Exclusion Criteria includes; any deformity/contracture of LL and UL, any previous surgical procedures of spine. Patients with major psychiatric disorder, neurological disorders, or any other chronic muscle wasting or weakness were also excluded. Subjects who are on narcotics, neurodepressants or are under current use of any steroidal medication prescribed for radiculopathy symptoms and use of steroidal injections (in spine) in the past 2wk.

The subjects in the first group were only on medication. In the second group along with medication other treatment was given which included hot pack, traction and tens. In the third group along with medication and above treatment iontophoresis was given. Iontophoresis was done using electrical stimulator with dose current of 2mA for 5 minutes. It was increased progressively to 3mA for next 5 mins and then increased to 4mA for the remaining 10 minutes, giving a total treatment time of 20 minutes. Treatment was continued for one week. Outcome measures were taken on pre (0 day) and on post treatment day (8^{th} day). For patients with low back pain modified Oswestry Disability Index was used and for patients with neck pain, Neck Pain Disability Index was administered. Dallas Pain Questionnaire and VAS score was also administered. Readings were taken on the 0 day and 8^{th} day. Data was collected and analyzed.

Results

Table1: Comparison of means of pre and post protocol readings of Visual Analog Scale (VAS) score, Dallas Pain Questionnaire(DPQ), Neck Pain Disability Index score(NPDI), Modified Oswestry Disability Index score(MODI) of each group.

Variables	Pre protocol 0-day	Post protocol 8^{th} day	Z-value	t-value	Significance
Group A					
VAS	7.35 ± 1.204	5.8 ± 1.33	-	2.75	S
DPQ-A	69.25±16.43	60 ± 15.08	-3.078	-	S
DPQ-B	61.25± 19.08	52.50± 20.83	-2.831	-	S
DPQ-C	49.58±18.52	39.58±15.44	-2.737	-	S
DPQ-D	44.58±19.75	37.91±18.022	-1.847	-	S
NPDI	66.33±11.82	50±9.71	-2.226	-	S
MODI	75.33±8.91	63±8.60	-2.207	-	S
Group B					
VAS	7.51 ± 1.314	4.69 ± 1.09	-	8.08	S
DPQ-A	62.25±11.59	35.25 ± 12.80	-3.066	-	S
DPQ-B	59.16±15.05	31.66±15.12	-3.086	-	S
DPQ-C	43.33±18.25	20.41±12.14	-3.076	-	S
DPQ-D	32.08±14.37	15.41±11.95	-2.968	-	S
NPDI	70.33±6.50	49.33±5.31	-2.214	-	S
MODI	60.66±11.77	37±11.22	-2.207	-	S
Group C					
VAS	8.25 ± 0.70	3.51 ± 0.5	-	2.62	S
DPQ-A	63.75±12.54	25±8.70	-3.084	-	S
DPQ-B	62.91±12.14	20.16±9.96	-3.077	-	S
DPQ-C	47.08±16.57	10.41±8.64	-3.072	-	S
DPQ-D	44.58±17.89	10.83±8.48	-3.070	-	S
NPDI	67.66±4.96	26.33±7.31	-2.201	-	S
MODI	73.33±8.16	34.33±5.85	-2.207	-	S

Table 2: Table showing Mean difference, Standard deviation, One Way Anova test & Significance values of VAS on 0 day & 8^{th} day.

Visual Analog Scale	0 day	8^{th} day
GROUP-A	7.35 ± 1.204	5.8 ± 1.33
GROUP-B	7.51 ± 1.314	4.69 ± 1.09
GROUP-C	8.25 ± 0.70	3.51 ± 0.5
F VALUE	2.258	14.492
SIGNIFICANT	NS	S

Table 3: Table showing Mean difference & Standard deviation values of Kruskal Wallis Test and Significance of values of Dallas Pain Questionnaire Scores on 0 day.

Kruskal Wallis	DPQ-A	DPQ-B	DPQ-C	DPQ-D
GROUP-A	9.25±16.43	61.25± 19.08	49.58±18.52	44.58±19.75
GROUP-B	62.25±11.59	59.16±15.05	43.33±18.25	32.08±14.37
GROUP-C	63.75±12.54	62.91±12.14	47.08±16.57	44.58±17.89
Chi.Square	3.110	.385	1.044	3.709
Asymp. Sig.	.211	.825	.593	.157

Table 4: Table showing Mean difference & Standard deviation values of Kruskal wallis Test And Significance & Jonkheere-Terpstra Test And Significance Of Values Of Dallas Pain Questionnaire Scores Post 1 week (on 8th day).

Kruskal Wallis	DPQ-A	DPQ-B	DPQ-C	DPQ-D
GROUP-A	60 ± 15.08	52.50± 20.83	39.58±15.44	37.91±18.022
GROUP-B	35.25 ± 12.80	31.66±15.12	20.41±12.14	15.41±11.95
GROUP-C	25±8.70	20.16±9.96	10.41±8.64	10.83±8.48
Chi.Square	18.982	13.076	17.056	14.537
Asymp. Sig.	0.000	0.001	0.000	0.001
Jonkheere-Terpstra	DPQ-A	DPQ-B	DPQ-C	DPQ-D
STD.J-T Value	-4.565	-3.759	-4.304	-3.729
Asymp. Signi.	0.000	0.000	0.000	0.000

Table 5: Table showing Mean difference & SD values of Kruskal Wallis Test and Significance & Jonkheere-Terpstra and Significance of Neck Pain Disability Index on 0day & Post 1 week (on 8th day).

NPDI	0-day	8th –day
GROUP-B	70.33±6.50	49.33±5.31
GROUP-C	67.66±4.96	26.33±7.31
Chi- SQUARE	4.813	10.434
Asymp. Significance	0.09	0.005
Std.J-T	-	-3.137
Asymp. Significance	-	0.002

Table 6 : Table showing Mean difference & Standard deviation values of Kruskal Wallis Test And Significance & Jonkheere-Terpstra and Significance and Modified Oswestry Disability Index on 0 day & Post 1 week (on 8th day).

MODI	1. Day	□ 8th day
GROUP-A	75.33±8.91	63±8.60
GROUP-B	60.66±11.77	37±11.22
GROUP-C	73.33±8.16	34.33±5.85
Chi- SQUARE	0.8	10.827
Asymp. Significance	0.668	0.004
Std. J-T	-	-2.814
Asymp. Significance	-	0.004

Discussion:-

In the current study the result showed reduction in pain and related disability, within all the three groups. However, on comparing the three groups, group C (ie the group that received transdermal application of drugs (iontophoresis) alongwith medication, heat therapy, TENS, traction,) showed the most significant results.

In the group that was on medication which included NSAID's (Voveron SR 100) along with antacid (Rentac 100mg) and neural vitamin tablets (Neurobion Forte). On analysis a significant reduction

in pain was found. *Sara Brown (2009)* also support that NSAIDs are effective to control acute pain and if the pain is severe then opioids are given. *Ross et al (2009)* said that anti-inflammatory medications and oral corticosteroids can decrease nerve inflammation thus help in immediate pain reduction. There are various side effects of NSAID's so antacids are preferably given along with them. NSAIDs exert an immediate analgesic effect; however their anti-inflammatory effect, which is related to the achievement of steady state, is only evident after dosing for three to five half-lives. This means that NSAIDs with shorter half-lives, such as ibuprofen and diclofenac, should be prescribed in preference to those with longer half-lives, such as piroxicam and sulindac, for non-specific low back pain due to acute injury. Although COX-2 selective inhibitors (eg Celecoxib, Rofecoxib) may reduce the risk of side effects but are less effective than NSAID's some are only preferred in high risk cases.

The group that received Conservative Treatment (Medication+Moist Heat+ Tens +Traction) also showed significant result from the 0 day to 8th day. On comparison between groups-A and group-B, group-A showed more significant difference in pain reduction, as this included other conservative treatment modalities along with medication. This group had heat therapy as an adjunct applied before Traction and TENS was applied. Moist heat has been a recommended therapy aid for many years. A report by *Meryl (2004)* says Heat, cold, and physical pressure sensations are transmitted by larger nerve fibers. When the large neurons are stimulated, by applying heat for example, they inhibit the pain transmission and close the gate to further travel of pain impulses, leading to a reduction of pain. Heat therapy can help to relieve pain by closing the gating system in the spinal cord. According to *McCaffery & Wolff (1992),* heat reduces muscle spasm by reducing tension in muscle trigger points, and it increases the ability of the muscle tendon unit to relax and stretch. The application of heat lowers the viscosity of collagen, softening muscle and tendon, enabling muscles to relax and extend more easily. In this way heat therapy had additive effects on relieving pain, and it also helps other modalities to work more efficiently and give beneficial outcomes.

According to *White et al (2001),* the purported mechanism of action of TENS invokes both spinal (i.e., gate-control, frequency-dependent blockade) and supraspinal theories (i.e., release of endogenous neuromediators). It has also been suggested that TENS involves activation of the body's pain modulation system and increases in the release of endogenous opioids within the central nervous system, thereby suppressing the transmission and perception of noxious stimuli from the periphery. *Mannheimer and Lampe (1984)* suggested that acute pain of superficial nature, including causalgia, responds best to conventional TENS whereas longstanding deep aching pain responds best to low frequency TENS, however *Johnson et al (1991)* found that there was no relation between the cause of pain and the pulse frequency or pattern used by their patients. Another study explains the purpose of AL-TENS, which is to selectively activate small diameter fibres (Aδ or group III) arising from muscles (ergoreceptors) by the induction of phasic muscle twitches. Evidence suggests that AL-TENS produces extra-segmental analgesia in a

manner similar to that suggested for acupuncture. TENS is delivered to selectively activate Aα afferents leading to inhibition of nociceptive transmission in the spinal cord. It is claimed that the mechanism of action and analgesic profile of AL-TENS and intense TENS differ from conventional TENS and they may prove useful when conventional TENS is providing limited benefit *(Kitchen, 2008)*. Traction is widely used modality for the cervical or lumbar spine disorder due to muscle spasm or intervertebral disc. *Moeti & Marchetti, (2001)* believed that it can reduce disk herniations, decompress the nerve root, or stretch ligaments and dural sheaths, thus reducing symptomatology. *Chung et al (2002)* reported that Cervical traction has been applied widely to relieve neck pain from muscle spasm or nerve compression in rehabilitation medicine settings. Continuous or intermittent traction has been regarded as an effective treatment for herniated cervical disks (HCDs) because it facilitates widening of the disk spaces. The traction induces pain relief and regression of the herniated disks. Several reports have described the regression of herniated disks either spontaneously or within the treatment period. The disk may be subject to desiccation and shrinkage from loss of hydrophilic proteoglycans, which leads to a loss of water content and, consequently, a decrease in disk size. Reports have suggested that traction therapy can induce HCD regression. In a report, it is stated that the length of a cervical disk increases during traction. *Krause et al (2000)* in their study concluded that traction is most commonly used for normalization of neurological deficits or painfully restricted neuromeningeal tension signs, relief of pain and for improving joint mobility. Evidence available suggests that traction is more effective for pain reduction and return to activity than infra-red radiation, corset and bed rest, hot pack and rest, hot pack, massage and mobilization and bed rest. Thus all these modalities are used under the conservative treatment protocol which proved to be more beneficial than giving medication alone.

Effect of Use of Transdermal Application (Iontophoresis) Of Steroids (In Addition To Conservative Management) In Reducing Pain and Disability

The group that received transdermal application (iontophoresis) of steroids in addition to conservative management showed the maximum significant results. In this group iontophoresis was included, which is one of the best noninvasive methods of drug delivery into the body. This route of drug delivery avoids all the systemic effects of drugs and first pass metabolism, thus this mode of drug delivery was chosen over other treatment techniques. Transdermal iontophoresis is the application of an electrical potential that maintains a constant electric current across the skin and enhances the delivery of ionized as well as unionized moieties *(Rashmi et al., 2005)*. It offers various advantages such as easier termination of therapy, better control of drug delivery, improving delivery of polar drugs as well as high molecular weight substances, benefits of bypassing hepatic metabolism and reducing considerably the inter and intra-individual variability *(Williams & Barry, 1991 & 1992)* and ability to be used for systemic delivery or local delivery of drugs *(Dehgan & Mouzam, 2008)*. Corticosteroids are widely used because they possess a profound anti-inflammatory effect and are available in

relatively inexpensive forms designed both for oral and topical administration. Several corticosteroids are available as water soluble salts, rendering the corticosteroid molecule negatively charged and therefore available to move under the influence of a negative current field *(Costello et al, 1995).* Corticosteroids inhibit the inflammatory process, in part by reducing the migration of neutrophils and monocytes into the inflamed area and reducing the activity of these white blood cells *(Wigard et al., 1991).* Corticosteroids have recently been shown to reduce "sprouting" that occurs in sensory nerves in association with tissue injury *(Hong et al, 1993).* Dexamethasone is often administered by iontophoresis, in combination with lidocaine, in the treatment of musculoskeletal disorders. This corticosteroid has frequently been administered from the positive electrode (it presumably comes through the skin by the electro osmotic effect, because it is a negatively charged ion) *(Costtelo et al., 1995).* Lidoaine is applied iontophoretically under the anode. When applied in this manner, lidocaine produces dilation of blood vessels and a rather profound topical anesthesia of the skin, to depths of several millimeters *(Gangarosa et al., 1981). DeLacerda (1982)* used dexamethasone (1mL of 0.4% dexamethasone mixed with **2**ml of 4% lidocaine in aqueous solution administered from the anode at a dosage of 5 mA for 10 minutes) to treat patients with myofacial shoulder girdle syndrome and found that iontophoresis produced the most rapid improvement in range of motion, compared with treatment with ultrasound or muscle relaxants. He used a current of 5mA for 15 minutes, applied over trigger points. *Bertolucci (1982)* reported reduction of pain and increased range of motion in a group of patients with shoulder tendinitis treated with the same mixture of dexamethasone and lidocaine iontophoresis, applied for 10 minutes at 2mA, for 5 minutes at **3**mA, and for 5 minutes at 4mA, compared with a control group. He reported that the results were similar to those seen with steroid injections. He used a current of 2 to 4mA, progressed over a 20-minute treatment period. Similarly, *Hasson and colleagues (1988)* reported a delay in the onset of post-acute exercise muscle soreness with the use of dexamethasone iontophoresis, and an improvement in knee joint range of motion and a reduction in knee circumference following dexamethasone iontophoresis, applied using the same protocol as Berto1ucci.

Thus from above studies and the results of the present study, conclusion is drawn that iontophoresis is very effective method to deliver drugs to suppress inflammation and pain. This suggests that the group which had iontophoresis as a treatment modality has to have extra effect to alleviate pain and disability in radiculitis compared to other groups.

Conclusion

On the basis of its results, the present study concluded that the third treatment protocol which includes medication, physiotherapy treatment and iontophoretic administration of mixture of anti-inflammatory (dexamethasone) & local anesthetic (lignocaine) showed the maximum positive effects. There was more relief in pain and the percentage of disability was also decreased, thus improving the activities of daily living.

References

Bertolucci, LE. 1982. Introduction of anti-inflammatory drugs by iontophoresis:

doubleblind study. *J Ortbop Sports Pbys Ther*. **4:**103-108.

Charles T Costello, Arthur H Jeske, 1995. Iontophoresis: Applications in transdermal medication delivery, *Phys. Therap.*, **75:** 554-563.

Dehghan, M.G.H., Mouzam, M.I. 2008. Advances in iontophoresis for drug delivery, *Int. J. Health Res.*, **1(3):** 115-127.

DeLacerda, F.G. 1982. A comparative study of three methods of treatment for shoulder girdle myofascial syndrome. *J Orthop. Sports Phys. Ther***., 4:**51-54.

Gangarosa, L.P. 1981. Defining a practical solution for iontophoretic local anesthesia of the skin. Methods *Find. Eq. Clin. Pharmacol.*, 3:83-94

Harris, P.R. 1982. Iontophoresis: clinical research in musculoskeletal inflammatory conditions, *J Orthop. Sports Phys. Ther***., 4:** 109-1 12.

Hasson SM. et. al. 1988. Effect of Iontophoretically Delivered Dexamethasone on Muscle Performance in a Rheumatoid Arthritic Joint. *Arthritis Care & Research*.; 1:177-182.

Koes, B. W. ,Van Tulder, M. W., Peul, W. C. 2007. Diagnosis and treatment of sciatica, *B.M.J.*, 334**:** 1313-7.

Krause, M., Refshauge, K.M., Dessen, M., Boland, R. 2000. Lumbar spine traction: evaluation of effects and recommended application for treatment, *Man. Therap.*, **5(2):**72-81.

Kyoung-Tae Kim, Young-Baeg Kim, 2010. Cervical Radiculopathy due to Cervical Degenerative Diseases: Anatomy, Diagnosis and Treatment, *J. Korean Neurosurg. Soc.*, **48:** 473-479.

McCaffery, M. and Wolff, M. 1992. Pain relief using cutaneous modalities, positioning and movement. *Hosp. J.*, 8(1-2): 121–153.

Meryl, R., 2004. Modern Heat Therapy: A Report, business briefing: *US Pharmacy Review*, 1-3.

Miller, K.A., Balakrishnan, G., Eichbauer, G., Betley, K. 2001. 1% lignocaine injection, EMLA cream or"numbing stuff" for topical analgesia associated with peripheral intravenous cannulation. *AANA J* **69:** 185-7.

Moeti, P., Marchetti, G.J. 2001. Clinical outcome from mechanical intermittent cervical traction for the treatment of cervical radiculopathy: a case series. *J. Orthop. Sports Phys. Ther***., 31:** 207-213.

Pearl, P., Law, W. and Gladys, L., Cheing, Y. 2004. Optimal Stimulation Frequency Of Transcutaneous Electrical Nerve Stimulation on people with Knee Osteoarthritis. *J. Rehabil. Med.*, **36:** 220-225.

Robinson, A.L. and Lee, A.T. (2010), Clinical and Diagnostic Findings in Patients withLumbar Radiculopathy and Polyneuropathy, *Am. J. Clin. Med.*, **7(2):** 80-85.

Ross, A. Hauser,Glen M. Batson,Chris Ferrigno. 2009. Non-Operative Treatment of Cervical Radiculopathy: A Three Part Article from the Approach of a Physiatrist, Chiropractor, and Physical Therapist, J. Prol., **4:** 217-231.

Tae- Sub Chung, Young- Jun Lee, Seong - Woong Kang, Chang – Jun Park, Won – Suk Kang,Yong – Woon Shim, (2002) , Reducibility of Cervical Disk Herniation : Evaluation at MR Imaging During Cervical Traction with a Nonmagnetic traction Device,Radiology;224:895-900.

Thakur, R., Yiping Wang, Y., Qiuxi Fan, Michniak, B. 2005. Transdermal iontophoresis: Combination strategies to improve transdermal iontophoretic drug delivery. *Eur. J. Pharm. Biopharm.*, **60(2):**179–191.

Wayne M. Whalen DC, (2007), Resolution of cervical radiculopathy in a woman after chiropractic manipulation, journal of chiropractic medicine ;7:17-23.

Williams AC, Barry BW. Skin absorption enhancers. Crit Rev Ther Drug Carrier Syst, 1992;9(3-4):305–353.

Wingard LB, Brody TM, Larner J. SchwartzA. Glucocorticoids and other adrenal steroids. In: Human Pbanacology. St Louis, Mo:Mosby-Year Book; 1991:484-493.

Isometric Peak Force of Shoulder Rotators in Cricketers with and without History of Shoulder Pain

Juneja, H[1], Verma[2], S.K., Khanna[3], G.L.
[1]Ph.D student, Department of Sports Sciences, Punjabi University, Patiala. India email: hemantjuneja@rediffmail.com
[2]Professor, Department of Sports Sciences, Punjabi University, Patiala. India e mail: satishsk1@rediffmail.com
[3]Dean, Faculty of Allied Health Sciences, Manav Rachna International University, Faridabad, Haryana, India email : glkhanna@gmail.com

Abstract

Aim: To find out the differences in Shoulder External and Internal Rotator strength and their ratios in cricketers with and without history of shoulder pain.
Background: Throwing activity imposes specific demands on shoulder muscles leading to imbalances especially between the External rotators (ER) and Internal rotators (IR). This study aims to investigate the isometric strength differences of shoulder ER and IR in cricketers with and without history of pain.
Materials & Methods: 52 healthy subjects between the age group of 16-18 with a mean age of 16.97 $\pm$ 0.55 years were recruited for this study. The subjects were divided into two groups a) those with history of pain (PH) which restricted throwing within the past 2 years- Group 1 and b) no history of pain (NPH)-Group 2. Isometric Shoulder External Rotator (ER) and Internal rotator (IR) maximal force was measured and Isometric ER: IR ratios were calculated.
Results: Significant differences were found in the isometric strength of ER and consequently ER:IR ratios between the two groups. However, no differences were found in the IR force between the two groups. PH group showed a mean ER force (in kg) of 7.38 $\pm$ .71(SD) while the mean ER force in NPH Group was 9.90 $\pm$ 1.32(SD). ER: IR force ratios were found to be 0.60 $\pm$.045 in the PH group while in the NPH group it was 0.82 $\pm$ .049.
Conclusion: The results of our study suggest that Isometric strength differences in shoulder rotators exist between sportspersons with and without history of shoulder pain. In addition to the advanced techniques of muscle force evaluation such as isokinetics, isometric measurements can also play an important role in evaluating muscle force.

Key words: External Rotators, Internal Rotators, Isometric, Isokinetic, Throwing

Introduction

Shoulder injuries in sports involving throwing actions are extremely common and often result in prolonged periods of absence from sporting activities *(Aagaard & Jorgensen, 1996; Wang & Cochrane, 2001; Kettunen et al, 2011).* The glenohumeral joint is inherently unstable due to its bony configuration and the degrees of freedom of movement. Therefore, it is dependent to a great extent on the ligaments and muscular structures to provide stability. High speed throwing actions requires frequent and synchronized activation of these stabilization mechanisms, specially the shoulder rotator muscles *(Bayios et al, 2001; Yildiz et al, 2006).* During the acceleration phase of throwing, the supraspinatus, infraspinatus and teres minor work eccentrically to provide

stability to the humeral head and prevent excessive anterior translation of the humeral head. This predisposes the sportspersons to painful syndromes of the shoulder rotator muscles in a variety of sports involving aggressive throwing. Therefore, an objective evaluation of shoulder rotator strength is crucial for rehabilitation and prevention of shoulder injuries.

Extensive work has been done by various authors on measurement of External and Internal rotator strength in different types of sports persons *(Aldenrink & Kuck, 1986; Chandler et al, 1992; McMaster et al, 1992).* In addition to Isokinetic shoulder External rotator(ER) and Internal Rotator (IR) strength, Isokinetic strength ratios have been used by various authors to predict and study performance, stability, injury patterns and strength differences between dominant and non dominant upper extremity (*Aldenrink & Kuck, 1986; Chandler et al, 1992; McMaster et al, 1992; Stickley et al, 2008)*. Lot of differences exists in the testing methodologies of rotator muscles strength with regards to the position of the shoulder, test speeds and modes of contraction in these studies *(Nadine et al, 2002).* Majority of work done on shoulder strength in overhead athletes has been done using Isokinetic type of muscle work in the concentric and eccentric mode clearly due to the reason that a Isokinetic measurements allows high reproducibility (r=0.82–0.96) *(Pincivero et al, 1997)* and measurements at high speeds with accommodating resistance which was thought of as having more relevance to function.

Although Isokinteuc testing in sports is a preferred mode of testing, it is interesting to note that the maximal velocity allowed by Isokinetic apparatus reaches only 40% of the maximal velocity that can developed by leg extensor muscles during ballistic motion *(Bosco et al, 1982b)* and only 10% of the maximal velocity obtained by shoulder during throwing motion *(Pappas et al, 1985)*. Also, Isokinetic testing does not always predict the performance differences between athletes possessing different skill levels *(Fry et al, 1991; Hurley et al, 1988).* 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. Isokinetic strength was found to be related to Isometric measurements in a study by *Lord et al (1992).* In a recent study Folland et al., reported that after Isometric training at 4 angles in one leg and Isokinetic in the other leg of same subjects, 9 weeks later the Isokinetic gains were similar in both legs[18]. Furthermore, isometric measurements using hand dynamometers and strain gauge have a high test -retest reliability in comparison to manual muscle testing and are reported to be comparable to Isokinetic testing in some studies *(Magnusson et al, 1990; Kuhlman et al, 1992; Malerba et al, 1993).* Therefore, the literature does indicate that isometric testing in sports has the potential to analyze effects of injury and guide the rehabilitation process.

Isokinetic strength ratios of shoulder rotators in symptomatic and non symptomatic sportspersons have been studied previously by various authors. Significant differences in the rotator cuff muscles and scapular muscles primarily

through Isokinetic measurements have been reported as a result of shoulder pain and injuries *(MacDermid et al, 2004; McCabe et al, 2005; Tyler et al, 2005)* but there is hardly any literature reporting Isometric strength changes in glenohumeral rotators in such population. Therefore, we hypothesize that there will a difference in Isometric strength of External and Internal rotators of shoulders and their ratios in cricketers with and without history of shoulder pain.

Materials and Methods

The subjects were volunteers from cricket training academies and were playing cricket for at least 5 years. Fifty two (52) subjects were recruited for the study. These 52 participants were currently pain free but out of these, 14 participants reported a previous history of shoulder pain once or more in the past 2 years which interrupted their throwing activities for few days. These 14 subjects were categorized as Group I (PH –Pain history) and the remaining 38 were categorized as Group 2(NPH-no pain history) for study purposes. Their mean age, height and weight are mentioned in Table 1. Only 2 participants were left handed.

Table 1: Means of Physical characteristics of two groups

No. of subjects	Age (in years) ± SD	Height (in cms) ± SD	Weight(in kg) ± SD
Group I (PH)	**16.78 ± 0.38**	**167.4 ± 3.1**	**65.54 ± 4.90**
Group 2 (NPH)	**17.04 ± .59**	**168.6 ±3.8**	**66.07 ± 5.67**
Total	**16.97 ± .55**	**168.3 ±3.6**	**65.93 ± 5.43**

Isometric Force measurements

All the 52 subjects completed a standard warm up protocol consisting of 10 overhead movements through complete range of abduction, 5 stretches of 6 seconds hold for internal rotators by performing horizontal abduction till comfortable stretch is felt and 5 stretches of 6 seconds hold for the external rotators by touching the opposite scapula till a comfortable stretch is felt .

Instrumentation

Isometric strength measurements of Shoulder rotators of dominant upper limb were obtained using a digital strain gauge with a range of 0-120 kg with sensitivity of .01 kg. Although there are sophisticated, computerized isometric dynamometers available nowadays, the portable hand held strain gauge has greater flexibility and may be carried by the therapist to evaluate patients in different settings. Isometric testing using strain gauge has been proved to have high inter-rater and intra- rater reliability *(Bohannon & Andrews, 1987)*.

Isometric External Rotator (ER) force

The measurements were done in supine position with elbow just on the edge of measuring surface and the forearm out of the couch for measurements. The shoulder External Rotator(ER) strength was measured with the subjects arm and forearm in a position close to that of throwing position which is 90^o of abduction and 90^o degrees of external rotation *(Sapega et al, 1982)*. Strain gauge which was attached perpendicularly to subject's forearm with the help of a wrist strap placed just proximal to the styloid process *(Andrews et al, 1996)*. The stationary end of the strain gauge was attached to a specially designed frame with the help of adjustable chains and screw mechanisms suspended

from the top. The arm component was stabilized using straps and elbow flexion was maintained at 90^0 throughout the measurements. Following warm-up procedures, each subject was asked to force into external rotation as "hard and fast" as it produces optimal results for recording maximal force *(Bemben et al, 1990; Sahaly et al, 2001; Haff et al, 2005).*

Isometric Internal Rotator (IR) Force

The Isometric Internal Rotator force were measured using a similar method as that for External rotator but in prone position so that the subjects could force into Internal rotation while the arm was abducted and externally rotated to 90^o and the elbow was flexed to 90^o. Both the groups were instructed to stop forcing in case of any pain. The authors felt that Group 1(PH) had higher chances of developing pain during the process. Although none of the subjects reported pain during the measurement process, some subjects in Group 1 informed that they felt reduced force capacity during forcing into external rotation in supine. The Isometric ER: IR ratios were calculated using the ER and IR Isometric force.

Data Analysis

The data was analyzed using SPSS 16.0. Independent samples t-test was performed to compare the means of (a) Isometric External rotators(ER) force (b) Isometric Internal Rotator(IR) Force (c) Ratio of ER:IR between PH(1) and NPH(2) groups. The α level was set at .05

Results

The means of isometric shoulder rotator force is shown in Table 2. The Isometric force of External rotators showed a significant difference between the two groups (Fig 1). Group 1 (PH) showed a mean force (in kg) of 7.38 ± .71(SD) while the mean ER force in Group 2(NPH) was 9.90 ± 1.32(SD). p<.000

The Internal Rotator muscle force in Group 1(PH) had a mean of 12.27 ± .96 and in Group 2(NPH) it was 12.10 ± 1.38. No significant differences were found between the two groups (Fig 2)(p=0 .618).

As is evident from the results of ER and IR Isometric forces, the ratios of External rotators force to internal rotator force showed significant differences between two groups. The mean ER: IR force ratios in Group I (PH) were 0.60 ± 0.045 and in Group 2(NPH) was 0.82 ± 0.05 (Fig 3).

Table 2: Means of Isometric ER, IR forces & ER: IR ratios

	External Rotators force (in kg) + SD	Internal Rotator Force(in kg) +SD	ER/IR ratios in kg + SD
Group I (PH)	**7.38 ± .71**	**12.27 ± .96**	**.60 ± .045**
Group 2 (NPH)	**9.90 ± 1.32**	**12.10 ± 1.38**	**.82 ± .049**
Group 1 vs Group 2	**P<.000**	**P= .618**	**P<.000**

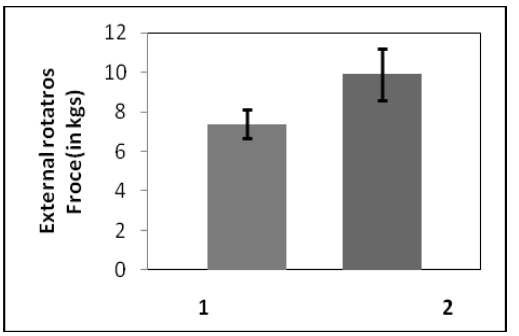


Figure 1: Mean of Isometric External rotator(ER) Force in two groups (p<.000)

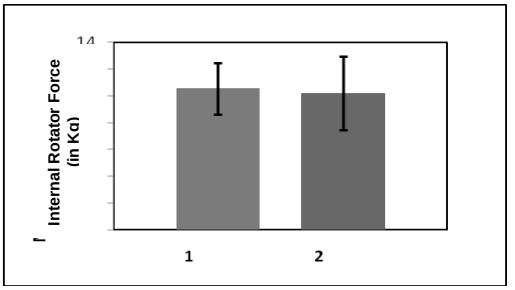


Figure 2: Means of Isometric Internal Rotator (IR) force in two groups (p= .618)

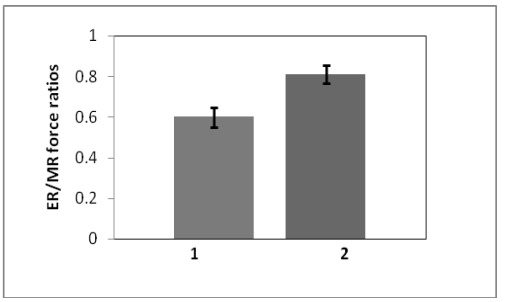


Figure 3: Means of Isometric ER: IR force ratios of two groups (p <.000)

Discussion

In spite of the potential clinical relevance of isometric strength measurements, there appears to be considerable controversy regarding the use of isometric muscle force evaluation and the ability of these tests to monitor changes in dynamic performance and predicting injuries. Although some studies have reported that isometric strength may not be related to function *(Murphy & Wilson, 1996)*, there is evidence to support the relationship of Isokinetic and Isometric measurements *(Lord et al, 1992; Folland et al, 2005*). This is interesting to note since Isokinetic evaluation and training has been used by various authors to study muscle performance in sportspersons as muscle work at various speeds could be evaluated using this technique. However, it has also been reported that the speeds of testing and training in Isokinetic muscle testing are much lesser than actual speeds of sporting activities such as throwing and jumping *(Bosco et al, 1982b; Pappas et al, 1985)*. Isometric strain gauge measurements have been reported to be reliable *(Bohannon & Andrews, 1987)* and can objectively quantify the muscle force or strength also. However their relationship to dynamic activities has been questioned by various authors.

Injuries and dysfunction of the shoulder in throwing can be attributed to a multitude of factors, including anatomical, biomechanical, and environmental concerns. The Internal rotator (IR) and External rotator (ER) muscles of the shoulder play a critical role in providing stability and mobility to the glenohumeral joint, particularly in overhead athletes *(Ramsl et al, 2004)*. Several authors have investigated muscular imbalance of the shoulder rotators using Isokinetic devices to identify any imbalancs in normal sportsperson involved in throwing *(Aldenrink & Kuck, 1986; Chandler et al, 1992; McMaster et al, 1992)* and reported ratios of Eccentric ER: Conc IR and Conc ER: Conc IR. But Isometric ratios of these muscles were not evaluated in these studies. In the present study we utilized Isometric tests to assess the muscular strength of shoulder rotators in subjects with and without history of pain.

Internal Rotator (IR) Isometric force in all 52 subjects was more than the External rotator (ER) Isometric force. Although a direct comparison cannot be made with other studies involving Isokinetic ER: IR strength ratios, our results do have some similarity in the patterns reported in these Isokinetic studies which have shown ER strength to be lesser than IR strength in throwers but not at high speeds (*Cook et al, 1987;*

Hinton, 1988; Ellenbecker & Mattalino, 1997; Guillermo & Noffal, 2003). Most studies on normal athletes involved in throwing activities have shown that due to demands imposed on the internal rotators, they tend to become stronger than the External rotators with time. The Isokinetic measurements in previous studies ((*Cook et al, 1987; Hinton, 1988; Guillermo & Noffal, 2003*) have shown an ER (conc.): IR(conc) of 0.65 to 0.71. The maximal isometric force in subjects without any history of pain (NPH) showed ER: IR ratios of 0.82 at 90 degree of external rotation. However, the Isometric ER: an IR ratio in the (PH) group was found to be 0.60 which was significantly lower than that of non painful group. Isokinetic ER: IR findings of *Stickly et al (2008)* also reported lower ratios in adolescent volleyball players with injury history.

Although, the number of subjects in the PH group was not high in our study, it is definitely possible that the causative factors of pain were different in different subjects. Further research is definitely warranted to investigate whether external rotator force can be affected by different types of shoulder problems. Furthermore, the results of our study and also those of many other previous studies do not establish a cause effect relationship between the strength ratios and incidence of shoulder pain or injury. There is a probability that the subjects developed painful shoulders as a result of this muscle imbalance or the imbalance was a result of the injury. A long term follow up of throwers with ER: IR imbalances are required to answer this question.

Another key area which can be focused in future researches is the correlation between the Isometric and Isokinetic ratios to find out the relationship between them. According to *Folland et al (2005)* isometric strengthening at multiple angles led to gains in Isokinetic strength. This is a crucial finding in view of the controversies surrounding the Isometric measurement and its relationship to dynamic performance. In our study, the results clearly highlight the fact that throwers with history of pain in dominant shoulders had significant Isometric strength deficits in their external rotator force when compared to their normal counterparts.

An interesting finding was that although all our subjects were professional cricketers and were training regularly with therabands and other resistive devices, the ER strength deficits still persisted. In our opinion, this was the result of lack of objective measurements of shoulder strength and a systematic progressive resisted program targeted towards improving imbalance between the two groups of muscles. Therefore, it is essential that after injuries and painful overuse syndromes of the shoulder in sportspersons, objective measures are utilized to analyze and correct the muscle imbalance of shoulder rotator muscles.

Conclusion

The results of our study indicate that Isometric strength and strength ratios of shoulder rotators can provide useful information in sportspersons with history of injury or pain in the shoulder. Isometric strength imbalances between the ER and IR may also guide the treating professional in correcting these discrepancies using objective methods. Our study also highlights the facts that in addition to the advanced techniques of muscle force evaluation such as

Isokinetics. Isometric force measurements can also play an important role in evaluating muscle force and that their role cannot be completely ignored.

References

Aagaard, H., Jorgensen, U. 1996. Injuries in elite volleyball. Scand. *J. Med. Sci. Sports.* **6(4):** 228–232.

Aldenrink, G.J., Kuck, D.J. 1986. Isokinetic shoulder strength of high school and college-aged pitchers. *J. Orthop. Sports Phys. Ther*, **7:** 163-172.

Andrews, A.W., Thomas, M.W., Bohannon, R.W. *1996.* Normative Values for Isometric Muscle Force Measurements Obtained With Hand-held Dynamometers. Phys. Therap. **76(3):** 248-259.

Bayios, I.A., Anastasopoulou, E.M., Sioudris, D. & Boudolos, K. D. 2001. Relationship between Isokinetic strength of the internal and external shoulder rotators and ball speed in team handball. *J. Sports Med. Phys. Fit.* **41:** 229–235

Bemben, M.G., Clasey, J.L. Massey, B.H. 1990. The effect of the rate of contraction on the force-time curve parameters of male and female subjects. *Res. Quart.* **61(1):** 96–99.

Bohannon, R.W., Andrews, A.W. 1987. Inter-rater reliability of hand held dynamometry. Phys. Therap. **67(7):** 931-33

Bosco, C., Ito, A., Komi, P.V. et al. 1982b. Neuromuscular function and mechanical efficiency of human leg extensor muscles during jumping exercises. *Acta. Physiol. Scand.* **114(4):** 543-50.

Brussock, C.M., Haley, S.M., Munsat, T.L., Bernhardt, D.B. 1992. Measurement of isometric force in children with and without Duchenne's muscular dystrophy. *Phys. Ther.* **72(2):**105-14.

Chandler, T.J., Kibler, W.B., Stracener, E.C., et al 1992. Shoulder strength, power, and endurance in college tennis players. *Am. J. Sports Med.*, **20:** 455-458

Cook E.E., Gray, V.L., Savinar-Nogue, E., et al 1987. Shoulder antagonistic strength ratios: A comparison between college-level baseball pitchers and nonpitchers. *J Orth. Sports Phys. Ther.*, ***8:*** 451–461.

Ellenbecker, T.S., Mattalino, A.J. 1997. Concentric Isokinetic shoulder internal and external rotation strength in professional baseball pitchers. *J. Orth. Sports Phys. Ther., 25:* 323–328,

Folland, J.P., Hawker, K., Leach, B., Little, T., & Jones, D.A. 2005. Strength training: Isometric training at a range of joint angles versus dynamic training. J. Sports Scien. **23(8):** 817 – 824.

Fry, A.C., Kraemer, W.J., Weseman, C.A., et. al 1991. Effects of an off-season strength and conditioning program on starters and non-starters in women's collegiate volleyball. J. Appl. Sport Sci. Res. **5:** 174–81.

Guillermo, J. N. 2003. Isokinetic Eccentric-to-Concentric Strength Ratios of the Shoulder Rotator Muscles in Throwers and Nonthrowers. Am. J. Sports Med. **31(4):** 537-541

Haff, G.G., Carlock, J.M., Hartman, M.J, Kilgore, J.L., Kawamori, N., Jackson, J.R., Morris, R.T., Sands, W.A., and Stone, M.H. 2005. Force-time curve characteristics of dynamic and isometric muscle actions of elite women Olympic weightlifters. *J. Stren. Cond. Res.* **19:** 741–748.

Hinton, R.Y. 1988. Isokinetic evaluation of shoulder rotational strength in high school baseball pitchers. *Am. J. Sports Med. **16:*** 274–279.

Hurley, J.M., Hagberg, J.M., Holloszy, B.F. 1988. Muscle weakness among elite power lifters. Med. & Sci. Sports Exerc. **20 :S** 81

Kettunen, J.A., Kujala, U., Sarna, S., Kaprio, J. 2011. Cumulative incidence of shoulder region tendon injuries in male former elite athletes. *Int. J. Sports Med.* **32(6):** 451-4.

Kuhlman, J.R., Iannotti, J.P., Kelly, M.J., Riegler, F.X., Gevaert, M.L., Ergin, T.M. 1992. Isokinetic and isometric measurement of strength of external rotation and abduction of the shoulder. J. Bone Joint Surg. **74(9):**1320-33

Lord, J.P., Aitkens, S.G., McCrory, M.A., Bernauer, E.M. 1992. Isometric and Isokinetic measurement of hamstring and quadriceps strength. *Arch. Phys. Med. Rehabil.* **73(4):** 324-30.

MacDermid, J.C., Ramos, J., Drosdowech, D., Faber, K., Patterson, S. 2004. The impact of rotator cuff pathology on isometric and Isokinetic strength, function, and quality of life. J. Shoulder Elbow Surg. **13(6):** 593–598.

Magnusson, S.P., Gleim, G.W., Nicholas, J.A. 1990. Subject variability of shoulder abduction strength testing. *Am. J. Sports Med.* **18:** 349-353.

Malerba, J.L., Adam, M.L., Harris, B.A., Krebs, D.E. 1993. Reliability of dynamic and isometric testing of shoulder external and internal rotators. J. Orthop. Sports Phys. Ther. **18(4):** 543-52.

Marília Dos Santos Andrade, Anna Maria Fleury a , Claudio Andre Barbosia de Lira b , João Paulo Dubas a & Antonio Carlos da Silva (2010). Profile of Isokinetic eccentric-to-concentric strength ratios of shoulder rotator muscles in elite female team handball players J. Sports Scien., May; **28(7):** 743–749

McCabe, R.A., Nicholas, S.J., Montgomery, K.D., Finneran, J.J., McHugh, M.P. 2005. The effect of rotator cuff tear size on shoulder strength and range of motion. *J Orthop. Sports Phys. Therap.* **35(3):** 130–135.

McMaster, W.C., Long, S.C., Caiozzo, V.J. 1992. Shoulder torque changes in the swimming athlete. *Am. J. Sports Med.*, **20:** 323-327

Murphy, A.J., Wilson, G.J. 1996. Poor correlations between isometric tests and dynamic performance: relationship to muscle activation. Eur. J. Appl. Physiol. Occup. Physiol. **73(3-4):** 353-7.

Nadine, A. Plotnikoff, D. MacIntyre, L. 2002. Test-Retest Reliability of Glenohumeral Internal and External. Rotator Strength. *Clin. J. Sport Med.*, **12:** 367–372.

Pappas, A.M., Zawaki, R.M., Sullivan, T.J. 1985. Biomechanics of baseball pitching: A preliminary report. Am July-Aug **13(4):** 216-22.

Pincivero, D.M., Lephart, S.M., Karunakara, R.A. 1997. Reliability and precision of Isokinetic strength and muscular endurance for quadriceps and hamstrings. *Int. J. Sports Med.*, **18:** 113-17

Ramsl, M., Swanik, K.A., Swanik. C.B., Straub, S., Maltacola, C. 2004. Shoulder-rotator strength of high school swimmers over the course of a competitive season. *Sport Rehabil.* **13:** 9-18. ©2004 Human Kinetics Publishers, Inc

Sahaly, R., H. Vandewalle, Driss, T., Monod, H. 2001. Maximal voluntary force and rate of force development in humans importance of instruction. *Eur. J. Appl. Physiol.* 85(3–4):345- 350.

Sapega, A.A., Nicholas, J.A., Sokolow, D., Saranti, A. 1982. The nature of torque "overshoot" in Cybex Isokinetic dynamometry. *Med. Sci. Sports and Exer.* **14(5):** 368-75.

Stickley, C.D. Ronald, K. Hetzler, B. Freemyer, G. Kimura, I.F. 2008. Isokinetic Peak Torque Ratios and Shoulder Injury History in Adolescent Female Volleyball Athletes. *J. Athl. Train.*, **43(6):** 571–577

Tyler, T.F., Nahow, R.C., Nicholas, S.J., McHugh, M.P. 2005. Quantifying shoulder rotation weakness in patients with shoulder impingement. *J. Shoulder Elbow Surg.* **14(6):** 570–574.

Wang, H.K., Cochrane, T. 2001. A descriptive epidemiological study of shoulder injury in top level English male volleyball players. *Int. J. Sports Med.* **22(2):** 159–163.

Yildiz, Y., Aydin, T., Sekir, U., Kiralp, M. Z., Hazneci, B., & Kalyon, T. A. 2006. Shoulder terminal range eccentric antagonist/concentric agonist strength ratios in overhead athletes. *Scand. J. of Med. Sci. Sports*, **16:** 174–180.

Effect of Combined Integrated Learning Programme (CILP) in children with Learning Disabilities

Kaur[1], N., Narkeesh[2], A
[1]Post graduate student of Neurological Physiotherapy, Punjabi University, Patiala-147002, Punjab
[2]Reader, Department of Physiotherapy, Punjabi University, Patiala

Abstract

Learning disabilities are heterogeneous group of disorders characterized by the unexpected failure of an individual to acquire, retrieve, and use information competently. It is estimated that around 15 million children suffer from this 'invisible handicap', thus average class in schools has about five students with learning disabilities. In order to encounter the problem, education authorities have issued some guidelines which are compensatory in nature and they lack a curative approach to the problem, till date the proper intervention is missing. Present study tries to interpret all the academic, therapeutic and psychological aspect through formulation of structured protocol in the form of intervention technique called Combined Integrated Learning Programme (CILP) and also finds efficacy along with guidelines of Punjab School Education Board (PSEB) on 30 subjects. The mean, standard deviation, t- value, F-value and post hoc analysis for all the variables were calculated. It was concluded that CILP has significant effect on the learning outcomes of children with learning disabilities.

Keywords: Learning Disabilities, therapeutic interventions, IQ, video games, Fine motor Skills and Cognition

Introduction

Learning Disabilities (LDs) are heterogeneous group of disorders characterized by the unexpected failure of an individual to acquire, retrieve, and use information competently. They are the most severe, pervasive, and chronic form of learning difficulty in children with average or above-average intellectual abilities because the concept of learning disability has a brief and turbulent history both conceptually and operationally, making them victims of over expectation and social obligations of parents due to their ability to deal intelligently with some topics while having problem in others. The estimated figures show that about 15 million children suffer from this 'invisible handicap' thus average class in schools has about five students with learning disabilities *(Thacker, 2007)*. Epidemiological studies of learning disabilities in India are burdened by problems ranging from identification, assessment, to socio-cultural factors unique to India. The characteristics of LD child may range from motor disorders to emotional disorders, perceptual disorders, symbiotic disorders, memory disorders and attention disorders *(Panda, 1997)*. In order to deal with the problem, disciples of both academic and medical sector have recommended the different management strategies according to their expertise. However, the existing dilemma about the conceptual and operational problems and the beliefs and practices of teachers, psychologists, neurophysiologists, psychiatrists and therapists directed our attention to the need of integrated approach in order to rectify the problem. This inspires the formation of Combine Integrated Learning Programme in the present study. Thus to formulate and

explore the effects of CILP was the main aim of study.

Materials and Methods

Study consists of following two parts:

Step – I: Formulation of 12 weeks structured protocol called Combined Integrated Learning Programme (CILP).

The procedure for formulation of Combined Integrated Learning Programme was undertaken at the Department of Physiotherapy, Punjabi University, Patiala. It involved the thorough study of various articles from journals, text books, case studies and the incorporation of knowledge, generated in the light of experience of the guide and other researchers. The areas that have been included in the CILP includes fine motor activity and hand functions *(Palmstrom, 1998)*, physical activity and motor skill training and problem solving approach and spatial orientation, enhancing learning process. *(Feng et al, 2007)* and abstract thinking and reasoning *(Hogle, 1996)*

Step – II: The experimental study in the form of randomized control trial was conducted in which the effects of Combined Integrated Learning Programme (CILP) were explored in children with learning disabilities.

Study was performed on 30 subjects taken from Government Middle School, Village- Goh, District- Ludhiana, Punjab, under the age group of 8-12 years. Study was performed in accordance with ethical considerations of the institute and their consent was taken prior to the study.

Variables: The dependent Learning Disability Diagnostic Inventory (LDDI) score, Standard Progressive Matrices (SPM) score, dart score, reaction time (RT), Teacher's Confidence (TC) and mini mental state examination score (MMSE) and the independent variables include Combined Integrated Learning Programme (CILP) and Punjab School Education Board (PSEB) guidelines.

Procedure: The children were screened through LDDI score and SPM Grade and those who satisfied the inclusion criterion were divided into 3 groups randomly. Each group consisted of 10 children. The inclusion criteria was age group 8-12years of both genders, subjects with at least one level in likely and one level in possibly grade of Learning Disability Diagnostic Inventory (LDDI), grade II- IV as per Standard Progressive Matrices (SPM) and dominant right hand. The exclusion criteria was subjects who have had any auditory or visual problem, whose profile had all scores above or below 6 grade of Learning Disability Diagnostic Inventory (LDDI), grade I or V as per Standard Progressive Matrices (SPM), physical disabilities and dominant left hand. Group A (Control Group), control was focused on subjects with limited activities and was supervised by teachers and parents. Group B (Experimental Group): This group received intervention as per existing guidelines issued by Punjab School Education Board (PSEB) strictly for 4 weeks. Subjects received 2 hours separate special education classes of 3 subjects- Mathematics, Science and English by qualified teachers in school premises Group C (Experimental Group): This group received intervention as per guidelines issued by Punjab School Education Board (PSEB) and also

according to Combined Integrated Learning Programme (CLIP) for 4 weeks. The data of all the outcome measures was taken at 0, 2 weeks and 4 weeks.

Results

Table 1 compares the mean age, height, weight abd BMI among the three groups of the study. Mean age of the Groups A, B & C were 9.61, 9.71 & 9.59 years respectively. The three groups demonstrated similar mean values of height, weight and BMI.

Table 1: Mean and SD of Age, Height, Weight and BMI for the subjects of Group A, Group B and Group C

Demographic	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Age	9.61	0.69	9.71	0.68	9.59	0.88
Height	4.01	0.17	3.98	0.15	3.99	0.22
Weight	29.85	1.58	29.50	1.25	29.40	2.13
BMI	20.71	1.38	21.47	1.07	20.55	1.27

Table 2 describes the comparison of mean values for LDDI, SPM and Dart score; the t–value for Group C is observed to be significant.

Table 2: Comparison of mean values for LDDI, SPM and DART at Pre, Post 2 week, Post 4 weeks and Mean Difference (MD) within Group A, Group B and Group C

Groups	Session	LDDI			SPM			DART		
		Mean	SD	t value	Mean	SD	t value	Mean	SD	t value
Group A	Pre	63.20	6.18		51.95	16.98		8.70	1.57	
	Post 2 week	63.20	6.18	0.002	51.95	16.98	0.003	8.70	1.57	0.054
	Post 4 week	63.35	6.17	(NS)	52.45	16.50	(NS)	8.90	1.60	(NS)
	MD	0.15	0.24		0.50	1.58		0.20	0.42	
Group B	Pre	62.55	5.87		43.40	12.87		9.10	1.20	
	Post 2 week	63.10	5.94	0.203	43.90	13.03	0.015	9.20	1.03	0.078
	Post 4 week	64.20	5.86	(NS)	44.40	12.96	(NS)	9.30	1.16	(NS)
	MD	1.65	0.41		1.00	2.11		0.20	0.42	
Group C	Pre	65.65	8.39		47.10	15.32		9.20	1.32	
	Post 2 week	67.45	8.49	0.432	49.00	14.52	0.135	11.90	0.99	70.355
	Post 4 week	69.15	8.39	(NS)	50.50	14.06	(NS)	14.80	0.79	(S)
	MD	3.50	0.33		3.40	4.72		5.60	1.07	

Comparison of mean values for RT, TC and MMSE is presented in table 3. The t – value for RT and TC for Group C is observed to be statistically significant.

Table 3: Comparison of mean value for RT, TC & MMSE at Pre, Post 2 week, Post 4 week and Mean Difference (MD) within Group A, Group B and Group C

Groups	Session	RT			TC			MMSE		
		Mean	SD	t value	Mean	SD	t value	Mean	SD	t value
Group A	Pre	792.60	6.67		41.80	1.55		26.50	0.53	
	Post 2 week	792.30	6.65	0.07	42.00	1.33	0.19	26.50	0.53	0.000
	Post 4 week	791.50	7.63	(NS)	42.20	1.48	(NS)	26.50	0.53	(NS)
	MD	1.10	1.85		0.40	0.52		0.00	0.00	
Group B	Pre	794.90	7.08		40.60	1.43		26.40	0.52	
	Post 2 week	794.70	6.58	0.051	41.00	1.25	1.17	26.50	0.53	0.370
	Post 4 week	793.90	7.16	(NS)	41.50	1.27	(NS)	26.60	0.52	(NS)
	MD	1.00	1.25		0.90	0.57		0.20	0.42	
Group C	Pre	793.90	6.06		41.00	1.25		26.60	0.52	
	Post 2 week	777.30	6.99	63.22	42.50	1.08	30.21	26.80	0.42	2.478
	Post 4 week	759.10	7.62	(S)	45.00	1.15	(S)	27.10	0.57	(NS)
	MD	34.80	3.26		4.00	0.67		0.50	0.53	

Table 4 presents the comparison of mean values for LDDI, SPM and Dart at Pre, Post 2 week, Post 4 week and mean differences between groups A, B and C. The F value for mean difference for LDDI and post 2 week, post 4 week and mean difference for Dart are observed to be statistically significant.

Table 4: Comparison of mean value for LDDI, SPM and DART at Pre, Post 2 week, Post 4 week and Mean diff. (Pre-Post) between Group A, Group B and Group C

Session	LDDI Group (A Vs B Vs C)		SPM Group (A Vs B Vs C)		DART Group (A Vs B Vs C)	
	F value	P value	F value	P value	F value	P value
Pre	0.561	P > 0.05	0.801	P > 0.05	0.374	P > 0.05
Post 2 week	1.271	P > 0.05	0.744	P > 0.05	19.707	P < 0.05
Post 4 week	2.061	P > 0.05	0.829	P > 0.05	72.288	P < 0.05
MD	249.270	P < 0.05	2.468	P > 0.05	192.971	P < 0.05

Table 5 presents the comparison of mean values of RT, TC and MMSE at Pre, Post 2 week, Post 4 week and the mean differences between group A, B and C. The F values for the mean difference for post 2 week for RT, TC and for post 4 week for RT, TC and MMSE are observed to be statistically significant.

Table 5: Comparison of mean value for RT, TC and MMSE at Pre, Post 2 week, Post 4 week and Mean diff. (Pre-Post) between Group A, Group B and Group C

Session	RT Group (A Vs B Vs C)		TC Group (A Vs B Vs C)		MMSE Group (A Vs B Vs C)	
	F value	P value	F value	P value	F value	P value
Pre	0.304	P > 0.05	1.867	P > 0.05	0.370	P > 0.05
Post 2 week	19.546	P < 0.05	3.889	P < 0.05	1.227	P > 0.05
Post 4 week	67.623	P < 0.05	20.089	P < 0.05	3.577	P < 0.05
MD	729.653	P < 0.05	110.419	P < 0.05	4.171	P < 0.05

Table 6 presents the post hoc values for LDDI, SPM and Dart for Groups A, B and C. The post hoc analysis for mean differences for Group A vs B, A vs C & B vs C for LDDI at post 2 week, post 4 week and mean difference A vs C & B vs C for Dart are observed to be statistically significant.

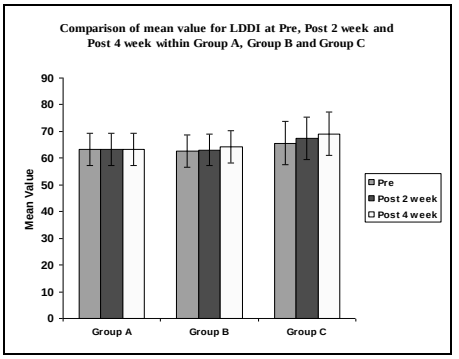
Table 6: Post Hoc Analysis of LDDI, SPM and DART

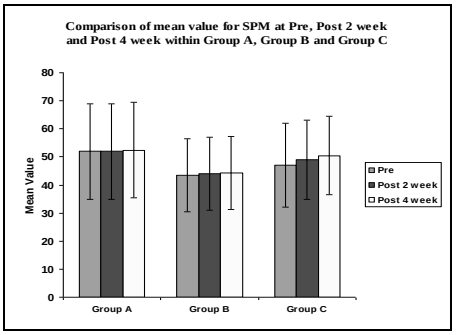
Group Comp.	LDDI				SPM				DART			
	Pre	Post 2 week	Post 4 week	MD	Pre	Post 2 week	Post 4 week	MD	Pre	Post 2 week	Post 4 week	MD
A Vs B	0.65 (NS)	0.10 (NS)	0.85 (NS)	-1.50 (S)	8.5 (NS)	8.0 (NS)	8.0 (NS)	-0.5 (NS)	-0.40 (NS)	-0.5 (NS)	-0.40 (NS)	0.00 (NS)
A Vs C	-2.45 (NS)	-4.25 (NS)	-5.80 (NS)	-3.35 (S)	4.8 (NS)	2.9 (NS)	1.9 (NS)	-2.9 (NS)	-0.50 (NS)	-3.2 (S)	-5.9 (S)	-5.4 (S)
B Vs C	-3.10 (NS)	-4.35 (NS)	-4.95 (NS)	-1.85 (S)	-3.7 (NS)	-5.1 (NS)	-6.1 (NS)	-2.4 (NS)	-0.10 (NS)	-3.7 (S)	-5.5 (S)	-5.4 (S)

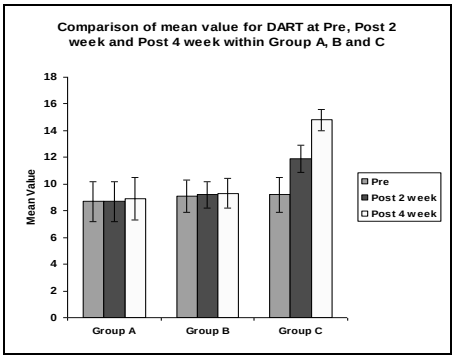
Table 7: Post Hoc Analysis of RT, TC and MMSE

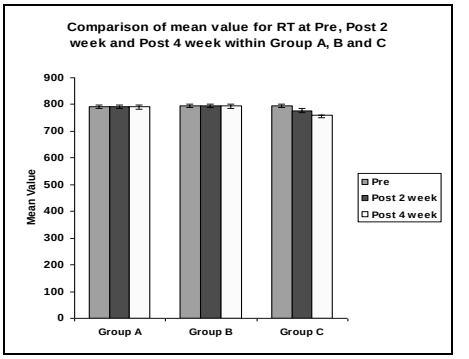
Group Comp.	RT				TC				MMSE			
	Pre	Post 2 week	Post 4 week	MD	Pre	Post 2 week	Post 4 week	MD	Pre	Post 2 week	Post 4 week	MD
A Vs B	-2.3 (NS)	-2.4 (NS)	-2.4 (NS)	-0.1 (NS)	1.2 (NS)	1.0 (NS)	0.7 (NS)	-0.5 (NS)	0.1 (NS)	0.0 (NS)	-0.10 (NS)	-0.2 (NS)
A Vs C	-1.3 (NS)	15.0 (S)	32.4 (S)	33.7 (S)	0.8 (NS)	-0.5 (NS)	-2.8 (S)	-3.6 (S)	-0.1 (NS)	-0.3 (NS)	-0.6 (NS)	-0.5 (S)
B Vs C	1.0 (NS)	17.4 (S)	34.8 (S)	33.8 (S)	-0.4 (NS)	-1.5 (S)	-3.5 (S)	-3.1 (S)	-0.2 (NS)	-0.3 (NS)	-0.5 (NS)	-0.3 (NS)

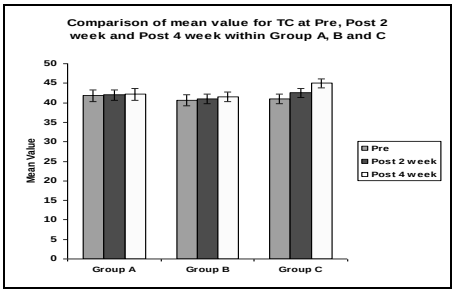
Table 7 presents the post hoc values for RT, TC and MMSE for Groups A, B and C. The post hoc value for post 2 week, post 4 week and mean difference for Group A vs C & B vs C for RT and TC and mean difference for A vs C for MMSE are observed to be statistically significant.

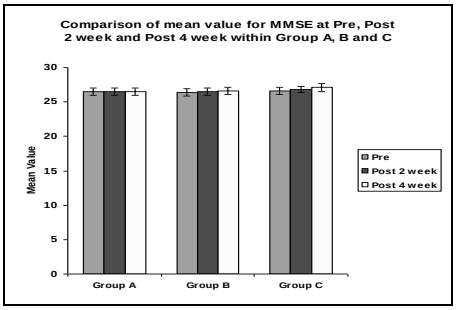












Learning disability is a term that refers to a group of varied and often multidimensional disorders as the characteristics of a child with learning disability are often diverse and complex, however the most commonly recognized performance difficulties in learning are associated with academic success *(Darcy, 2007)*. As a result of lack of awareness and difficulties in the diagnosis and identification, both parents and teachers either ignore the deficiency or blame it on the child's personality branding it as laziness, attitude or aggression. This leads to extreme stress and children negotiate these stresses with resilience and mastery. In Mumbai four students committed suicide in a period of three days and all were related to academic failure and stress *(Malik, 2009)*.

In order to deal with the problem, disciples of both academic and medical sector have recommended the management strategies according to their expertise. Taken into consideration the role of psychologists, teachers, neuro-

psychiatrists and therapists, it was evident that there is lack of combined effort in the form of integrated approach in order to deal the problem on a bigger front. This is how the formulation of Combined Integrated Learning Programme (CILP) comes into play and the areas that have been included in the CILP includes fine motor activity and hand functions through games like spinning tops, painting *(Palmstrom,1998),* motor skill training through games like dart, physical activity and perception training through outdoor games like basketball *(Carlson et al, 2008)* problem solving approach, reasoning and improvement in eye – hand co-ordination through video – games *(Feng et al, 2007),* cognitive skill games like rubiks, fun puzzles and numerical puzzles.

In order to find the effect of CILP, experimental study was conducted in form of randomized control trial. This randomized control trial was performed in 3 groups (10 subjects each) of 8-12 years school going children with learning disabilities. Group A – Control Group which was controlled against any old or new intervention method whereas Group B – Experimental Group received intervention according to PSEB guidelines and Group C - Experimental Group received intervention according to PSEB and CILP protocol. The data is collected and analyzed using SPSS 16 software and mean, standard deviation; t-value, one-way ANOVA and Post hoc Scheffe tests were applied. The present study found that Group C is better than Group A and Group B for all the variables. Going through statistical analysis, it is revealed that group C stands out to be statistically significant from Group A and Group B in dart score, reaction time, teacher's confidence and MMSE score.

Conclusion

From the present study, it can be concluded that CILP, the protocol formulated for learning disabled children, has been found to be an effective tool in enhancing the learning outcomes than the conventional guidelines of PSEB. It also emphasized that curriculum of schools should be based on problem solving approach and interactional study is more beneficial. It has also been observed that longitudinal study is required to know the extreme effects of CILP.

References

Carlson, S.A., Fulton, J.E., Lee, S.M., L, Maynard, M., David R, Brown, D.R., Kohl, H.W. and Dietz, W.H. 2008. Physical education and academic achievement in elementary school. *Am. J. Pub. Health*, **98(4):** 1-7.

Darcy, A.U. 2007. Neurological Rehabilitation. 4th edition; *Mosby Elsevier*, 309- 310.

Feng, S., Spence, I., and Pratt, J. 2007. Playing an action video game reduces gender differences in spatial cognition, *J. Psych. Sci.*, **18(10):** 850-855.

Hammill, D.D. and Bryant, B.R. 1998. Learning Disabilities Diagnostic Inventory: A method to help identify intrinsic processing disorders in children and adolescents"; pro-ed publisher. Examiner's Manual.

Hogle, J. G. 1996. Considering games as cognitive tools. *In search of effective edutainment, Website:ftp://twinpinefarm.com/pub/pdf/*

Malik, 2009. Learning Disability in India, *www.merinews.com*

Palmstrom, 1998. Occupational Therapy and Learning Disabilities", *Learn. Disab. J.*, **8(2):** 28 – 30

Panda, K.C. 1997 *Elements of Child Development*; 3rd edition; Kalyani Publishers, New Delhi. 365-375.

Thacker, E.L. 2007. Poor scholastic performance in children and adolescents. *Ind. J. Paed.*; **44:** 411-414.

Rotator Cuff Lesions: A Case Report

Khurana[1], N., Hanspal[1], S.S. and Singh[2], G.
[1]Clinical Therapist, Banarsidas Chandiwala Institue of Physiotherapy, Chandiwala Estate, Maa anandmai Marg, Kalkaji, New Delhi 110019.
[2]MPT Final year Student, Banarsidas Chandiwala Institue Of Physiotherapy,Chandiwala Estate, Maa Anandmai Marg ,Kalkaji, New Delhi 110019.

Abstract

Objective: To describe the evaluation, management, and rehabilitation of a multifactorial rotator cuff lesion in an elderly female. **Background:** The reported onset of pain was gradual. No history of fall or trauma. Pain was present on anterolateral aspect of left shoulder. Pain was sharp and deep on abduction and flexion of the left shoulder and reported a VAS of 9.5/10. **Treatment:** The patient was managed conservatively with steroid injections and physiotherapy. The patient underwent a 2-month rehabilitation protocol in preparation for return to normal daily activities. **Uniqueness:** This case involved an elderly female who sustained a multiple causative factors for rotator cuff lesions. **Conclusions:** By presenting this case report, we hope a better understanding of rotator cuff lesions and how to successfully manage and rehabilitate.

Key Words: Rotator Cuff Lesion, Elderly, Shoulder Impingement, Calcification, Physiotherapy.

Introduction

Shoulder pain is a common musculoskeletal complaint in the general population. The elderly population is often afflicted, and rotator cuff problems are among the most common causes of shoulder pain seen in primary care practices. The prevalence of shoulder pain in the elderly has been estimated to range from 21% to 27%, and the prevalence of rotator cuff tear increases with advanced age. The etiology of rotator cuff disease is likely multifactorial, including both extrinsic and intrinsic factors. Rotator cuff dysfunction encompasses a spectrum of pathological changes, ranging from impingement syndrome to rotator cuff tendonitis to rotator cuff tendon tear. In the elderly population, the clinical manifestations from rotator cuff dysfunction can translate into significant morbidity and disabilities, interfering with ability for self care and functional independence. The goals of managing rotator cuff disease are to regain normal shoulder function and biomechanics, and to improve functional abilities in elderly patients (*Lin et al, 1972*). *Neer (1972)* first introduced the concept of rotator cuff impingement to the literature, stating that it resulted from mechanical impingement of the rotator cuff tendon beneath the anteroinferior portion of the acromion, especially when the shoulder is placed in the forward-flexed and internally rotated position. He reported that about 90% of rotator cuff tears are a result of subacromial impingement from supraspinatus outlet narrowing.

There is also an association of rotator cuff disease with abnormal acromions *(Cofeild, 1985)*. Changes in the bone or ligament can cause decreased space for the cuff or abnormal biomechanics. There is also controversy regarding whether subacromial spurs cause rotator cuff disease or whether these are secondary changes caused by a poorly functioning cuff. Several studies have found a strong association between aging, cuff tears, and altered acromial contours. The most

common change in contour is an acromial hook that lies within the coracoacromial ligament. This change most likely is caused by rotator cuff disease. As the rotator cuff degenerates, the cuff no longer can fulfill its role of providing superior stability and acting as a spacer. The shoulder relies on the coracoacromial arch for stability, and an increase load is placed on the coracoacromial ligament.

Partial rotator cuff tears, especially tears in the older population, have a limited ability to heal because of several factors *(Kazemi, 1999)*. One is that the torn tendon is under tension during activity as the cuff contracts and at rest because of the weight of the arm and the role of the cuff to compress the humeral head into the glenoid. This tension causes a relative avascularity around the edges of the tear and causes the ends to retract, which does not allow approximation for healing. In addition, the torn ends of the tendons, especially the distal margins, often develop neovascular tissue that causes resorption of the tendon fibers, and without closure of the defect, healing does not occur. Another factor is that the torn cuff is bathed in synovial fluid, which disrupts some of the normal healing factors, such as a fibrin clot. A final, and perhaps most important, factor is that tendon tears in older patients generally occur because of tendon degeneration.

Calcifying tendinitis of the rotator cuff is a common condition in middle aged individuals *(Chiou et al, 2002, Jacobs & Debeer, 2006)*. This condition affects 2.7% to 20% of the population, mostly aged between 30 and 50 years. Women are more frequently affected than men. Only a few of them have clinical symptoms. Hydroxyapatite is formed by fibrocartilage cells in the tendon following an unknown stimulus. Subsequently, depending on the disease phase, pain and limitation of motion can occur. *Uhthoff and Loehr (1997)* believe that calcifying tendinitis progresses through correlating pathological and clinical stages. During the formative phase, a portion of the tendon undergoes fibrocartilaginous transformation, and calcification occurs in this transformed tissue. Once formed, the calcific deposit enters a resting period (resting phase). The calcific deposit may or may not be painful. If large enough, it may cause mechanical symptoms. After a variable period, an inflammatory reaction may ensue. Vascular tissue develops at the periphery of the deposit. Macrophages and multinuclear giant cells absorb the deposit during this resorptive phase. Occasionally, it leaks into the subacromial bursa. This stage may be very painful. Once the calcific deposit has been resorbed, fibroblasts reconstitute the collagen pattern of the tendon in the postcalcific phase.

Case Report

A 63-year-old female presented with left shoulder pain since 8 months. The reported onset was gradual. No history of fall or trauma. Pain was present on anterolateral aspect of left shoulder. Pain was sharp and deep on abduction and flexion of the left shoulder. Patient reported a VAS of 9.5/10. SPADI **(**Shoulder Pain and Disability Index) (Speed CA) score of 110/130. It was aggravated by lying on the shoulder, reaching and lifting with the left arm. Pain was relieved by medications and keeping shoulder adducted. Previous treatment received included medications (Cartigen, T. Dolocide, Idrofos and Calcium

supplements) along with physiotherapy (Hot packs, Ultrasound and ROM exercises including pulleys, wheel and ladder) *(Will, 2005)* for 4 weeks, but patient complained of increase pain. She further consulted the orthopaedic surgeon; medications were changed to T.Nucoxia, T.Ultracet and Pantop-D. Physiotherapy included hot packs for 15-20 minutes, 2-*(Cofeild, 1985)* times daily. Along with this she also took one week of Acupuncture *(Hing, 2005)* in August 2010. Continuing to have pain and left shoulder movement restriction, she consulted her surgeon who injected her with cortisone twice (one in November 2010 & the other in December 2010) in her left shoulder and recommended light exercises. One month prior to presenting to the author's office patient felt 50% better only in terms of pain relief but there was no increase in range of motion at the left shoulder. At this time the patient presented to the author's clinic with dull and achy pain in the left shoulder and with a sharp pain to the posterior and anterolateral left arm. She complained of not being able to move her left arm and having a hard time dressing and washing herself. The pain was aggravated by any movement of the left arm, lying on the left arm and she was awakened at night when she rolled onto the affected arm. The pain was slightly relieved by taking hot fomentation. Patient has a medical history of hypertension and hypothyroidism and diabetes mellitus but was under control with medications. Hematological tests revealed normal uric acid level. Family history was unremarkable.

On examination, upper extremity deep tendon reflexes were normal bilaterally and light touch sensation examination was unremarkable. Cervical spine bilateral lateral flexion bilateral rotation and flexion were full and pain free. However, the left shoulder pain could not be reproduced by the neck examinations (i.e. range of motion, soft tissue palpation, Spurling's, Jackson's and maximal compression tests). Her active left glenohumeral ROM was; flexion 0 - 80º, abduction 0 - 45º, external rotation 0-10º and internal rotation 0 -20º. The left glenohumeral joint passive ROM was 5 degrees more in each direction. Posterior and posteroinferior glide restricted and painful. The resisted left glenohumeral joint flexion, abduction, internal and external rotations were graded 3/5. Her left deltoid, infraspinatus, supraspinatus and teres muscles were spasmodic and tender upon palpation. There was severe point tenderness over the left deltoid tuberosity and the rotator cuff. Special tests such as painful arc (pain and weakness between 60-120 degrees shoulder abduction), Empty can test *(Barr, 2004)*, Hawkins Kennedy impingement test (*Barr, 2004*) was positive and Drop arm test was negative.

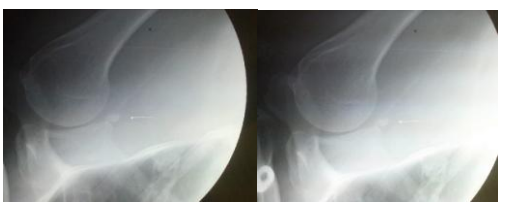


Figure :1(X Ray Left Shoulder)

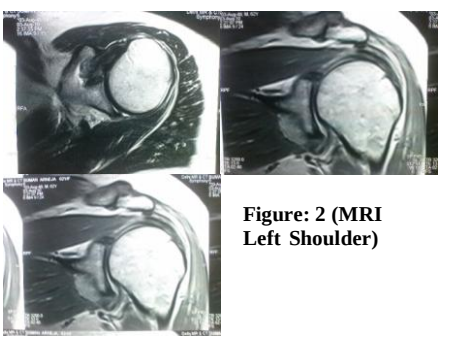


Figure: 2 (MRI Left Shoulder)

Radiographs of the right shoulder revealed reduced glenohumeral joint space, calcific (calcium hydroxyapatite deposition) density near inferior angle of glenoid (figure1). MRI revealed acromioclavicular osteoarthritic changes with laterally downsloping acromion with acromial osteophyte impinging on to supraspinatus tendinosis with subacromial and subdeltoid bursitis. A clinical diagnosis of the left multiple cuff lesions were made (figure 2).

Initial treatment consisted of Ultra – Riez current therapy *(Charlusz et al, 2005; Shaw et al, 2010),* hot packs, anteroposterior and long axis distraction mobilization, sustained capsular stretches, Anteroposterior glenohumeral glides, Grade 3 Kaltenborne mobilization technique for increasing the ROM and Grade 1 & 2 for pain relief, active as well as active assisted exercises, we also used suspension therapy to reduce the pain along with pendular home exercises *(Nitz, 1986)* for the left shoulder were done. The patient came regularly for 6 weeks and a considerable improvement in range was appreciated but pain was still present. At the end of the sixth week, the active left glenohumeral (initial range in brackets) abduction, flexion and external rotation were 105(80), 90(45) and 15(10) degrees respectively and the passive ROM showed even more improvements where the passive abduction, flexion and external rotation were 95, 110 and 20 degrees respectively. After 6 weeks, strengthening exercises using 0.5 kg dumbbells in all planes of glenohumeral ROM were introduced along with multiangle isometrics and scapular strengthening exercise .Even though considerable improvement in range was appreciated, pain was still present and the patient was referred back to the orthopaedic surgeon and third intra-articular injection (Hing, 2005) in March 2011 was given, after which the physiotherapy treatment was discontinued for 10 days. After 10 days there was considerable pain relief (85%) was achieved and physiotherapy was restarted with hot packs, gentle mobilization, active assisted exercises with bar, pulley, finger ladder and strengthening of shoulder muscles with 1 kg dumbbells. Patient's range of motion, strength and pain were markedly improved after the rehabilitation. There was a marked improvement in pain as well as the glenohumeral range of motion at the left shoulder with flexion ROM was 160 degrees, abduction 140 degrees, external rotation 60 degrees and internal rotation 80 degrees. Patient now reported a VAS of 0/10**.** SPADI of 23/130, Muscle strength also improved and the muscle were graded at 4/5.The patient could perform all her activities of daily living with ease and minimal pain. In addition, the left glenohumeral joint long axis distraction, anteroposterior and posteroinferior manual high speed low amplitude manipulation, capsular stretches and tender point therapy over the hypertonic and tender muscles (lateral deltoid, supraspinatus and infraspinatus muscles) were started. Tender point therapy was utilized by exerting digital compressive pressure over the tender points palpated in the involved muscles. This pressure was gauged to the patient's tolerance and was sustained until the patient reported the dissipation of the pain. At the end of this course of treatment, the patient's left glenohumeral active abduction was 140 degrees and her

flexion and external rotation were nearing end range. The left glenohumeral passive abduction was full but the resisted strength remained 4/5. The patient was attributed to isotonic strengthening exercises using free weights (1 kg dumbbell). A regimen of weight training exercises (isotonic) for shoulder abduction, forward flexion, extension, internal and external rotations were prescribed.

Discussion

This case involves multifactorial rotator cuff lesions, both extrinsic and intrinsic *(Toby et al, 2007):* Etiologies of shoulder pain can be categorized by location as either intrinsic or extrinsic. Extrinsic factors being anatomical and environmental. One of the most acclaimed anatomical factors is the morphologic characteristics of the acromion. Hooked, curved, and laterally sloping acromions are strongly associated with cuff tears and may contribute by causing tractional damage to the tendon. A progression to a hooked acromion may simply be an adaptation to an already damaged, poorly balanced rotator cuff that is creating increasing stress on the coracoacromial arch. Environmental factors implicated include increasing age, shoulder overuse, smoking, and any medical condition that impairs the inflammatory and healing response such as diabetes mellitus. *(Will, 2005).* Intrinsic factors encompass the range of injury mechanisms that occur within the rotator cuff itself. Chief among these is a degenerative-micro trauma model, which supposes that age-related tendon damage compounded by chronic microtrauma results in partial tendon tears that then develop into full rotator cuff tears. *(Nho et al, 2008).* Rotator cuff pathology is the most common cause of shoulder pain, the most common presenting features of which are shoulder pain, decreased shoulder ROM, and weakness (9, 10). In this case our patient presented with these features. It is commonly believed that corticosteroid injections are beneficial in nonoperative management of intrinsic shoulder pathology *(Barr, 2004; Nho et al, 2008; Charlusz et al, 2010 Shaw et al, 2010).* However, these generally accepted treatment strategies employed for rotator cuff pathology, including a subacromial corticosteroid injection and physical therapy improved patient's symptoms.

This case is unique in that it involved an elderly female with left multiple rotator cuff lesions with calcific deposition near inferior glenoid, acromioclavicular osteoarthritic changes, a laterally downsloping acromion with acromial osteophyte, supraspinatus tendinosis, subacromial and subdeltoid bursitis. Rotator cuff lesions in the younger population are rare and often occur chronically in the older population secondary to impingement syndrome. *(Cofeild, 1985)* Over time, bony alterations (acromion thickening and bone spurs) develop within the subacromial space. *Neer (1972)* stated that the typical age of these individuals with stage Ill impingement was greater than 40 years old. The patient opted for corticosteroid injection. After corticosteroid injections, the patient participated in a 6 week rehabilitation program. The initial goals of the rehabilitation program were to decrease pain through modality use; and to restore range of motion, first passively and progressing to full AROM. No studies have been identified that suggest the best practice for physical rehabilitative measures *(McClure & Flowers, 1992*). Many therapeutic approaches that have

been used to treat a person with rotator cuff lesion include manual therapy, electrical modalities, active exercises, and various basic and advanced joint mobilization techniques (*McClure & Flowers, 1992*). Hot pack, ultra reiz current therapy and light mobilization shoulder exercises were prescribed to this patient due to pain. *Ryans (2005)* did a study on A randomized controlled trial of intra-articular triamcinolone and/or physiotherapy in shoulder capsulitis. The purpose of the study was to assess the effectiveness of intra-articular triamcinolone injection and physiotherapy singly or combined in the treatment of adhesive capsulitis of the shoulder. Once sufficient range of motion was achieved, rotator cuff resistance training was initiated (*Davies & Durall, 2000).* The rotator cuff both centralizes and approximates the humeral head within the glenoid.'8 9 Sharkey and Marder' reported that the rotator cuff musculature opposes superior translation of the humeral head during abduction. If the rotator cuff fails to perform this humeral depression function (as in this patient), the supraspinatus can become impinged, placing the repaired supraspinatus tendon in a compromising position. Initially, the only resistance provided was arm weight against gravity, progressing to dumbbells. In addition to rotator cuff strengthening, the patient performed a full scapular stabilization program. The scapular stabilizers play a vital role in the rehabilitation of rotator cuff repair. Motion of the scapulothoracic articulation is essential for fluent, coordinated movement of the shoulder.2' The scapular stabilizers provide a firm base of support for glenohumeral movements and simultaneously rotate the scapula as the humeral head moves within the glenoid fossa (scapulohumeral rhythm). Proper scapulohumeral rhythm maintains the humeral head in optimal alignment within the glenoid, allowing for the proper length-tension relationship among the rotator cuff muscles, glenoid, and humeral head *(Ryans, 2005)*. Asynchronous scapulohumeral rhythm by the scapular stabilizers disrupts this glenohumeral-scapulothoracic alignment and coordinated movement by the shoulder.2' With this humeral head alignment disrupted, the likelihood of the greater tuberosity's impinging the subacromial structures (supraspinatus tendon, subacromial bursa, and bicepital tendon) increases *(Myers, 1999)*.

Post pain relief the exercise regime included rotator cuff strengthening and in addition a scapular stabilization program. The scapular stabilizers play a vital role in the rehabilitation of rotator cuff repair. Motion of the scapulothoracic articulation is essential for fluent, coordinated movement of the shoulder (Myers JB). The scapular stabilizers provide a firm base of support for glenohumeral movements and simultaneously rotate the scapula as the humeral head moves within the glenoid fossa (scapulohumeral rhythm). Proper scapulohumeral rhythm maintains the humeral head in optimal alignment within the glenoid, allowing for the proper length-tension relationship among the rotator cuff muscles, glenoid, and humeral head *(Norkin & Levangie, 1988).* Asynchronous scapulohumeral rhythm by the scapular stabilizers disrupts this glenohumeral-scapulothoracic alignment and coordinated movement by the shoulder *(Myers, 1999)*. *Speed et al (2002)* studied 74 subjects with rotator cuff tendinitis. Extracorporeal shock wave

therapy and placebo treatment was given. Mean change in SPADI of 16.1 in the treatment group and 24.3 in the placebo group at 3 months. At 6 months the mean changes were 28.4 and 30.4, respectively. No significant differences between groups were found. *Bang & Deyle (2000)* studied 52 impingement syndrome patients and one group were given physiotherapy alone while other group was given physiotherapy along with manual therapy. Follow-up was done at 2 months. Both groups had significant improvements. Pain reduction significantly better in physiotherapy with manual therapy group, with a decrease in pain scores from 575.8 to 174.4, while physiotherapy alone reduced pain from a pre-treatment mean of 557.1 to a post-treatment mean of 360.6 (VAS 0–1,000). (*Hay et al (2003)* studied 207 patients with shoulder pain and they were given physiotherapy with subacromial steroid injection. Follow-up at 6 months was done. Improvements (defined as minimum of 50% drop in disability scores) in 60% of patients in PT group and in 53% in injection group were noted. No statistically significant difference between treatment arms at 6 weeks and 3 months. *Donatelli & Greenfield (1987)* did a case study on Rehabilitation of a Stiff and Painful Shoulder: A Biomechanical Approach. The research demonstrates there are many different treatment regimes for the management of shoulder dysfunction, none of which indicate overwhelming success. Traditionally, the painful, stiff shoulder, commonly diagnosed as frozen shoulder, is assessed without consideration of the entire shoulder complex. The biomechanics of the shoulder complex must be re-evaluated before each treatment session to determine the appropriate course of treatment.

Prognosis

Variables that correlated with a satisfactory outcome included improvement in pain relief, the ability to carry a 10 to 15 pound suitcase at one side and the ability to eat using a utensil *(Kazemi, 1999)*. Changes, ranging from tendinosis to subacromial impingement to partial- and full-thickness tears most rotator cuff injuries can be adequately diagnosed on the basis of a careful history review and physical examination, and respond well to conservative measures.

Conclusion

The shoulder is the site of many painful conditions. Because much of the symptomatology and many findings of these various conditions overlap, accurate diagnosis is dependent on a meticulous medical history and an equally thorough physical examination. Fortunately, most shoulder disorders respond to non-operative management or may resolve spontaneously. Consequently, physical therapists probably will continue to have an integral role in treating patients with shoulder pain.

References

Bang, M.D., Deyle, G.D. 2000. Comparison of supervised exercises with and without manual physical therapy for patients with shoulder impingement syndrome. J. Sports Phys. Ther., **30:** 126-37.

Barr, K.P. 2004. Rotator cuff disease. Phys. Med. Rehab. Clin. North America., **15:** 475-491.

Charłusz M, Gasztych J, Irzmański R, Kujawa J. 2010. Comparative analysis of analgesic efficacy of selected physiotherapy methods in low back pain patients. *Orthop. Traumat. Rehab.*, **12(2):** 225-36..

Chiou, H.J., Chou, Y.H., Wu, J.J., Hsu, C.C., Huang, D.Y., Chang, C.Y. 2002.

Evaluation of calcific tendonitis of the rotator cuf: Role of color doppler ultrasonography. *J. Ultrasound Med.* **21:** 289-295.

Cofeild, R.H. 1985**.** Rotator Cuff Disease of the shoulder. *J. Bone Joint Surg.,* **67:** 974-979.

Davies, G.J., Durall, C. 2000. Typical rotator cuff impingement syndrome: It's not always typical. *Pt Mag Phys Ther.* **8(5):** 58, 60, 62-4, 66-72.

Donatelli, R.A. & Greenfield, B. 1987. Case study on Rehabilitation of a Stiff and Painful Shoulder: A Biomechanical Approach, *J. Ortho. Sports Phys. Ther.;* **9(3):**118-126.

Hay, E.M., Thomas, E., Paterson, S.M., et al. 2003. A pragmatic RCT of local corticosteroid injection and physiotherapy for the treatment of new episodes of unilateral shoulder pain in primary care. *Ann. Rheum. Dis.* **62:** 394-9.

Hing, K-Tsui Sum. 2005. Shoulder impingement syndrome; Review. Hong Kong Bull. Rheum. Dis.., **5(1):** 14-18.

Jacobs, R., Debeer, P. 2006. Calcifying tendonitis of the rotator cuff: Functional outcome after arthroscopic treatment. Acta Orthop. Belgica., **72(3):** 276-281.

Kazemi, M. 1999. Degenerative rotator cuff tears in an elderly athlete: A case report. J. Canad. Chiro. Assoc., **43(2):** 104-110.

Lin, J.C., Weintraub, N., Aragaki, D.R. 2008. Nonsurgical Treatment for rotator cuff injury in the elderly. *J. Am. Med. Dir. Assoc.* **9(9):** 626-632.

McClure, P., Flowers, K. 1992. Treatment of limited shoulder motion: A case study based on biomechanical considerations. *Phys. Ther.,* **72:** 97–104.

Myers, J.B. 1999. Conservative management of impingement syndrome in the athletic population. *J. Sports Rehab.,* **8:** 230-254.

Neer CS 2nd. 1972. Anterior acromioplasty for chronic impingement syndrome in the shoulder: A preliminary report. *J. Bone Joint Surg.,* 54:41-50.

Nho, S. J., Yadav, H., Shindle, M. K., & MacGillivray, J. D. 2008. Rotator Cuff Degeneration: Etiology and Pathogenesis. *Am. J. Sports Med.,* **36(5):** 987-93.

Nitz, A.J. 1986. Physical Therapy Management of the shoulder. *Phys. Therap.,* **66(12):**1912-19.

Norkin, C.C., Levangie, P.K. 1988. Joint Structure and Function: A comprehensive analysis. FA Davis, Philadelphia, Pennsylvania.

Ryans, A. Montgomery, R. Galway, W. G. Kernohan and R. McKane 2005. Randomized controlled trial of intra-articular triamcinolone and/or physiotherapy in shoulder capsulitis. *Rheumatology*, **44(4):** 529-534.

Shaw L, Descarreaux M, Bryans R et al. 2010. A systematic review of chiropractic management of adults with whiplash associated disorders: Recommendations for advancing evidence-based practice and research. *Work.* **35:** 369-394.

Speed CA, Richards C, Nichols D, Burnet S, Wies JT, Humphreys H, et al. 2002. Extracorporeal shockwave therapy for tendonitis of the rotator cuff: A double blind RCT. *J. Bone and Joint Surg. Br.* **84:** 509-12.

Toby, B., Roger, E., Peter, R. .2007. Management of rotator cuff disease: Specific treatment for specific disorders. Best Practice Res. Clin. Rheum.., 21**(2):** 274-294.

Uhthoff, H.K., Loehr, J.W. 1997. Calcific tendinopathy of the rotator cuff. Pathogenesis, diagnosis and management. *J. Am. Acad. Ortho. Surg.,* **5:**183-191.

Will, L.A. 2005. A conservative approach to shoulder impingement syndrome and rotator cuff disease: A case report. *Clin. Chiro.,* **8:** 173-178.

Managing the Challenge of Sports Related Dental Injuries in Atheletic Children- A Case Report

Verma, L. Assistant Professor, Dr. H.S. Judge Dental College, Punjab University, Chandigarh
email: drleenaverma32@rediffmail.com

Abstract

Sports related injuries are the most common cause of dental trauma in children. The most commonly injured teeth are the maxillary central incisors, followed by the maxillary lateral incisors and the mandibular incisors. Presented here is a case of a 13 year hockey player who met with a sports injury and reported to the dental clinic with the chief complaint of broken upper left central incisor. The treatment was carried out by doing Root canal treatment of the broken tooth followed by the crowning of the fractured tooth with porcelain fused to metal. The goal of present paper was to help develop dental trauma management awareness in sportspersons which can help deal with everyday teeth trauma in most appropriate way.

Key words: Sports injury, porcelain fused to metal, dental trauma

Introduction

It has been widely reported that participation in sports carries a considerable risk of sustaining dental injury *[Davies & Bradley, 1977; Sane & Ylipaavalnimei, 1988; Flanders & Bhat, 1995 and Rodd & Chesham, 1997]*. Contact sports are defined as those sports in which players physically interact with each other, trying to prevent the opposing team or person from winning *[Rodd & Chesham, 1998]*. A considerable number of papers have appeared in the dental literature highlighting the dangers of participation in such sporting activities, in particular 'stick' sports such as lacrosse, and field and ice hockey [*Sane & Ylipaavalnimei, 1988 and Rodd & Chesham, 1997*]. In addition, competitive matches have been shown to be far more hazardous than training sessions. Highly significant differences have been shown to exist between the number of teeth injured and the causes of injury [*Sane & Ylipaavalnimei, 1988*]. For example, a blow or kick from another player most often causes injury to one tooth, while a fall or blow from a hard object often results in injury to two teeth. The prompt and appropriate management of traumatic dental injury is an important determinant of the prognosis of the involved tooth. The lack of knowledge of the appropriate handling sequence often has detrimental effect. Dental injuries can be classified by etiology, anatomy, pathology or therapeutic considerations with extrusion, intrusion and tooth avulsion being the most frequent types of dental trauma that we see in the dental office. The transport and care of the affected tooth, the prompt and adequate treatment in the dental office, as well as the proper follow up are imperative for a successful outcome of these incidents. The goal of present paper is to help develop dental trauma management awareness in sportspersons which can help deal with everyday teeth trauma in most appropriate way.

Case Report

A 13 year old young hockey player reported to the dental clinic with a chief

complaint of broken upper front tooth following trauma due to a blow from the other player while playing hockey. No apparent trauma to the soft tissues in the intraoral and extraoral examination was noted. The patient gave a history of trauma to upper front tooth 7 days ago. Neither the child nor the parent sought immediate dental treatment after the trauma. Her medical and dental history was unremarkable. Clinical and radiographic examinations were conducted. Clinical examination revealed a fracture in the middle third of the crown of the maxillary left central incisor, exposing the pulp (Figure 1).

Figure 1: Fractured left central incisor (Pre-Operative)

The tooth showed negative response to cold and electric pulp sensibility tests. There was no mobility or displacement. The remaining maxillary and mandibular anterior teeth were intact. Periapical radiograph was taken which confirmed pulpal involvement .The apex was fully formed and there was no associated root fracture or periapical pathology. (Figure 2)

Figure 2: Preoperative IOPA X-ray

The treatment plan was divided into 3 steps:-

Step 1- Endodontic phase

Step 2- Construction of the restoration phase

Step -3: Crown cutting of the restored tooth

Step 1: The Endodontic Phase

An infraorbital block was administered for 11, 12. The pulp chamber was opened using no. 330 round carbide steel bur & working length determination IOPA was taken with a no. 10 K-file (Figure 3).

Figure 3: IOPA showing working length x-ray

The pulp tissue was extirpated using no. 10 – no. 60 K-files. After irrigation with copious amounts of 2.5% NaOCl & Normal Saline, the root canal was dried using paper points. A thin mix of Zinc oxide eugenol paste was mixed and G.P points were coated with Zinc oxide eugenol paste and filled in the canal (Figure 4).

Figure 4: IOPA showing obturation of maxillary left central incisor

Step -2: Construction of restoration Phase

After the root canal treatment the coronal enamel was then etched for 20 seconds, rinsed with water & air dried followed by application of bonding agent – which was then light cured. The coronal enamel was then covered with the hybrid composite for core build –up, followed by light curing it for 60 seconds. The final finishing & polishing was done with finishing burs.

Step -3: Crown cutting of the restored tooth Phase

Figure 5: Crown cutting of tooth done (Operative)

After root canal treatment and composite build up of the fractured tooth, crown cutting of the teeth was done as shown in (Figure 5). After the crown cutting impression was taken and sent to the laboratory for the processing of Porcelain fused to metal crown. The crown was fixed with the help of luting cement i.e GIC TYPE 1 as shown in the (Figure 6).

Figure 6: Crown on Fractured Incisor Given (Post – Operative)

Dental injuries are a major problem for the players from the pain, asthetic and economics stand point of view. The athletes have to go through many procedures to get the whole thing corrected which leads to the wastage of their valuable time and money. Sports related injuries can become expensive depending on the nature and extent of trauma. Dental injuries incurred during sports activities are highly treatable, and can involve good outcomes if participants act quickly to see a dentist after an injury event. However, if not treated quickly these kinds of injuries can lead to discomfort, embarrassment and a lifetime of dental costs. The best medicine is, of course, prevention. If one is involved in a contact sport, wearing of the proper protective equipment, particularly a mouthguard is strongly reccommended. If it is economically feasible, have a custom-fit mouthguard made especially for the sportsman. Eat properly and well, refrain from smokeless and all tobacco products and drugs. Taking these steps can help avoid injury and focus attention on enjoying your sports. Sports injuries to the mouth and oral tissues are not necessarily treated any differently than other traumatic injuries to the oral tissues. There are various treatment options in sports related injuries like direct composite veneers, removable partial dentures, dental crowns, replantation of the avulsed tooth. The present case report, discusses the sports related dental injury to the anterior teeth and its treatment.

Conclusions

Dental injuries are common incidents and timely and suitable management of these occurrences is crucial for the prospects of the involved tooth. Although

different entities require different treatment approaches, it is paramount to determine the time frame of the incident, the vitality of the affected tooth, as well as set up a proper follow up scenario. Dentist should have readily available a case-scenario protocol which can help deal with teeth trauma in most fitting way.

References

Davies, R, Bradley, D. 1997. The prevalence of dental injuries in rugby players and their attitude to mouthguards. *Brit. J. Sports Med.,* **11**: 72–74.

Dorney, B. 1998. Dental screening for rugby players in New South Wales, Australia. *FDI World,* **7:** 10–13

Flanders, R., Bhat M. 1995. The incidence of orofacial injuries in sports: a pilot study in Illinois. *J. Am. Dental Asso.,* **126** : 491–496.

Rodd, H., Chesham, D. 1997. Sports-related oral injury and mouthguard use among Sheffield school children. *Community Dental Health,* **14** : 25–30.

Sae-Lim, V, Lim, L.P. 2001. Dental trauma management awareness of Singapore pre-school teachers. *Dental Traumatol.,* **17:**71-76.

Sane, J., Ylipaavalnimei, P. 1988. Dental trauma in contact team sports. *Endod. Dental Traumat.,* **4**: 164–169.

Instructions to Contributors

Journal of Exercise Science and Physiotherapy (JESP) is a scientific peer reviewed journal, publishing research studies and review articles in the field of sports injuries, physiotherapy, exercise physiology, sports rehabilitation, diseases and exercise, sports psychology, nutrition, physical education, sports biomechanics, kinesiology and sports education.

JESP is published annually in June but is planned to be published biannually in the near future. Articles written in English should be sent to the editor of JESP. The research paper for publication in the journal could be sent not only in typed manuscript form but also through the Internet using email attachment. Keeping in view the postal delays, authors, therefore, are encouraged to submit their research material/articles as email directly to ***satishsk1@rediffmail.com***

Mission

JESP aims to present easy access to the scientific knowledge for health & sport conscious individuals. The purpose is to minimise the problems like the delays in publishing process of the articles by drawing advantage from electronic medium.

Instructions to Authors

The articles may be submitted to the Editor, JESP (*email: satishsk1@rediffmail.com OR editor@efha-in.org*). Manuscripts are considered if they are submitted only to JESP and therefore should not be under consideration for publication elsewhere, either in part or in whole. Authors are responsible for the scientific context and legal aspects of the articles. Editors may make necessary changes to articles in accordance with "Instructions to Authors". Normally the complete research paper should not exceed 15 typed pages including tables and figures; however under exceptional circumstances this limit can be relaxed. There is no page and reference limitation for the review articles. All files related to manuscripts should be submitted electronically. Internet transmission and e-mail attachments are preferred; CD-ROM is acceptable for large files. Text files should be in Microsoft Word 6.O and later versions. Each figure, table, photograph or other image should be submitted electronically. The manuscripts should be submitted in Times New Roman font, 12-point type, double-spaced with 3 cm margins on all sides. The reference style used by the Journal is the Harvard System of referencing.

Format for Research Article

Include the following sections in research articles without page space:

TITLE: Capital letters.

AUTHORS: Surname followed by initials and institution(s) where the study was conducted.

ABSTRACT Include an abstract of not more than 150 words that includes objectives, methods, results and conclusions.

KEY WORDS*:* To assist in indexing the journal, list up to 6 key words (not from title), which your article could be indexed.

INTRODUCTION

METHODS

RESULTS

DISCUSSION

CONCLUSION

ACKNOWLEDGMENTS: Provide information sufficient to identify sources of support, technical assistance, and intellectual contributions not associated with authorship.

REFERENCES: Each citation in the text must be noted by surname and year in parentheses and must appear in the reference section as an alphabetic order. Example for citation in the text; a) for single author (Gür, 1999), b) for two authors (Gür and Akova, 2001), c) more than two authors (Gür et al., 2000).

Journal Article:

Akova, B., Sürmen-Gür, E., Gür, H., Dirican, M., Sarandöl, E. and Kücükoglu, S. 2001. Exercise-induced oxidative stress and muscular performance in healthy women: role of vitamin E supplementation and endogenous estradiol. *European Journal of Applied Physiology*, **84:** 141-147.

Journal Article, Article not in English:

Seker-Aygül, Z., Akova, B. and Gür, H. 2001. The relationship of stress and stress management factors with injury in soccer players. *Turkish Journal of Sports Medicine*, **36:** 71-80. (In Turkish: English abstract).

Journal Article in press:

Gür, H., Cakin, N., Akova, B., Okay, E. and Kücükoglu, S 2002. Concentric versus combined concentric- eccentric isokinetic training: Effects on functional capacity and symptoms in patients with osteoarthrosis of the knee. *Archives of Physical Medicine and Rehabilitation*, in press.

Journal Article in electronic format:

Weigand, D.A., Carr, S., Petherick, C. and Taylor, A. 2001. Motivational climate in Sport and Physical Education: The role of significant others. *European Journal of Sports Science (serial online)* **1(4)**, (13 screens/inclusive page), October. Available from URL: http://www.humankinetics.com/ejss

Book:

Guyton, A.C. and Hall, J.E. 1996. *Textbook of medical physiology*. 9th edition. W. B. Saunders Company, London.

Chapter in edited book:

Wilson, C.H. 1984. Exercise for arthritis. In: *Therapeutic exercise*. Ed: Basmajian, J.V. 4th edition. Baltimore: Williams and Wilkins. 529-545.

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 smoker*s. Doctoral thesis, University of Uludag, Bursa. 1-54. (In Turkish: English abstract).

LEGENDS

AUTHOR BIOGRAPHY: Please include a brief biography, approximately 50 words per author, for each author including (1) academic title/degrees, (2) institution affiliation, (3) research focus, (4) post and e-mail addresses.

TABLES, FIGURES, etc.: The location within the article where e.g. figures and tables appear should be indicated in the text. These materials (e.g. table, figure) should be submitted separately from the text document. Each item should be produced in Microsoft Office (Word, Excel, or PowerPoint), GIF or JPEG format. Submit each item separately and number sequentially as (main author) Figure 1.jpg, (main author) Figure2.jpg, and so on, for example, GurFigure1.jpg and GurTable1.doc.

FORMAT FOR REVIEW ARTICLE

Include the following sections in research articles without page space:

TITLE: Capital letters.

AUTHORS: Surname followed by initials and institution(s) where the study was conducted.

ABSTRACT Include an abstract of not more than 300 words.

KEY WORDS: To assist in indexing the journal, list up to 6 key words (not from title), which your article could be indexed

MAIN TEXT

CONCLUSION

ACKNOWLEDGMENT

REFERENCES*:* Each citation in the text must be noted by surname and year in parentheses and must appear in the reference section as an alphabetic order. Example for citation in the text; a) for single author (Gür, 1999), b) for two authors (Gür and Akova, 2001), c) more than two authors (Gür et al., 2000). See the reference section of research article for detail.

LEGENDS

AUTHOR BIOGRAPHY: For detail see the author biography section of research article.

TABLES, FIGURES, etc.: For details see the tables, figures, section of research article.

REVIEW AND PUBLISHING POLICY

Upon receipt of a manuscript the editor will notify the main author that the submission has been received. The manuscript will undergo a blinded review process. Under this process the editor will forward (electronically) the manuscript to two independent reviewers. Normally the review process will take approximately 4 weeks. After the review process has been completed the main author will be notified via E-mail either of acceptance, revision or rejection of the manuscript. If the main author has not been informed of the results of the review process after 8 weeks from the date of confirmation of receipt of the manuscript (by the editor), the author should notify the editor-in-chief directly. If revision was recommended, this should be completed and returned to the editor within 4 weeks; failure to return the revised manuscript within the allotted time span will lead to rejection of the manuscript. When a manuscript has been accepted for publication it will be forwarded to the editor-in-chief for final approval. The editor-in-chief will work with the main author to make necessary revisions in order for the manuscript to appear in the Journal of Exercise Science and Physiotherapy. The final proof of the manuscript will be sent to the main author as an E-mail attachment. If the main author requires any minor changes to the finished work, these should be submitted electronically to the editor-in-chief within one week. Manuscript accepted in the first half of the year will be published not later than the second half of the year.

Checklist for Authors

- Double-space manuscript text and use 3cm margins on all sides, and Times New Roman, 12-point type, English and SI units.
- Include with text a title, abstract, key words, figure and table lists, figure and table legends.
- Submit all materials electronically.
- Include complete author names, addresses, e-mail, phone and fax numbers.
- Include a short (~50 words) author biography for each author.

Editor-in-Chief,
JESP