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Contents

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EFHA in continuation to its policy of serving the exercise science fraternity is pleased to publish Volume 3, No. 2 issue of **Journal of Exercise Science and Physiotherapy *(JESP)***. This volume of JESP contains thirteen original research papers contributed by exercise scientists from India and abroad and cover important areas of exercise, fitness and health research. **Singh et al from Patiala** have reported in their research paper the development of Geriatric assessment tool and also checked its validity on Indian older population. **Dewan from Chandigarh** in her study empahsises the promotion of physical activity in the prevention of diabetes. **Desalgen from Gondar University, Ethiopia and Verma from Patiala** compared the effects of three recovery interventions in footballers and observed that active and massage interventions applied during recovery following maximal exercise resulted in quicker recovery as compared to passive recovery. **Gandhi & Kumar from Department of Human Genetics, Guru Nanak Dev University, Amritsar** studied the potential of strenuous exercise in causing genetic damage. Their results warn that wrestlers may be prone to cancer and age-related diseases. They further report that genetic damage increased with age, duration and longer routine of heavy exercising. **Sarkari & Multani from M.M.I.P.R., Mullana** concldes that neural mobilization alongwith conventional treatment is more effective in improving pain and range of motion in sciatica than conventional treatment alone. **Narkeesh and co-workers** found that application of mechanical compression on the median nerve decreases the conduction velocity of the nerve and the decline is linked with the magnitude of compression. The finding has important bearing in physiotherapy evaluation and treatment progression.

Recently the popularity of Yoga has increased not only in India but worldover. This is reflected in the increase in the number of research papers received in the JESP. **Bindal & Ghai from LBNIPE, Gwalior** tried yogic asanas in alleviating low back pain. They found it as effective as the conventional physiotherapy treatment. Another study by **Johnson & Mariayyah from Tiruchirappalli** employed selected Hathayogic practices in enhancing kicking ability in soccer players. The results are interesting as the yogic practice has been found to improve the kicking ability. **Uthirapathy & Chandrasekaran from Tiruvarur,** reports better influence of yogic practices in improving serum protein levels as compared to aerobic exercises. The present issue of JESP also contains two research articles on physical fitness & motor development patterns in girls. **Kaur et al from Patiala** studied the physical fitness and growth performance of menstruating girls belonging to Upper and Lower Socio-economic status. **Ghai & Negi from LBNIPE, Gwalior** report motor development pattern of untrained and trained Indian girls. **Gahlawat from Kurukshetra** compared physical fitness of rural and urban collegeiate students of Kurukshetra, Haryana.

One study on nutrition by **Walia from Patiala** has revealed that urbam slum females gain weight with increase in age. On an average, the females especially after the age of 40 years, exhibit greater caloric intake than their energy expenditure. I hope the readers will enjoy reading the research articles published in this issue of JESP. I wish them all the best in their future research endeavours.

S.K. Verma

Development and Validation of Geriatric Assessment Tools: A Preliminary Report from Indian Population

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Abstract

With the explosion in the number of older adults in India, it becomes more and more important to study alterations in their function. Although many assessment tools are available, most of them lack both sensitivity and reliability in Indian settings. ADL, IADL and modified POMA were developed and administered on the older adults living in community. Validity of the three assessment tools was suggested by their low correlation with age (r = -0.255, -0.485 and -0.436) and moderate to high correlation with frequency of falls (r = -0.496, -0.628 and -0.496) in Indian Geriatric population. Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL) and Modified performance Oriented Mobility Assessment (Modified POMA) tools were developed which appears to have acceptable validity with reference to Indian geriatric population.

Key words: Elderly, Fall, ADL, IADL, Modified POMA

Introduction:

In the 20th century the elderly population has represented the fastest growing segment of total world population. However, these demographic changes were high-flying in developed countries. For example, in United Kingdom the population of people over 65 years has increased from 5 % to 16 % in this period. Population projections suggest that this trend will be continuing in 21st century and elderly will represent 10.8 % of total world population by 2025. Nevertheless these demographic changes will be more prominent in underdeveloped and rapidly developing countries than developed countries where these changes are slowing down. For example, in India over 82 million now, it will cross 177 million by 2025 and 324 million by 2050 which shows almost a two-fold increase in the proportion of elderly people. This is in contrast to America where currently 13 % of elderly population will approach 22 % by 2030.

The startling fact is that the aged population in India is currently the second largest in the world. This was highlighted by Prof J.J. Kattakayam, Director, Centre of Gerontological Studies, University of Kerala, Trivandrum, in his key-note address in the inaugural function of a two-day seminar on “Aging: issues and emerging trends, with special reference to women’s problems” held at MCM DAV College for Women, Chandigarh, from October 21-22, 2005.

The changing scenario of the demography of elderly has a major impact on the health and social services. Life expectancy today is 74 years for men and 80 years for women, a remarkable rise in longevity from 100 years ago, when men lived an average of 48 years and women an average of 51 years *(Landefeld et al, 2004).* While a gain in average life expectancy is the indicator of nation’s well being, it does not imply that these additional years of life are the quality years. Rather, it has been postulated that there is an exponential increase in disability, and mental and physical morbidity, in individuals over the age of 75 years. In the UK, the estimated prevalence of those with severe disability is less than 1% in those aged 50-59, but 13% in those aged over 80 years *(Colledge, 2002). Olshansky (1991)* have also argued that there will be an expansion of morbidity as medical technology improves the likelihood of survival from previously fatal diseases without improving overall quality of life for these individuals. Hence it is imperative to evaluate the status of elderly in detail so as to understand the role of Geriatric Physiotherapy in modifying and upgrading the quality of life in older population.

Many resources that provide current, accurate information on geriatric patient evaluation are available. However, few of them are portable enough to be used in the examining room, on Hospital rounds or when the therapist is on call outside the office. Thus, the aim of present study was to develop and study the validity of geriatric assessment tools which would be especially suitable for Indian population.

The geriatric assessment tools developed in the present study were selected only in terms of potential applicability for the functional assessment and the frequency of falls in older population in India. Because when it comes to quality of life, the measurement of the level of function possible for the individual is of utmost importance.

Aims and Objectives:

a. To develop geriatric assessment tools
b. To establish the validity of these tools
c. To study the relation of frequency of falls with age in Indian geriatric population

Limitations

1. The present study was limited to a sample size of 30 older individuals.
2. It was restricted to the elderly residing in Punjab state especially in and around Patiala.

Material & Methods

The study was conducted on a sample size of 30 individuals within age group 65 to 85 year residing in Punjab especially in and around Patiala for the duration of 8 weeks.

Inclusion Criteria

- ✓ Men and women within age group 65 to 85 years
- ✓ Elderly having impaired balance otherwise are healthy individuals
- ✓ Should not have undergone any surgery in lower limbs

Exclusion Criteria

- ✓ People suffering from acute illness
- ✓ History of syncope
- ✓ Medication side effect
- ✓ Neurological diagnosis
- ✓ Orthostatic hypotension

Listing of familiar assessment tools:

- ✓ Index of Independence in Activities of Daily Living *(Katz et al, 1963)*
- ✓ The Barthel Index *(Mahoney et al, 1958)*
- ✓ The Physical Self-Maintenance Scale *(Lawton & Brody, 1969)*
- ✓ Instrumental Activities of Daily Living *(Lawton & Brody, 1969)*
- ✓ The Functional Status Index *(Jette, 1980)*
- ✓ Performance Oriented Mobility Assessment *(Tinetti, 1986)*
- ✓ Functional Independence Measure *(Grander & Hamilton, 1993)*

Based on a review of the above functional assessment tools three potential tools were developed for geriatric assessment.

- Activities of Daily Living (ADL)
- Instrumental Activities of Daily Living (IADL)
- Modified performance Oriented Mobility Assessment (Modified POMA)

ADL and IADL were developed to assess the functional independence whereas Modified POMA was developed to assess the likelihood of falling in older adults.

Geriatric Assessment Tool – I
Activities of Daily Living (ADLs)

A. Toilet

I: Able to get to, on and off toilet, cleans self
A: Needs help getting to and using toilet, soiling or wetting while asleep more than once a week
D: Completely unable to use toilet

B. Feeding

I: Able to completely feed self
A: Feeds self with assistance and is untidy
D: Completely unable to feed self or needs parenteral feeding

C. Dressing

I: Able to select clothes, dress and undress self
A: Needs assistance in dressing and selection of clothes
D: Completely unable to dress and undress self

D. Grooming (neatness, hair, nails, hands, face, clothing)

I: Able to groom well without assistance
A: Needs assistance for grooming
D: Completely unable to care for appearance

E. Physical Ambulation

I: Able to get in/out of bed, roam around without help
A: Needs human or mechanical (crutch, walker, cane) assistance
D: Completely unable to get in/out of bed/chair, walk

F. Bathing

I: Able to bathe (tub, shower or sponge) without assistance
A: Needs assistance for getting in and out of tub or washing more than 1 body part
D: Completely unable to bathe self

Directions: I – Independent
A – Requires assistance
D – Dependent

Geriatric Assessment Tool – II
Instrumental Activities of Daily Living (IADLs)

A. Ability to use telephone

I: Able to operate telephone on own initiative, look up numbers, dial and receive without help
A: Answers telephone but needs special phone or assistance in getting number, dialing
D: Unable to use telephone at all

B. Shopping

I: Able to take care of all shopping needs independently
A: Able to shop but needs to be accompanied on any shopping trip
D: Unable to shop

C. Preparing meals

I: Able to plan and prepare meals independently
A: Unable to cook full meals alone
D: Unable to prepare any meals

D. Housekeeping

I: Able to maintain house independently, e.g. scrubbing the floor
A: Able to do light housework but needs assistance with heavy tasks
D: Unable to do any housework

E. Laundry

I: Able to launder independently
A: Launders small items such as socks, handkerchiefs
D: Unable to launder at all

F. Traveling

I: Able to drive own car or travels independently on public transportation
A: Needs assistance for traveling
D: Unable to travel

G. Responsibility for own medications

I: Able to take medications in correct dose at the right time
A: Able to take medications if it is prepared in advance in separate dosages
D: Unable to take medications

H. Ability to manage finances

I: Able to manage finances independently, e.g. write checks, pay bills
A: Able to manages day-to-day purchases but needs assistance for banking or major purchases
D: Unable to handle money

Directions: I – Independent
A – Requires assistance
D - Dependent

Geriatric Assessment Tool – III Modified Performance-Oriented Mobility Assessment (POMA)

Balance

Initial instructions: Subject is seated in hard, armless chair. The following maneuvers are tested.

1. **Sitting down**

   0 = misjudged distance, falls into chair or lands off center of chair
   1 = uses arms or not a smooth motion
   2 = sits in a smooth, safe motion and ends with buttocks against back of chair and thighs centered on chair

2. **Sitting balance**

   0 = leans or slides in chair
   1 = holds onto chair to keep upright
   2 = steady, safe, upright

3. **Arising**

   0 = unable without help or requires
   1 = able but uses arms to help to pull or push up; and or moves forward in chair before attempting to arise
   2 = able without using arms

4. **Attempts to arise**

   0 = more than 3 attempts required
   1 = more than 1 attempt required
   2 = single attempt

5. **Immediate standing balance (first 5 seconds)**

   0 = any sign of unsteadiness (swaggers, moves feet, marked trunk sway or grabs object for support)
   1 = steady but uses walker or other support but catches self without grabbing object
   2 = steady without walker or other support

6. **Standing balance (Romberg position)**

   0 = unsteady
   1 = steady but wide stance (medial heals > 4 inches apart) and uses cane or other support
   2 = steady, narrow stance without support for 10 seconds

7. **Eyes closed (Romberg position)**

   0 = any sign of unsteadiness or needs to hold onto an object
   1 = steady with feet apart
   2 = steady without holding onto any object with feet together

8. **Nudge on sternum** (patient standing with feet as close together as possible, examiner pushes with light even pressure over sternum 3 times)

   0 = begins to fall
   1 = needs to move feet, but able to maintain balance
   2 = steady, able to withstand pressure

9. **Semi – tandem stand (stand with the heel of one foot placed to the side of the big toe of the opposite foot for 10 seconds)**

   0 = unable to semi – tandem stand or begins to fall or holds for ≤ 3 seconds
   1 = able to semi – tandem stand for 4 to 9 seconds

2 = able to semi – tandem stand for 10 seconds

10. Full tandem stand

0 = unable to tandem stand or begins to fall or holds for ≤ 3 seconds
1 = able to tandem stand for 4 to 9 seconds
2 = able to tandem stand for 10 seconds

11. Standing on one leg

0 = unable to stand or begins to fall or holds for < 3 seconds
1 = able to stand for 3 to 4 seconds
2 = able to stand for 5 seconds

12. Reaching up (ask patient to remove an object from a shelf high enough to require stretching or standing on toes)

0 = unable or is unsteady
1 = able to get object but needs to steady self by holding on to something for support
2 = able to take down the object and is steady

13. Heel stand

0 = unable to stand or begins to fall
1 = able to stand for < 3 seconds
2 = able to stand for 3 seconds

14. Bending over (ask the patient to pick up a pen that is placed approximately 12 inches from the patient's foot on dominant side)

0 = unable or is unsteady
1 = able, but needs more than one attempts to complete the task
2 = able and is steady

15. Turning balance 360°

0 = unsteady (grabs or staggers)
1 = discontinuous steps (patient puts one foot completely on floor before raising other foot)
2 = steady, continuous steps (turn is a flowing movement)

Balance Score: -----/30

Gait

Initial instructions: Subject stands with examiner, walks down 10-ft walkway (measured), first at "usual" pace, then turn and walk back at "rapid, but safe" pace. The subject should use customary walking aid.

16. Initiation of gait (immediately after told to "go")

0 = any hesitancy or multiple attempts to start
1 = no hesitancy

17. Step height

0 = swing foot is not completely raised off floor
1 = swing foot completely clears floor

18. Step length

0 = swing foot does not pass the stance foot with step
1 = swing foot passes the stance foot

19. Step symmetry

0 = right and left step length not equal,
1 = right and left step length appear equal

20. Step continuity

0 = places entire foot on floor before beginning to raise other foot or stops completely between steps
1 = begins raising heel of one foot as heel of other foot touches the floor, steps appear continue

21. Path deviation

0 = foot deviates from side to side or toward one direction
1 = foot follows close to straight line as subject advances

22. Trunk stability

0 = presence of marked trunk sway or flexion of knees or flexion of back or abduction of arms in an effort to maintain stability
1 = trunk does not sway, knees or back are not flexed, arms are not abducted in an effort to maintain stability

23. Walking stance

0 = feet apart with stepping
1 = feet should almost touch as one passes other

24. Turning (while walking)

0 = staggers, stops before initiating turn or steps are discontinuous
1 = no staggering, turning continuous with walking and steps are continuous while turning

Gait Score: -----/ 9

Directions: Total score (Gait + Balance) = -----/ 39
"0" indicates the highest level of impairment.
Higher score indicates lower risk for falls.

ADL and IADL were administered via personal interview. However, modified POMA is task-oriented test that measures an older adult's balance and gait abilities. Hence, subject was asked to perform a task, his/her performance was judged and then scored by a physiotherapist. Regardless of the method of administration, each subject was queried concerning his/her understanding of instructions to avoid poor judgment.

Statistical Analysis: The cross-sectional data were analyzed using Pearson's Correlation Coefficient (r) to know how the variables in the present study were related. SPSS 7.5 was used for this purpose.

Results

Validity of the three assessment tools namely ADL, IADL and modified POMA was suggested by their low correlation with age (r = -0.255, -0.485 and -0.436) and moderate to high correlation with frequency of falls (r = -0.496, -0.628 and -0.496) in Indian Geriatric population. In addition to this, results displayed in table 3 indicates that as the individual ages, the occurrence of falls increases (r = 0.743).

Table 1: Correlation Analysis between age and Geriatric assessment tools

Variables	Correlation	N	Sig
Age & ADL	- 0.255	30	NS
Age & IADL	-0.485**	30	0.01
Age & Mod. POMA	-0.436*	30	0.05

* p< 0.05 significant, ** p< 0.01 highly significant

Table 2: Correlation Analysis between frequency of falls and Geriatric assessment tools

Variables	Correlation	N	Sig
Frequency of falls & ADL	- 0.496**	30	0.01
Frequency of falls & IADL	- 0.628***	30	0.01
Frequency of falls & Mod. POMA	-0.496**	30	0.01

** p< 0.01 highly significant, *** p< 0.01 Very highly significant

Table 3: Correlation Analysis between age and frequency of falls in Indian geriatric population

Variables	Correlation	N	Sig
Age & frequency of falls	0.743***	30	0.01

*** p< 0.01 Very highly significant*** p< 0.01 Very highly significant

Discussion

The positive relationship established between the age and frequency of falls in the present study has been supported by many researchers. Falls occur in approximately one third of adults over the age of 65 years and account for 65% of all injuries in this group. Approximately 30% of people over the age of 65 fall each year *(Mahoney 2004)*. In about 3% of falls, the older adult lies on the floor for at least 20 min. Up to 20% of community dwelling elderly persons fall each year in the U.S and this figure has doubled in institutionalized ambulatory populations *(Prudham and Evan 1981)*. These falls have serious immediate as well as long term complications. Nearly 200,000 aged Americans have a fracture of the hip each year usually during a fall and often with little obvious environmental provocation

(Wylie 1977). About 10% of falls require hospitalization due to fractures and other injuries. Approximately 50% of fall injuries seen in an emergency room will have continued pain and mobility limitations *(Mahoney 2004).*

This demonstrates the need to develop geriatric assessment tools and study their validity with special reference to the frequent occurrence of falls in older adults. As the Geriatric Assessment tools ADL, IADL and modified POMA are valid, easy to score, quick to administer, requires little space and needs no special equipment. ADL is a dichotomous rating (dependent/independent) of six functions of daily living: toilet, feeding, dressing, grooming, transfer from bed and bathing. IADL is also a dichotomous rating that measures functional independence in the domains of instrumental activities such as ability to use telephone, shopping, preparing meals, house keeping, laundry, traveling, taking medications and managing finance. *Katz et al (1963)* has also included six daily functions in his Index of Independence in Activities of Daily Living (ADL). However, it lacks the important function of grooming. The Barthel Index covers 10 activities regarding personal care and mobility. However, it omits everyday tasks essential for life in the community for example, housekeeping and shopping.

Both Katz's Index of Independence in Activities of Daily Living and the Barthel Index are appropriate for severely ill patients since low levels of disability may not be detected and so do not show the limitations in the activities covered in these scales. Thus, they are not suitable for health surveys or in general practice as they are not sensitive to minor deviations from complete well-being. This is in contrast to present study because most of the subjects included were living in the community which suggests that ADL and IADL are valid for clinical and survey research.

The Physical Self-Maintenance Scale *(Lawton & Brody, 1969)* appears to be a reliable and valid scale for health surveys. Nevertheless it has not been widely reported on in the literature on its own but primarily when used in combination with other instruments. In addition to this, *Katz and associates in 1966 & 1986* applied the index to the patients at the time of discharge from a hospital for the chronically ill. Index scores were found to correlate (0.50) with a mobility scale and with a house confinement scale (0.39), providing evidence of somewhat low degree of validity to not very well known instruments. The index of ADL was shown to predict the long-term course and social adaptation of patients with strokes and hip fractures and was used to evaluate outpatient treatment for rheumatoid arthritis.

Thus, it appears that not many studies have been attempted to correlate either ADL or IADL with the occurrence of falls in elderly. However, the present study has shown that the level of functional independence is not age dependent meaning it is not always true that the individual becomes dependent as he ages. On the other hand the significant negative relationship between these assessment tools and frequency of falls suggests that as there is improvement in the level of independence judged from ADL and IADL, the incidence of falls are reduced. This indicates that ADL and IADL developed in the present study are valid assessment tools to predict the occurrence of falls in older adults.

The original POMA does not include all the items related with balance and gait such as balance in semi-tandem or full tandem. This is in contrast with Modified POMA that measures 30 items of static balance on three-point scale whereas 9 items related with gait on two-point scale. In addition to this, the original POMA does not consider the visual stimuli. Thus, it is reasonable to assume that modified POMA is a broad scale that measures the level of difficulty in performing various activities of balance and gait. Its research orientation is reflected in the validity test conducted in the present study.

Conclusion: Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL) and Modified performance Oriented Mobility Assessment (Modified POMA) tools were developed which appears to have acceptable validity with reference to Indian geriatric population.

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A Prospective Study of Physical Activity and Its Role in Management and Prevention of Diabetes

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Abstract

Physical activity may be a therapeutic tool in a variety of patients with, or at risk for diabetes. Recent evidence has shown that increased physical activity in conjunction with dietary changes can prevent individuals heading towards diabetes. Physical activity plays an independent role in protection against diabetes. Present study indicates that in a total sample of 1000 subjects, 359 persons are performing physical activities and 641 are doing sitting type of work. Borderline, newly detected, known and total diabetic subjects are more in subjects performing sitting type of work than physical work. Men are more physically active than women. Physical activity is more in rural population in borderline and newly detected diabetic subjects but in known cases it is more in urban population. Hence the risk of developing diabetes is more in urban population. In the total population (1000) only 38 subjects (3.8%) were doing exercise daily. Similarly in the present study, borderline, newly detected, known and total diabetic subjects are more in physically inactive persons. The significance of this study, thus, lies in the fact that the individuals are unaware of their disease status and more having a sedentary life style. These findings indicate that promotion of physical activity is important in the prevention of diabetes mellitus.

Key Words: Diabetes, Physical activity, Sedentary, Borderline, Newly detected diabetics

Introduction

Diabetes is such a complex disease with many different forms. Physical activity is any bodily movement produced by skeletal muscles resulting in energy expenditure. Therefore this includes sports and leisure activities of all forms. Physical activity and exercise helps tune the "human machine" and help to make our organs, muscles, bones and arteries more efficient. This is our way of counter attacking and we can reduce the chances of getting an illness or a disease. Aristotle and the Indian physician, Sushruta, suggested the use of exercise in the treatment of diabetic patients as early as 600 B.C. and during late last century and early this century many physicians claimed that the need for insulin decreased in exercising patients.

During physical activity, whole-body oxygen consumption may increase by as much as 20-fold and even greater increases may occur in the working muscles. To meet its energy needs under these circumstances, skeletal muscle uses, at a greatly increased rate, its own stores of glycogen and triglycerides, as well as free fatty acids (FFAs) derived from the breakdown of adipose tissue triglycerides and glucose released from the liver. To preserve central nervous system function, blood glucose levels are remarkably well maintained during physical activity. The metabolic adjustments that preserve normoglycaemia during physical activity are in large part hormonally mediated. A decrease in plasma insulin and the presence of glucagons appear to be necessary for the early increase in hepatic glucose production during physical activity, and during prolonged exercise, increases in plasma glucagon and catecholamine appear to play a key role. These hormonal adaptations are essentially lost in insulin-deficient patients with type 1 diabetes. As a consequence, when such individuals have too little insulin in their circulation due to inadequate therapy, an excessive release of counter insulin hormones during physical activity may increase already high levels of glucose and ketone bodies and can even precipitate diabetic ketoacidosis. Indeed, in patients with type 2 diabetes, physical activity may improve insulin sensitivity and assist in diminishing elevated blood glucose levels into the normal range (*American Diabetes Association, 2003*).

With the publication of new clinical reviews, it is becoming increasingly clear that physical activity may be a therapeutic tool in a variety of patients with, or at risk for diabetes, but that like any therapy its effects must be thoroughly understood. People at an increased risk of Type 2 diabetes are those with; impaired glucose tolerance, obesity, family history of diabetes or previous gestational diabetes. Recent evidence has shown that increased physical activity in conjunction with dietary changes can prevent individuals with impaired glucose tolerance from progressing to Type 2 diabetes (*Schneider and Ruderman, 1990; Wasserman and Zinman, 1994; Devlin and Ruderman, 2002; Diabetes Prevention Program Research Group, 2002*).

The main goal of any intervention in diabetes is to maintain blood glucose, blood pressure and lipid levels within a range that will either prevent or delay the onset of any diabetes complications. The health benefits of physical activity are well documented in the prevention of diabetes in individuals at high risk and in the management of Type 2 diabetes (*Zinman et al., 2004*).

The health benefits of physical activity are less well studied in diabetes and shows that regular physical activity is likely to confer cardiovascular benefits. Physical activity promotion needs to be given at least equal importance as advice regarding diet and medication by the diabetes team. Resources need to be made available so that people with diabetes have access to information and advice, which will help them to build regular physical activity into their lifestyle.

Material and Methods

The present epidemiological and biochemical study has been undertaken in the district Sangrur, Punjab (India). The samples survey has been undertaken from the area covered and 1000 subjects were selected randomly for questioning regarding the different aspects of epidemiology. Out of these 1000 samples, 500 are from urban population and 500 from rural population

The subjects were questioned personally, using a questionnaire which is designed for collection of data and general information regarding age, sex, socio-economic status, marital status, education, occupation, physical activity, dietary intake habits, and family history of diabetes, awareness and treatment taken for diabetes. But amongst them obesity, diet, family history and physical activity were found to highly correlated with the disease and in this paper the role of physical activity is explained in the management of diabetes. Fasting and random blood sugar levels, blood groups, blood pressure, urine sugar and urine protein (fasting and random), body mass index were also measured in the 1000 subjects.

Results

Table 1: Distribution of number of subjects of diabetes mellitus according to nature of work in different status of subjects

S. No.	Status	Nature of Work				Total
		Physical		Sitting		
		N	%	N	%	
I	N	272	41.65	381	58.35	653
II	BL	70	29.04	171	70.96	241
III	ND	4	7.27	51	92.73	55
IV	KD	9	23.68	29	76.32	38
V	TD	4	30.77	9	69.23	13
	Total	359	35.90	641	64.10	1000

Table 1a: Statistical Analysis

Status of subjects	χ^2	DF	p	HS/NS
N	22.964	1	<0.0001	HS
BL	6.877	1	<0.001	HS
ND	21.291	1	<0.0001	HS
KD	2.938	1	>0.05	NS
TD	0.365	1	>0.05	NS

χ^2 : Chi Square test, p : Probability, HS : Highly Significant, NS : Non significant, DF : Degree of Freedom,

Table 1b: Comparison of Fasting Blood Sugar Level in Relation to Actual Work Condition of occupation between Physical and Sitting Type of Jobs

Status	Physical		Sitting		't'	Sig
	N	Mean ±SD	N	Mean ±SD		
N	272	81.19 ± 8.76	381	81.61 ± 9.47	0.59	NS
BL	70	96.21 ±10.75	171	97.81 ±10.47	1.05	NS
ND	4	128.75 ±24.75	51	140.45 ±29.41	0.8	NS
KD	9	151.33 ±31.96	29	159.93 ±45.61	0.63	NS
TD	4	51.50 ± 7.53	9	51.00 ± 7.4	0.11	NS

In the total population (1000), 359 persons are observed to be performing physical activities and 641 are doing sitting type of work. Borderline (BL), newly detected (ND); known diabetic (KD) and total diabetic (TD) subjects are more in subjects performing sitting type of work than physical work (Table-1).

Men are more physically active than women. Difference between male and female according to their work conditions is given in table 2. Females are doing more sedentary type of jobs. When physical activity is compared between rural and urban populations then the following results have been obtained –

		Physical	Sitting
BL (241)	Urban (139)	42 (30.21%)	97 (69.78%)
	Rural (102)	28 (27.45%)	74 (72.54%)
ND (55)	Urban (28)	1 (3.57%)	27 (96.42%)
	Rural (27)	3 (11.11%)	24 (88.88%)
KD (38)	Urban (27)	8 (29.62%)	19 (70.37%)
	Rural (11)	1 (9.09%)	10 (90.90%)

TABLE 1c: Comparison of Random Blood Sugar Level in relation to actual work condition of their occupation between physical and sitting type of job

Status	Physical		Sitting		't'	
	N	Mean±SD	N	Mean±SD		
N	272	116.64 ± 12.96	381	116.26 ±15.77	0.33	NS
BL	70	156.32 ± 15.45	171	161.53 ±17.89	2.27	S
ND	4	272.50 ± 34.61	51	229.58±50.55	2.29	S
KD	9	256.11 ± 68.74	29	263.89± 68.34	0.29	NS
HG	4	84.00 ± 12.41	9	92.66 ±20.79	0.93	NS

Physical activity is more in rural population in borderline and newly detected diabetic subjects but in known cases it is more in urban population. Hence the risk of developing diabetes is more in urban population as discussed earlier.

TABLE 2: Distribution of males and females according to their nature of work.

STATUS		PHYSICALLY ACTIVE		SEDENTARY	
		Male (226)	Female (133)	Male (329)	Female (312)
Normal (653)	N	177	95	226	155
	%	(78.3)	(71.4)	(68.69)	(49.67)
Bordeline (241)	N	40	30	66	105
	%	(17.69)	(22.55)	(20.06)	(33.65)
Newly detected (55)	N	2	2	16	35
	%	(0.88)	(1.5)	(4.8)	(11.2)
Known diabetic (38)	N	5	4	17	12
	%	(2.21)	(3.0)	(5.16)	(3.84)
Hypoglycemic (13)	N	2	2	4	5
	%	(0.88)	(1.50)	(1.21)	(1.60)
Total diabetic (93)	N	7	6	33	47
	%	(3.09)	(4.51)	(10.03)	(15.06)

Chi-square test is applied in which calculated values are more than tabulated values and highly significant for borderline ($p<0.001$) and newly detected ($p<0.0001$) categories but non-significant in known diabetic ($p>0.05$) and total diabetic ($p>0.05$) categories (Table-1a). Comparison is done between the fasting and random blood sugar levels of the subjects performing physical and sitting type of job (Table-1b and 1c) and significant results have been obtained for only random blood sugar levels of borderline (at 95% level) and newly detected ($p <0.05$) subjects (Table-1c). In the total population (1000) only 38 subjects (3.8%) were doing exercise daily.

Discussion

An endeavour has been made putting the present study along with the earlier studies to bring out the fact that physical exercise is a very important factor either to escape or delay the onset of this disease. This statement is supported by various workers who have done research from different parts of the globe.

Physical inactivity was found to be a risk factor for the incidence of diabetes mellitus (*Kriska et al., 2006*).

Similarly in the present study, borderline, newly detected, known and total diabetic subjects are more in physically inactive persons. These findings indicate that promotion of physical activity may be important in the prevention of diabetes mellitus.

The higher prevalence of diabetes mellitus and lower levels of physical activity was also observed among older persons by *Clark (1997)*. In the present study, prevalence of diabetes is also more in subjects of 70 years. The young individual in good metabolic control can safely participate in most activities. The middle-aged and older individual with diabetes should be encouraged to be physically active. The aging process leads to a degeneration of muscles, ligaments, bones, and joints, and disuse and diabetes may exacerbate the problem. Physical activity is known to reduce the risk of non-insulin dependent diabetes mellitus in younger and middle aged subjects. According to *Williams et al. (1999)* people with newly diagnosed diabetes were less physically active than their counter parts.

In the study of *Baan et al. (1999)*, a significant inverse association between physical activity and presence of newly diagnosed diabetes was observed. The purpose of this past study was to estimate the association between physical activity and presence of risk for diabetes. The same relationship has been observed in the present study. Subjects who are borderline and newly detected diabetics are totally unaware of the diagnosis at the time of examination, and also of any physical activity which can change their status. On examination of the data regarding their habits, finds out that all such cases are not performing any physical activity or exercise which indicates fully unawareness in general population about their health. Thus, it makes very clear that the physical exercise has got a profound affect on this disease.

There is evidence that physical activity increases peripheral sensitivity to insulin, especially in skeletal muscle and adipose tissue (*Horton, 1991; Pescatello and Dipietro, 1993; Feskens et al., 1994*). Besides, physical activity may improve weight reduction by increasing the energy expenditure associated with exercise because obesity is a major risk factor for developing diabetes (*Horton, 1988*). In the present study, among total population, only 3.8% are doing the regular exercise. According to *Gopalan et al. (1991)* in Pondicherry found some of those subjects who took some form of exercise (50%) and less than a third did so daily. *Rema et al. (1997)* also found, that out of 304 diabetic patients only 85 (27.9%) were doing walking or jogging. These findings, therefore, serves to strengthen the grounds for encouraging physical activity and exercise.

According to *Taylor et al. (1984)*, there was an epidemiological evidence for the role of physical activity as an independent risk factor for type-II diabetes in Melanesian and Indian men in Fiji. Prevalence of diabetes was more than twice as high in those graded as sedentary or undertaking light activity than performing more physical activities.

Physical activity is a protective factor against the diabetes. Physical inactivity is found to be a risk factor for the development of diabetes. Various epidemiological studies of following workers have showed that more active individuals have a lower incidence of diabetes mellitus (*Gopalan et al., 1991; Helmrick et al., 1991; Horton, 1991; Manson, 1991; 1992; Pescatello and Dipietro, 1993; Feskens et al., 1994; Burchfiel et al., 1995; Perry et al., 1995; Crespo et al., 1996; Lynch et al., 1996; Clark, 1997; Rema et al., 1997; Will et al., 1997; Giacca et al., 1998; Harris et al., 1998; Wing et al., 1998; Baan et al., 1999; Williams et al., 1999*).

The increase in prevalence of diabetes in U.S. has shown substantial increase in obesity together with the high frequency of sedentary life style in U.S. (*Crespo et al., 1996*). Rural urban shifts and migration are usually accompanied by change in levels of physical activity, almost invariably to a more sedentary pattern.

A major characteristic of type-II diabetes is insulin resistance at the level of target tissues - possibly a post receptor defect. A sedentary type of life could be one of the numbers of factors causing insulin resistance in an individual with genetic susceptibility to diabetes. Physical exercise had been recommended as a part of therapy for type II diabetes because of increased insulin sensitivity during the exercise (*Bjorntorp, 1982*). Hence the main finding of the present study is repeated encouragement to increase physical activity and to do exercise to prevent the diabetes and its complications.

A standard recommendation for diabetic patients, as for nondiabetic individuals, is that physical activity includes a proper warm-up and cool-down period. A warm-up should consist of 5–10 min of aerobic activity (walking, cycling, etc.) at a low-intensity level. The warm-up session is to prepare the skeletal muscles, heart, and lungs for a progressive increase in exercise intensity. After a short warm-up, muscles should be gently stretched for another 5–10 min. Primarily, the muscles used during the active physical activity session should be stretched, but warming up all muscle groups is optimal. The active warm-up can either take place before or after stretching. After the activity session, a cool-down should be structured similarly to the warm-up. The cool-down should last about 5–10 min and gradually bring the heart rate down to its pre-exercise level.

There are several considerations that are particularly important and specific for the individual with diabetes. Aerobic physical activity should be recommended, but taking precautionary measures for physical activity involving the feet is essential for many patients with diabetes. The use of silica gel or air midsoles as well as polyester or blend (cotton-polyester) socks to prevent blisters and keep the feet dry is important for minimizing trauma to the feet. Proper footwear is essential and must be emphasized for individuals. Individuals must be taught to monitor closely for blisters and other potential damage to their feet, both before and after physical activity. A diabetes identification bracelet or shoe tag should be clearly visible when exercising. Proper hydration is also essential, as dehydration can affect blood glucose levels and heart function adversely. Physical activity in heat requires special attention to maintain hydration. Adequate hydration prior to physical activity is recommended (e.g., 17 ounces of fluid consumed 2 h before physical activity). During physical activity, fluid should be taken early and frequently in an amount sufficient to compensate for losses in sweat reflected in body weight loss, or the maximal amount of fluid tolerated. Precautions should be taken when exercising in extremely hot or cold environments. High-resistance exercise using weights may be acceptable for young individuals with diabetes, but not for older individuals or those with long-standing diabetes. Moderate weight training programs that utilize light weights and high repetitions can be used for maintaining or enhancing upper body strength in nearly all patients with diabetes (*American College of Sports Medicine, 2000*).

A great deal of evidence has been accumulated supporting the hypothesis that physical activity may be useful in preventing or delaying the onset of type 2 diabetes. There are now three published trials documenting that with lifestyle modification (weight loss, regular moderate physical activity), diabetes can be delayed or prevented (*Pan et al, 1997 and Tuomilehto et al, 2001*)

All levels of physical activity, including leisure activities, recreational sports, and competitive professional performance, can be performed by people with type 1 diabetes who do not have complications and are in good blood glucose control. The ability to adjust the therapeutic regimen (insulin and medical nutrition therapy) to allow safe participation and high performance has recently been recognized as an important management strategy in these individuals. (*Wasserman and Zinman, 1994*).

Patient should have both an adequate knowledge of the metabolic and hormonal responses to physical activity and well-tuned self-management skills. The increasing use of intensive insulin therapy has provided patients with the flexibility to make appropriate insulin dose adjustments for various activities. Such an approach frequently neutralizes the beneficial glycemic lowering effects of physical activity in patients with type 1 diabetes (*Schneider and Ruderman, 1990*).

Diabetes is associated with an increased risk of macro vascular disease; the benefit of physical activity in improving known risk factors for atherosclerosis is to be highly valued. This is particularly true for physical activity that can improve the lipoprotein profile, reduce blood pressure, and improve cardiovascular fitness These studies have valuable contribution in changing the focus for physical activity in diabetes from glucose control to that of an important life behavior with multiple benefits.

The significance of this study, thus, lies in the fact that the individuals are unaware of their disease status and more having a sedentary life style. This study therefore suggests that mild exercise as prescribed in various general information hand books should be undertaken to avoid the occurrence of this disease. The challenge is to develop strategies that allow individuals with diabetes or to prevent diabetes should participate in activities that are consistent with their lifestyle and culture in a safe and enjoyable manner.

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Effect of Leg Massage on Recovery from High Intensity Exercise on Football Players

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Abstract

The study was conducted on fifty two Punjabi University football probable preparing for inter university competition during their training camp held at the Punjabi University, Patiala campus in the years 2006 and 2007. The age range of the subjects was 18-25 years. The players were grouped into the three categories viz. massage group, active group & passive group. The massage group was administered effleurage & kneading massage on calf & hamstring & quadriceps regions of the leg. The active group of footballers was instructed to do a light intensity exercise of 30W during the recovery period of 15 minutes. The third group designated as the passive group was given no intervention during the recovery period. It is concluded from the present study that active and massage interventions applied during recovery following maximal exercise helps the footballers to recover better in terms of heart rate and blood pressure as compared to the passive mode of recovery. Football players exhibit significantly quicker heart rate recovery following leg massage as compared to active and passive mode of recovery. Active mode of recovery on the other hand is observed to help the footballers recover faster in terms of systolic blood pressure as compared to the passive and massage recovery intervention.

Key Words: Massage, Heart Rate, Blood Pressure, Footballers

Massage research has produced equivocal findings in recent years. Some athletes and physiotherapists support claims that massage can aid recovery and optimize performance; however, most of the evidence is anecdotal. Research in the field of sports massage has been flawed by many methodological variations and poor experimental control during the test phase including: inconsistent massage duration, no standardization of warm up, absence of a period of active recovery when comparing massage with other interventions, and often no standardization of physical activity performed preceding the massage. The literature does, to some extent, support psychological benefits from massage *(Hemmings et al, 2000),* but physiological and performance benefits have never been consistently observed. *Cafarelli & Flint (1992)* and *Tiidus (1997)* suggested that, in a practical setting, massage could show performance improvements, but lack of control would devalue the results. Beneficial effects of active recovery after intense exercise are well established *(Weltman, et al, 1979; Dodd et al, 1984 & Ahmadi et al, 1996)* research on the effect of massage on recovery of muscle function should include active recovery of some sort in all phases of the experimental design. To date, only one study has adopted this type of design in attempt to tease out any potential benefits of massage combined with active recovery versus active recovery alone or massage alone *(Monedero and Donne, 2000).* These findings indicate a beneficial effect of a 15 minute combined intervention, compared with active recovery or massage alone, on performance in repeated 5-minute cycle ergometer time trials. These data provide some evidence for the beneficial effect of massage when combined with a short active recovery process; however, the massage was short (7.5 minute), confined to the calf or hamstrings, and no indication of massage protocol or diet/activity control was provided. Furthermore, the main emphasis for an effect of massage in recovery from exercise is focused on improvements in blood flow and lactate clearance *(Cafferelli* *and Flint, 1992). Therefore* it appears that there is a need for controlled study incorporating certain aspects of a practical setting (inclusion of a short active recovery period), a more suitable length of massage (20-30 minutes), and greater experimental control (preceding diet and exercise), to assess the potential benefits of massage on lactate clearance and subsequent high intensity exercise capacity/performance. Further more, the literature on the role of massage in increasing blood flow or lactate clearance is equivocal, *(Dolgener, and Morien, 1993; Shoemaker et al 1997; Martin et al 1998 & Monedero and Donne, 2000)* raising a question as to the precise role of massage in short-term recovery. Football playing requires short bursts of intermittent violent muscular actions. Trainers' emphasize on increasing the ability to recover quickly during training of foot ballers. Therefore, different recovery interventions are necessary for footballers to increase blood flow, induce changes in blood flow distribution and improve range of motion. These responses could enhance the clearance rate of Cretine Kinase from the muscle *(Ehlers et al 2002).* There fore the aim of this work was to compare the effects of different recovery interventions like leg massage, passive and active mode of recovery on certain common cardiovascular variables following high intensity cycle ergometer exercise in footballers.

Material & Method

The study was conducted on fifty two Punjabi University football probable preparing for inter university competition during their training camp held at the Punjabi University, Patiala campus in the years 2006 and 2007. The age range of the subjects was 18-25 years. As per the objective of the study, the players were grouped into the three categories viz. massage group, active group & passive group. The massage group was administered effleurage & kneading massage on calf & hamstring & quadriceps regions of the leg. This massage was given for first 3 minutes subsequent to the stoppage of exercise followed by no massage for next three minutes. This cycle was repeated in the subsequent phase of the remaining nine minutes of recovery. The active group of footballers was instructed to do a light intensity exercise of 30W during the recovery period of 15 minutes. The third group designated as the passive group was given no intervention during the recovery period. Mean characteristics of age, weight & height of the three groups are presented in table 1. Statistically speaking there is no difference in age, weight & height among the three groups.

Table 1: Age, weight and height characteristics of three groups of footballers

		Age, Yrs		Weight, Kgs		Height, Meters	
Group	N	Mean	SD	Mean	SD	Mean	SD
Massage	13	19.77	1.83	64.00	5.39	1.72	0.05
Active	23	18.91	1.28	65.43	7.15	1.74	0.07
Passive	16	19.06	1.24	65.00	7.69	1.73	0.04

ANOVA	Statistical Comparison of age, weight and height of three groups of footballers					
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Age	Between Groups	6.37	2	3.19	1.58	0.22
	Within Groups	99.07	49	2.02		
	Total	105.44	51			
Height	Between Groups	0.01	2	0.00	0.85	0.44
	Within Groups	0.17	49	0.00		
	Total	0.18	51			
Weight	Between Groups	17.18	2	8.59	0.18	0.84
	Within Groups	2357.65	49	48.12		
	Total	2374.83	51			

Following cardiovascular parameters were measured in all the subjects at rest, during different progressive workloads and different stages of recovery.

- Heart rate in beats/min using Polar heart rate monitor

- Systolic & diastolic components of blood pressure by Ascultatory method using sphygmomanometer & stethoscope

All the subjects were administered progressive workloads on an electrically controlled bicycle ergometer starting from 50W and the load was then increased in steps of 25W every minute until the exhaustion of the subject. Each subject was asked to maintain the pedaling frequency at 60 rpm. After exhaustion, the recovery parameters in terms of heart rate and blood pressure were recorded at intervals of 1 minute for a total period of 15 minutes following maximal exercise for active and passive recovery groups where as for massage groups at interval of 3minute.

Result and Discussion

Table 2: Comparison of mean values of heart rate and blood pressure at rest of three groups of footballers

		Resting Heart Rate (RHR), Beats/Min.		Resting Systolic Blood Pressure (RSBP), mm Hg.		Resting Diastolic Blood Pressure, mm Hg.	
Group	N	Mean	SD	Mean	SD	Mean	SD
Massage	13	70.77	6.95	113.08	4.80	73.08	4.80
Active	23	69.13	7.03	113.04	4.70	73.04	4.70
Passive	16	73.00	6.66	114.06	5.54	73.75	5.00

ANOVA	Statistical Comparison of resting heart rate and blood pressure among three groups of footballers					
		Sum of Squares	df	Mean Square	F	Sig.
Resting heart rate	Between Groups	141.31	2	70.66	1.48	0.24
	Within Groups	2334.92	49	47.65		
	Total	2476.23	51			
Resting Systolic Blood Pressure	Between Groups	11.24	2	5.62	0.23	0.80
	Within Groups	1224.82	49	25.00		
	Total	1236.06	51			
Resting Diastolic Blood Pressure	Between Groups	5.35	2	2.68	0.12	0.89
	Within Groups	1138.88	49	23.24		
	Total	1144.23	51			

Age, weight and height characteristics of three groups of foot balers reveal non-significant differences (Table 1). Mean values of resting heart rate and blood pressure parameters of the three groups of football players are presented in (table 2). Statistically speaking no significant difference in the mean resting value of heart rate, systolic blood pressure and diastolic blood pressure have been observed in football players.

Table 3: Comparison of mean values of exercise heart rates during various workloads among three groups of footballers

	Group	N	Mean	SD
Exercise Heart Rate 50W, Beats/min	Massage	13	144.92	10.33
	Active Recovery	23	144.43	6.52
	Passive Recovery	16	146.31	11.43
Exercise Heart Rate 75W, Beats/min	Massage	13	159.38	10.34
	Active Recovery	23	157.00	6.44
	Passive Recovery	16	159.69	11.26
Exercise Heart Rate 100W, Beats/min	Massage	13	170.31	10.02
	Active Recovery	23	167.26	6.64
	Passive Recovery	16	168.00	10.24
Exercise Heart Rate 120W, Beats/min	Massage	13	177.38	10.02
	Active Recovery	23	177.00	8.06
	Passive Recovery	16	175.50	10.63
Exercise Heart Rate 150W, Beats/min	Massage	13	181.85	8.75
	Active Recovery	23	182.52	9.26
	Passive Recovery	16	179.06	10.29

ANOVA	Statistical Comparison of exercise heart rates during various workloads among three groups of footballers					
		Sum of Squares	df	Mean Square	F	Sig.
Exercise Heart Rate 50W	Between Groups	34.05	2	17.02	0.20	0.82
	Within Groups	4176.01	49	85.23		
	Total	4210.06	51			
Exercise Heart Rate 75W	Between Groups	84.18	2	42.09	0.50	0.61
	Within Groups	4096.51	49	83.60		
	Total	4180.69	51			
Exercise Heart Rate 100W	Between Groups	78.55	2	39.27	0.51	0.60
	Within Groups	3749.20	49	76.51		
	Total	3827.75	51			
Exercise Heart Rate 125W	Between Groups	30.98	2	15.49	0.18	0.84
	Within Groups	4329.08	49	88.35		
	Total	4360.06	51			
Exercise Heart Rate 150W	Between Groups	118.30	2	59.15	0.66	0.52
	Within Groups	4394.37	49	89.68		
	Total	4512.67	51			

Table 4: Comparison of mean values of systolic blood pressure during various workloads among three groups of footballers

	Group	N	Mean	SD
Exercise Systolic Blood Pressure (EXSBP) 50W mm Hg	Massage	13	148.46	6.89
	Active Recovery	23	149.57	7.67
	Passive Recovery	16	151.88	9.11
Exercise Systolic Blood Pressure 75W mm Hg	Massage	13	167.69	8.57
	Active Recovery	23	165.22	7.15
	Passive Recovery	16	167.50	7.75
Exercise Systolic Blood Pressure 100W mm Hg	Massage	13	180.77	6.72
	Active Recovery	23	176.52	6.47
	Passive Recovery	16	179.06	5.54
Exercise Systolic Blood Pressure 125W mm Hg	Massage	13	191.54	6.25
	Active Recovery	23	188.26	4.42
	Passive Recovery	16	190.88	4.50
Exercise Systolic Blood Pressure 150W mm Hg	Massage	13	203.46	6.89
	Active Recovery	23	199.74	3.06
	Passive Recovery	16	200.75	4.04

ANOVA	Statistical Comparison of systolic blood pressure during various Workloads among three groups of footballers					
		Sum of Squares	df	Mean Square	F	Sig.
EXSBP 50W	Between Groups	91.37	2	45.68	0.72	0.49
	Within Groups	3108.63	49	63.44		
	Total	3200.00	51			
EXSBP 75W	Between Groups	72.24	2	36.12	0.61	0.55
	Within Groups	2904.68	49	59.28		
	Total	2976.92	51			
EXSBP 100W	Between Groups	161.07	2	80.54	2.05	0.14
	Within Groups	1924.98	49	39.29		
	Total	2086.06	51			
EXSBP 125W	Between Groups	111.89	2	55.95	2.28	0.11
	Within Groups	1203.42	49	24.56		
	Total	1315.31	51			
EXSBP 150W	Between Groups	116.32	2	58.16	2.79	0.07
	Within Groups	1020.67	49	20.83		
	Total	1136.98	51			

Graded exercise response of subjects in terms of their mean exercise heart rates and systolic blood pressure are observed to reveal increases in these parameters with increase in work intensity but intergroup comparison demonstrate no significant differences at various graded exercise intensities of work load as evaluated by analysis of variance (ANOVA) tests (Figure 1 & 2, Tables 3 & 4).

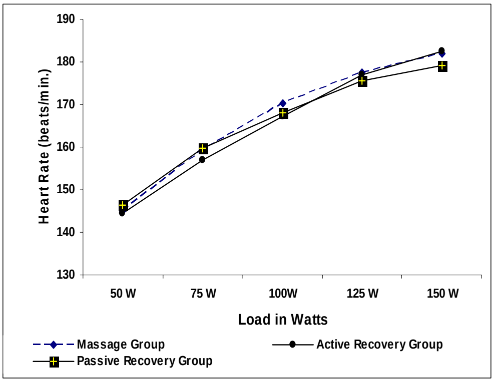

Figure 1: Heart Rate Response to Progressive Exercise in Football Players subjected to different Recovery Interventions

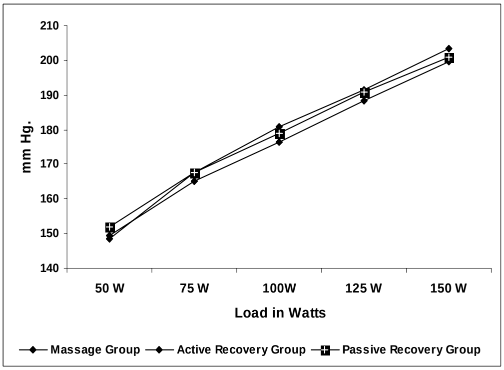

Figure 2: Systolic Blood Pressure Response to Progressive Exercise in Football Players subjected to different Recovery Interventions

Diastolic blood pressure on the other hand exhibit a different pattern of response that is at the initial exercise intensities no statistical significant difference is noticed between the three groups of foot ball players. However, group of foot ball players subjected to active mode of recovery demonstrate a significantly lower diastolic blood pressure in comparison to the other two groups at exercise intensity exceeding 100W (Figure 3 & table 5).

Table 5: Comparison of mean values of diastolic blood pressure during various workloads among three groups of footballers

	Group	N	Mean	SD
Exercise Diastolic Blood Pressure (EXDBP) 50W mm Hg	Massage	13	57.69	3.30
	Active Recovery	23	58.91	2.11
	Passive Recovery	16	58.75	2.89
EXDBP 75W mm Hg	Massage	13	55.00	4.08
	Active Recovery	23	57.17	3.64
	Passive Recovery	16	55.63	4.03
EXDBP 100W mm Hg	Massage	13	52.69	2.59
	Active Recovery	23	56.74	3.88
	Passive Recovery	16	54.06	4.55
EXDBP 125W mm Hg	Massage	13	51.92	3.25
	Active Recovery	23	56.09	4.25
	Passive Recovery	16	53.75	4.65
EXDBP 150W mm Hg	Massage	13	51.54	4.27
	Active Recovery	23	55.43	4.50
	Passive Recovery	16	53.44	5.39

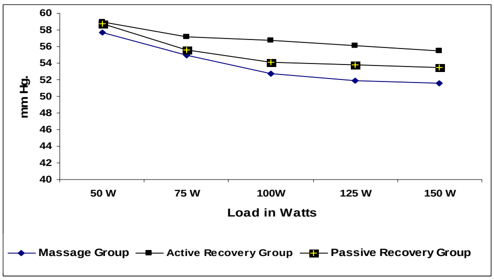

Figure 3: Diastolic Blood Pressure Response to Progressive Exercise in Football Players subjected to different Recovery Interventions

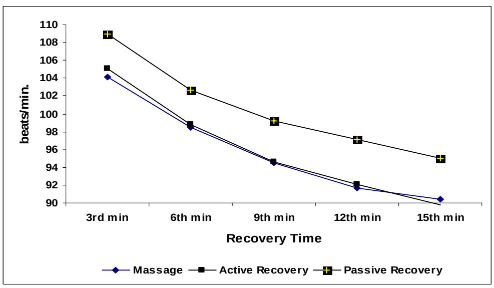

Figure 4 **: Heart Rate Response in Football Players subjected to different Recovery Interventions**

Recovery of the subjects in terms of heart rate and blood pressure have been explored with the employment of three interventions viz leg massage, active sum-maximal exercise (30W) and passive recovery methods. It is interesting to observe that recovery of heart rate was significantly faster in the football group to which leg massage was applied as compared to football players who were given the active and passive modes of recovery interventions (Figure 4 & table 6).

Table 6: Comparison of mean values of heart rate during different point of time of recovery following maximal exercise among three groups of footballers

	Group	N	Mean	SD
Recovery Heart Rate (RECHR) 3rd min Beats/min	Massage	13	104.15	4.71
	Active Recovery	23	105.13	5.69
	Passive Recovery	16	109.00	6.49
RECHR 6th min Beats/min	Massage	13	98.46	4.43
	Active Recovery	23	98.78	4.59
	Passive Recovery	16	102.63	5.51
RECHR 9th min Beats/min	Massage	13	94.46	4.29
	Active Recovery	23	94.57	4.14
	Passive Recovery	16	99.25	4.65
RECHR 12th min Beats/min	Massage	13	91.69	3.88
	Active Recovery	23	92.04	3.67
	Passive Recovery	16	97.13	3.77
RECHR 15th min Beats/min	Massage	13	90.38	4.11
	Active Recovery	23	89.74	3.28
	Passive Recovery	16	95.00	2.39

ANOVA	Statistical Comparison of recovery heart rates during different Point of time of recovery among three groups of footballers					
		Sum of Squares	df	Mean Square	F	Sig.
RECHR 3rd min	Between Groups	205.4	2	102.7	3.1	**0.05**
	Within Groups	1610.3	49	32.9		
	Total	1815.7	51			
RECHR 6th min	Between Groups	174.4	2	87.2	3.7	**0.03**
	Within Groups	1154.9	49	23.6		
	Total	1329.3	51			
RECHR 9min	Between Groups	247.1	2	123.6	6.6	**0.00**
	Within Groups	923.9	49	18.9		
	Total	1171.0	51			
RECHR 12th min	Between Groups	301.5	2	150.8	10.7	**0.00**
	Within Groups	691.5	49	14.1		
	Total	993.0	51			
RECHR 15th min	Between Groups	283.5	2	141.7	13.2	**0.00**
	Within Groups	525.5	49	10.7		
	Total	809.0	51			

Scheffe Post Hoc Test Comparisons

Parameter	Group 1	Group 2	Mean Difference (Group 1- Group 2)	Standard Error	Sig
RECHR 3rd min	Massage	Active	-0.98	1.99	0.89
		Passive	-4.85	2.14	0.09
	Active	Massage	0.98	1.99	0.89
		Passive	-3.87	1.87	0.13
	Passive	Massage	4.85	2.14	0.09
		Active	3.87	1.87	0.13
RECHR 6th min	Massage	Active	-0.32	1.68	0.98
		Passive	-4.16	1.81	0.08
	Active	Massage	0.32	1.68	0.98
		Passive	-3.84	1.58	0.06
	Passive	Massage	4.16	1.81	0.08
		Active	3.84	1.58	0.06
RECHR 9th min	Massage	Active	-0.10	1.51	1.00
		Passive	-4.79	1.62	**0.02**
	Active	Massage	0.10	1.51	1.00
		Passive	-4.68	1.41	**0.01**
	Passive	Massage	4.79	1.62	**0.02**
		Active	4.68	1.41	**0.01**
RECHR 12th min	Massage	Active	-0.35	1.30	0.96
		Passive	-5.43	1.40	**0.00**
	Active	Massage	0.35	1.30	0.96
		Passive	-5.08	1.22	**0.00**
	Passive	Massage	5.43	1.40	**0.00**
		Active	5.08	1.22	**0.00**
RECHR 15th min	Massage	Active	0.65	1.14	0.85
		Passive	-4.62	1.22	**0.00**
	Active	Massage	-0.65	1.14	0.85
		Passive	-5.26	1.07	**0.00**
	Passive	Massage	4.62	1.22	**0.00**
		Active	5.26	1.07	**0.00**

It is pertinent to mention here that the differences related to heart rate recovery assume statistically significant proportion during the later past of recovery i.e. from 9-15 minute of recovery following maximal exercise. In case of recovery of systolic blood pressure, the picture is different in the sense that foot ball players who were given sum-maximal exercise during recovery (active group) demonstrated significantly lower blood pressure as compared to those footballers who were given leg massage or passive mode of recovery intervention (fig 5 & table 7).

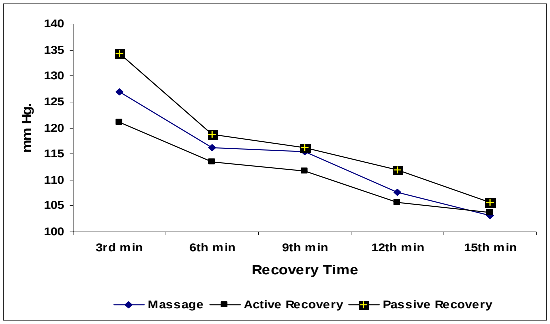

Figure 5 Systolic Blood Pressure Response in Football Players subjected to different Recovery Interventions

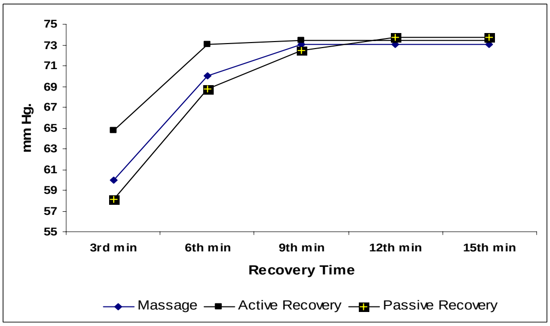

Figure 6 Diastolic Blood Pressure Response in Football Players subjected to different Recovery Interventions

Table 7: Comparison of mean values of systolic blood pressure during different point of time of recovery following maximal exercise among three groups of footballers

	Group	N	Mean	SD
Recovery Systolic Blood Pressure (RECSBP) 3rd min	Massage	13	126.92	3.84
	Active Recovery	23	121.09	4.25
	Passive Recovery	16	134.38	5.12
RECSBP 6th min	Massage	13	116.15	5.06
	Active Recovery	23	113.48	4.87
	Passive Recovery	16	118.75	3.42
RECSBP 9th min	Massage	13	115.38	5.19
	Active Recovery	23	111.74	6.50
	Passive Recovery	16	116.25	5.00
RECSBP 12th min	Massage	13	107.69	4.39
	Active Recovery	23	105.65	5.90
	Passive Recovery	16	111.88	4.03
RECSBP 15th min	Massage	13	103.08	4.80
	Active Recovery	23	103.70	4.58
	Passive Recovery	16	105.63	5.12

ANOVA	Statistical Comparison of recovery of systolic blood pressure during different point of time of recovery among three groups of footballers					
		Sum of Squares	df	Mean Square	F	Sig.
RECSBP 3rd min	Between Groups	1667.56	2	833.78	42.18	**0.00**
	Within Groups	968.50	49	19.77		
	Total	2636.06	51			
RECSBP 6th min	Between Groups	264.80	2	132.40	6.46	**0.00**
	Within Groups	1004.43	49	20.50		
	Total	1269.23	51			
RECSBP 9th min	Between Groups	223.41	2	111.71	3.36	**0.04**
	Within Groups	1628.51	49	33.24		
	Total	1851.92	51			
RECSBP 12th min	Between Groups	367.96	2	183.98	7.27	**0.00**
	Within Groups	1239.74	49	25.30		
	Total	1607.69	51			
RECSBP 15th min	Between Groups	54.52	2	27.26	1.18	0.32
	Within Groups	1131.54	49	23.09		
	Total	1186.06	51			

Schaeffe Post Hoc Test Comparisons

Parameter	Group 1	Group 2	Mean Difference (Group 1- Group 2)	Standard Error	Significance
RECSBP 3rd min	Massage	Active	5.84	1.54	**0.00**
		Passive	-7.45	1.66	**0.00**
	Active	Massage	-5.84	1.54	**0.00**
		Passive	-13.29	1.45	**0.00**
	Passive	Massage	7.45	1.66	**0.00**
		Active	13.29	1.45	**0.00**
RECSBP 6th min	Massage	Active	2.68	1.57	0.24
		Passive	-2.60	1.69	0.32
	Active	Massage	-2.68	1.57	0.24
		Passive	-5.27	1.47	**0.00**
	Passive	Massage	2.60	1.69	0.32
		Active	5.27	1.47	**0.00**
RECSBP 9th min	Massage	Active	3.65	2.00	0.20
		Passive	-0.87	2.15	0.92
	Active	Massage	-3.65	2.00	0.20
		Passive	-4.51	1.88	0.07
	Passive	Massage	0.87	2.15	0.92
		Active	4.51	1.88	0.07
RECSBP 12th min	Massage	Active	2.04	1.75	0.51
		Passive	-4.18	1.88	0.09
	Active	Massage	-2.04	1.75	0.51
		Passive	-6.22	1.64	**0.00**
	Passive	Massage	4.18	1.88	0.09
		Active	6.22	1.64	**0.00**

Recovery in case of diastolic blood pressure in general reveal no statistical difference among the three groups of footballers except the massage group where the diastolic blood pressure was observed to remain significantly lower in comparison to the active and passive groups (table 8).

Table 8: Comparison of mean values of diastolic blood pressure during different point of time of recovery following maximal exercise among three groups of footballers

	Group	N	Mean	SD
Recovery Diastolic Blood Pressure (RECDBP) 3rd min	Massage	13	60.00	0.00
	Active Recovery	23	64.78	5.11
	Passive Recovery	16	58.13	3.59
RECDBP 6th min	Massage	13	70.00	0.00
	Active Recovery	23	73.04	4.70
	Passive Recovery	16	68.75	8.85
RECDBP 9th min	Massage	13	73.08	4.80
	Active Recovery	23	73.48	4.87
	Passive Recovery	16	72.50	6.83
RECDBP 12th min	Massage	13	73.08	4.80
	Active Recovery	23	73.48	4.87
	Passive Recovery	16	73.75	5.00
RECDBP 15th min	Massage	13	73.08	4.80
	Active Recovery	23	73.48	4.87
	Passive Recovery	16	73.75	5.00

ANOVA	Statistical Comparison of recovery of diastolic blood pressure during different point of time of recovery among three groups of footballers					
		Sum of Squares	df	Mean Square	F	Sig.
RECDBP 3min	Between Groups	**459.26**	2	229.63	14.66	**0.00**
	Within Groups	767.66	49	15.67		
	Total	1226.92	51			
RECDBP 6min	Between Groups	189.97	2	94.98	2.80	0.07
	Within Groups	1661.96	49	33.92		
	Total	1851.92	51			
RECDBP 9min	Between Groups	9.03	2	4.52	0.15	0.86
	Within Groups	1498.66	49	30.59		
	Total	1507.69	51			
RECDBP 12min	Between Groups	3.26	2	1.63	0.07	0.93
	Within Groups	1173.66	49	23.95		
	Total	1176.92	51			
RECDBP 15min	Between Groups	3.26	2	1.63	0.07	0.93
	Within Groups	1173.66	49	23.95		
	Total	1176.92	51			

Scheffe Post Hoc Test Comparisons

Parameter	Group 1	Group 2	Mean Difference (Group 1- Group 2)	Standard Error	Sig
RECDBP 3rd min	Massage	Active	-4.78	1.37	**0.00**
		Passive	1.88	1.48	0.45
	Active	Massage	4.78	1.37	**0.00**
		Passive	6.66	1.29	**0.00**
	Passive	Massage	-1.88	1.48	0.45
		Active	-6.66	1.29	**0.00**

The findings of the study reveal that massage and active modes of interventions during following maximal exercise helps the footballers to attend the physiological restoration more quickly and faster as compared to passive mode of recovery.

An active recovery (i.e. 30- 40% of VO_2 max.) has been shown by many investigators to promote faster clearance of blood lactate when undertaken after high- intensity exercise *(Thiriet, et al, 1993, Billat, 2001).* Further more an active recovery has also been reported to improve power output recovery during subsequent exercise bout in most studies *(Thiriet et al, 1993; Bogdanis et al, 1995; Connolly et al, 2003).* According to *Poliner et al (1993)*, left ventricular end-diastolic volume increases largely because of the return of blood to the heart by the active muscle pump and the increased sympathetic out flow to the veins causing vasoconstriction and augmenting venous return. Left ventricular end-systolic volume decrease because of augmented contractility of the heart, which eject more blood from the ventricle and leaves less in the ventricle. As per this notion, the systolic blood pressure during active recovery should exhibit higher values as compared to other modes of exercise interventions. But in the present study the results are contrary indicating that systolic blood pressure tends to remain significantly lower during active mode of recovery in comparison to the passive and massage intervention groups. The probable reason may be long duration of very low intensity of exercise load of 30W given to the subjects during recovery as compared to other studies where the load was 30 to 40% of their VO_2 max and for short duration.

Massage intervention during recovery was observed to successfully keep the diastolic blood pressure significantly lower in footballers as compared to other modes of recovery intervention. Diastolic blood pressure is the outcome of the balance of vasodilatation in the vasculature of the active muscle and vasoconstriction in other vascular beds. It is visualized that massage applied to the leg region may have resulted in opening of more vascular beds and thus favored vasodilatation resulting in lowering of diastolic blood pressure. In addition the application of leg massage may have contributed to increase in temperature causing dilatation of skin vessels and decrease in resistance to blood flow.

Conclusion

It is concluded from the present study that active and massage interventions applied during recovery following maximal exercise helps the footballers to recover better in terms of heart rate and blood pressure as compared to the passive mode of recovery. Football players exhibit significantly quicker heart rate recovery following leg massage as compared to active and passive mode of recovery. Active mode of recovery on the other hand is observed to help the footballers recover faster in terms of systolic blood pressure as compared to the passive and massage recovery intervention.

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The Capillary Blood *In-Vivo* Micronucleus Test: Wrestlers Exercising at *Akharas*

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Abstract

Some studies have indicated the potential for strenuous exercise to cause genetic damage. In order to investigate whether wrestling can induce any chromosomal damage, micronuclei were scored in small T-lymphocytes of wrestlers using the *in vivo* capillary blood micronucleus (MN) assay. Blood samples from 15 wrestlers and ten controls were analysed. Requisite anamnesic data were collected on a pre-designed proforma. The wrestlers (15– 30y, middle socio- economic class) were mostly non-vegetarians, taking alcohol and smoking. Finger-prick capillary blood samples were processed and 2000 cells per individual were scored for MN. The MN frequency in the wrestlers was statistically significant and increased with age, duration and longer routine of heavy exercising. These observations imply that wrestling causes cytogenetic damage indexed as micronucleated cells resulting from aneugenicity and/or clastogenicity. Wrestlers therefore may be prone to long- term consequence with outcomes in terms of cancer and age-related disease.

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Key Words: Chromosomal damage, strenuous exercise

Introduction

The art of wrestling as a sport and method of defense goes further back in time than any other exercising record of empty-handed combat. It can be traced back to as far as 3400 BC when the Egyptians practiced wrestling as a favourite past-time event. Images of wrestling artifacts can still be seen on the tomb walls in Egypt. As a game, wrestling has been on the maps since as far back as 708 B.C. when it first featured in the Greek Olympics. Gradually, wrestling modified to become a sport with safety guidelines and formal training methods. Amateur wrestling is the most widespread form of sport wrestling. There are two international wrestling styles performed in the Olympic Games under the supervision of FILA (Fédération Internationale des Luttes Associées or International Federation of Associated Wrestling Styles): Freestyle and Greco-Roman. Freestyle is possibly derived from the English Lancashire style. A similar style, commonly called Collegiate, Folkstyle, or Scholastic, is practiced in secondary schools, colleges, and younger age groups in the United States.

Traditional Indian wrestling since 11 AD has however been integral to Hinduism. It is known as *Pahalwani* or *Mallavidya* and is a form of exercise that defines the essence of wrestling and in being human so as to achieve self discipline through physical fitness as well as being an identity and purity of the body, mind and spirit. Trainees reside at the *Akharas* (temples, gyms), leaving civilization and entering the world of tranquility and acknowledgment. *Akharas* are equipped with fine grit dirt floors to bring one closer to natural elements of the earth (sifted and saturated with essential oils to supple the skin of the wrestler when he is wrestling). The oils also keep the dirt clean and compressed for the body to tumble upon.

Natural light and fresh air impact the training area as well to keep it in harmony with the surrounding atmosphere. Exercise is done with one's own body weight. Performing Yoga (posture stretches), *Bethak* (in place squats), *Dand* (push ups), *Jori* (swinging weighted wooden clubs), *Gada* (swinging weighted ball and mace) and body massages give the wrestler a complete regimen. Standardized square earth-filled pits (*Akharas)*, measuring approximately 20'x20'for training and competition were introduced. In India, the authorities have banned the ancient sport of sandpit wrestling in an attempt to help its wrestlers keep pace with the rest of the world by training on mats. Wrestling (or *Dungal*, as often called) has remained a trainers dream and many males opt for it, both as a sport and profession. In *Akharas,* a former wrestler teaches different techniques and tricks of wrestling to the students and also the types of exercises which they have to perform to get fit and ready for the competitions.

Among the effects of exercising is the ability to create free radicals due to increased oxygen uptake. This can cause genetic damage as reported in the literature. DNA damage has been observed in recreationally active individuals, trained athletes and untrained individuals (*Niess et al., 1996; Hartmann et al., 1998; Tsai et al., 2001*). However no literature on genetic damage in tissues of wrestlers has come to attention. Hence the objective of the present study was to score for genetic damage by the capillary blood *in-vivo* micronucleus test in peripheral blood lymphocytes of some wrestlers working out at local *Akharas*.

Materials and Methods

The capillary blood *in vivo* micronucleus test (*Xue et al., 1984*) was performed to score for any chromosomal (micronuclei, MN) damage. Since lymphocytes are distributed throughout the body, circulate in all tissues and are long-lived, therefore cell- cycle kinetics, chromosomal studies, biochemical tests besides others biological investigations, can be carried out on peripheral blood lymphocytes (PBL). The capillary blood *in vivo* micronucleus test scores for micronuclei in the small lymphocytes which have a high nuclear to cytoplasmic ratio. The study involved cytogenetic analysis of 15 male wrestlers and 10 healthy age-matched controls who had never exercised. All the wrestlers (15-30y) were residents of Amritsar city and had been visiting the Shankar *Akhara* and the Kallu *Akhara* for 3-5 years. Male controls in the similar age range were students of the Dayanand Anglo Vedic College, Amritsar. Some wrestlers and controls were non-smokers. Relevant information about the wrestlers and controls was noted on a pre-designed proforma and sample collection was done after their written informed consent. The study was cleared by the Institutional Ethics Committee.

About (150µl) of capillary blood was taken in a heparinized sedimentation tube from a finger-prick made with the help of a lancet. The blood samples were transported to the laboratory and processed for the MN test. The procedure involved adding of methyl cellulose (0.3%) to the heparinized blood sample in a ratio of 1:2 to 1:3; it was mixed carefully with a fine glass rod and the samples were put in a water bath at 37ºC for about 40 min. The lymphocyte suspension was decanted into a micro - centrifuge tube with the help of the micropipette and was centrifuged at 3000rpm for 6 min. The supernatant was decanted except for 0.3ml in which the pellet was re-suspended with the help of the small vortex mixer. A smear was prepared and the slide was left to air-dry. Fixing of the cells was carried out with 100% methanol for one min. The slides were air-dried, stained in buffered 10% Giemsa (pH-6.4) for 10 min. and mounted in D.P.X. A total of 2000 cells were scored per individual under the low power (40X) of a binocular microscope. The presence of micronuclei in the cells was confirmed at 100X under oil immersion. Slides were randomly scored by another worker to confirm the presence of micronuclei. The criteria for scoring cells for micronuclei were: cytoplasm intact and lying flat, no overlapping between adjacent cells, the nucleus normal and intact, the nuclear perimeter smooth and distinct and only little or no debris . The criteria for identifying micronuclei in the cell were: the size of the micronucleus less than one-third of the diameter of the nucleus, nucleus rounded with smooth perimeter, texture and the staining intensity of micronucleus similar to the nucleus, and no overlapping with the nucleus (*Tolbert et al., 1984*).

Results

Table1. Types of Exercises Performed by Wrestlers

Target Organs	Types of exercise	Daily Duration (min)	Out of n=15, no.of individuals doing various exercises
Chest	Push-ups	20-40	15
Thighs	Sit-ups	20-30	12
Biceps, Triceps	Pull-ups, Rope climbing	40-50	15
Abdominal Muscles	Swinging weighted wooden clubs	30-40	10
Lateral Muscles	Swinging weighted ball and mace	10-20	15

Table 2. General Information about selected males exercising at *Akharas* and control individuals.

Sample Groups	Age (yr.)	Duration of exercising (yr)	Daily exercising (hr)	Warm up ime(min)	Mobile phone	Smoking	Drinking	Veg/non-veg diet	MNd cells/Total cells scored	% MN$ frequency
Wrestlers (n=15)	14-28	2-6	2-6	20-40	8	9	11	13	163/30000	0.54**
Controls (n=10)	17-28	-	-	-	-	3	4	5	16/20000	0.08

$ – Calculated as an average of MNd cells in that group

**Highly significant from controls at 1% level (p<0.001;Student's t-test).

The list of various exercises performed by the wrestlers' group is given in Table 1. Genetic damage was observed as MNd cells in 94% of the wrestlers and in 8 % among the control individuals (Table 2). The percentage frequency of MN ranged from 0.50 to 0.65 among wrestlers. A minimum of 2000 cells were scored per sample with minimum of 10 MN and a maximum of 13. The overall frequency of MN in the sample group (0.54 %) was statistically significant when compared with that in (0.08%) control group. The statistical difference for MN frequencies between the wrestlers and the control group reveals that wrestlers are subjected to genetic stress.

Table 3. Chi-Square Test- Comparison of the Sample and Control Group Individuals

Variable	χ^2 calculated	χ^2 tabular 5%	Significant/non Significant	Degree of freedom
Age	1.68	3.14	NS	1
Smoker/Non Smoker	2.95	3.14	NS	1
Alcohol/Non Alcohol	1.82	3.14	NS	1
Mobile User/ Non Mobile User	1.31	3.14	NS	1
Veg/ Non Veg	0.99	3.14	NS	1

Table 4. Regression Coefficient Analysis for Comparison of various Factors with Percent Frequency of MNd Cells

Wrestlers	Age	Alcohol intake	Daily exercise duration	Years since exercising	Mobile Phone usage	Veg/ Non veg	Smoker/Non Smoker	Warming Up
r	0.002	0.010	0.040	0.006	0.054	0.081	0.230	0.040
p	0.946	0.960	0.030	0.040	0.620	0.540	0.530	0.340
Controls								
r	0.005							
p	0.960							

r- Regression coefficient, if (p) = 0.05, test is significant.

Table 5. Multifactorial Analysis of Variance (ANOVA) of Independent Variables for MNT: Persons Doing Heavy Exercise in *Akharas* and of Control Individuals

Source of variation	Sum of squares	Degrees of freedom	Mean squares	F-ratio	Significant (p-value)
Age	154.500	12	16.564	0.874	NS
Alc. Intake	2.984	12	0.876	0.956	NS
Daily Duration	3.430	12	0.654	0.564	S
Time Since exercising	30.640	12	2.453	3.548	S
Mobile Phone usage	2.540	12	2.432	9.876	S
Veg/Non veg	3.560	12	9.756	1.987	NS
Smoker/Non Smoker	3.654	12	4.873	4.634	NS
Warming up	654.870	12	5.342	1.342	S
Control					
Age	123.650	12	9.654	0.321	NS

Table 6. Effect of Age on Chromosomal Damage in Wrestlers.

Age (y)	No.	Age (y)		Time since exercising (y)		Daily exercise (hr)		Warm-up (min)		MNed cells/Total cells scored	% MN$ frequency±SEM
		Range	Mean	Range	Mean	Range	Mean	Range	Mean		
Wrestlers											
14-20	5	14-19	17.0	2-6	3.4	3-4	3.6	20-40	29.0	57/10000	0.41**±0.081
20-25	6	22-23	22.5	2-6	4.0	2-4	4.5	20-40	29.1	63/12000	0.37*± 0.089
25-30	4	25-28	26.0	3-6	4.5	3-6	4.2	20-40	30.0	43/8000	0.48**± 0.067
Controls											
14-20	4	16-19	17.5							6/8000	0.05± 0.001
20-25	3	20-23	21.6							4/6000	0.06± 0.009
25-30	3	25-28	26.6							6/6000	0.06± 0.009

$ – Calculated as an average of MNd cells in that group, *Significant from parallel controls at 5% level (p<0.05; Student's t-test) and **Highly significant from parallel controls at 1% level p<0.001; Student's t-test). Non-significant within wrestlers' group.

Table 7. Effect of Years of Exercising on Chromosomal Damage in Wrestlers.

Time since Exercising (yr)	No.	Mobile Phone users	Smokers	Alcohol Intake	Age Range (y)		Daily exercise (hr)		Warm-up (min)		MNed cells/Total cells scored	% MN$ frequency±SEM
					Range	Mean	Range	Mean	Range	Mean		
Wrestlers												
1-3	6	4	3	3	14-25	19.6	2-4	3.5	20-30	22.5	65/12000	0.43**±0.068
4-6	9	4	6	8	18-28	22.8	2-6	3.5	25-40	33.8	98/18000	0.54**±0.076
Controls												
	10	3	4	2	15-30	24.0					16/20000	0.06±0.008

$ – Calculated as an average of MNd cells in that group. **Highly significant with total control at 1% level (p<0.001; Student's t-test). Non-significant within wrestlers' group.

Table 8. Effect of Daily Exercise on Chromosomal Damage in Wrestlers.

Daily Exercise (hrs)	No.	Mobile Phone users	Smokers	Alcohol Intake	Age Range (y)		Years since exercising (y)		Warm-up (min)		MNed cells/Total cells scored	% MN$ frequency±SEM
					Range	Mean	Range	Mean	Range	Mean		
Wrestlers												
1-2	2	0	1	1	23	23.0	3-4	3.5	20-40	30.0	23/4000	0.57**±0.075
3-4	12	8	7	9	18-28	21.08	2-6	3.8	20-40	29.5	120/24000	0.51**±0.081
5-6	1	0	1	1	25	25.0	6.0	6.0	25	25.0	10/2000	0.43**±0.061
Controls												
	10	3	4	2							16/20000	0.08±0.008

$ – Calculated as an average of MNd cells in that group. **Highly significant with total control at 1% level (p<0.001; Student's t-test). Non-significant within wrestlers' group.

Table 9. Effect of Warm-Ups on Chromosomal Damage in Wrestlers.

Warm-up (min)	No.	Mobile Phone users	Smokers	Alcohol Intake	Age Range (y)		Daily exercise (hr)		Time since exercising(y)		MNed cells/Total cells scored	% MN$ frequency±SEM
					Range	Mean	Range	Mean	Range	Mean		
Wrestlers												
20-30	7	5	5	5	14-25	21.1	2-6	3	2-6	3.2	73/14000	0.38**±0.081
30-40	5	2	2	4	18-26	21.4	3-4	3.2	2-6	4.2	54/10000	0.31**±0.071
40-50	3	1	2	2	18-28	23.0	2-4	3.3	4-6	5.0	36/6000	0.43**±0.066
Controls												
	10				16-28	22.5					16/20000	0.07±0.009

$ – Calculated as an average of MNd cells in that group. **Highly significant with control group at 1% level p<0.001;Student's t-test). Non-significant within wrestlers' group

Table 10. Effect Of Height on Chromosomal Damage in Wrestlers.

Height (cm)	No.	Mobile Phone users	Smoker	Alcohol Intake	Age Range (y)		Daily exercise (min)		Time since exercising (y)		Warm-up (min)		MNed cells/Total cells scored	% MN$ frequency±SEM
					Range	Mean	Range	Mean	Range	Mean	Range	Mean		
Wrestlers														
160-170	5	2	2	3	18-28	22.6	2-4	3.4	2-6	4.2	30-40	37	59/10000	0.48**±0.069
170-180	4	3	2	3	14-23	18.75	2-4	3.2	2-3	2.2	20-25	21.2	41/8000	0.52**[b]±0.081
180-190	6	3	5	5	19-25	22.6	3-6	3.8	3-6	4.8	20-35	28.3	63/12000	0.42*[c]±-0.068
Control														
160-170	6	2	3	2	16-28	22.5							10/12000	0.08±0.009
170-180	2	1	1	0	17-22	19.5							3/4000	0.06±0.008
180-190	2	0	0	0	18-23	20.5							3/4000	0.05±0.007

$ – Calculated as an average of MNd cells in that group, *Significant from parallel controls at 5% level (p<0.05;Student's t-test) and **highly significant within groups at 1% level p<0.001;Student's t-test) except [b,c]

Table 11. Effect of Weight on Chromosomal Damage in Wrestlers

Weight (kg)	No.	Mobile Phone users	Smoker	Alcohol Intake	Age Range (y)		Daily exercise (min)		Time since exercising (y)		Warm-up (min)		MNed cells/Total cells scored	% MN$ frequency±SEM
					Range	Mean	Range	Mean	Range	Mean	Range	Mean		
Wrestlers														
60-70	4	2	4	4	19-28	23.0	3-4	3.5	4-5	4.7	25-40	32.5	42/8000	0.31±0.078
70-80	5	2	1	4	18-26	22.2	2-4	3.2	2-6	3.4	20-35	29.0	53/10000	0.41±0.086
80-90	3	1	3	2	14-25	20.6	2-6	3.6	2-6	4.0	20-40	28.3	33/6000	0.38±0.075
90-100	3	3	1	1	16-25	19.6	4-4	4	2-6	3.6	20-40	26.6	35/6000	0.41*±0.067
Control														
60-70	3	1	1	1	18-23	21.0							3/6000	0.05±0.007
70-80	2	0	1	0	19-20	19.5							4/4000	0.08±0.001
80-90	4	2	1	1	16-28	21.5							7/8000	0.07±0.009
90-100	1	0	1	0	27	27.0							2/2000	0.05±0.010

$ – Calculated as an average of MNd cells in that group, *Significant from parallel control at 5% level (Student's t-test). Non-significant within and between other groups.

The 2x2 contingency Chi-square (χ^2) test was performed to find out if the control group matched the sample group with respect to demographic, dietary and life style features (Table 3). The groups did not differ and hence matched. Multiple regression analysis was performed to assess the possible relationship of various independent variables which could be confounding factors i.e. age, weight, alcohol consumption, use of mobile phone, dietary pattern (non-vegetarian) in physically active and control individuals for micronuclei induction (dependent variable). The calculated correlation coefficient 'r' and probability 'p' values revealed that daily exercise duration and years of exercising contributed to chromosomal damage (Table 4). The analysis of variance (ANOVA) revealed that significant increase in MN induction was observed for daily exercise time, time-since-exercising, mobile phone usage and for warming-up (Table 5).

The Student's t-test was performed to analyse whether age, weight, height, time-since-exercising, daily exercise time, warm-up time exhibited genetic damage. The distribution of percentage frequencies of MNd cells in various age groups of both wrestlers and control group is presented in Table 6. The mean time of exercising of the wrestlers is 5-6 years. The MN frequency in the youngest age range was between 0.57 to 0.07 in the wrestlers with the mean time of exercising of 3.4 years while it was highest (0.53 to 0.10) in the 25-30 years interval with a mean time of exercising of 4.5 years. Significantly elevated frequency of MNd cells was observed between the damage in wrestlers' and parallel controls but this was non-significant within wrestlers' group. For effect of time-of-exercising (Table 7), daily duration (Table 8) and warm-up (Table 9) on chromosomal damage highly significant differences were observed with total control at 1% level but none within the wrestlers' group. Significant differences from parallel controls were also observed for height (Table 10) but not for weight (Table 11) for which significance from parallel control was seen in the most heavy category.

Discussion

Endurance exercise elicits a 10-20 folds increase in whole body oxygen (O_2) consumption which at the level of the skeletal muscle increases 100-200 folds. This increase in O_2 utilization may result in the production of reactive oxygen species (ROS) at rates that exceed the body's capacity to detoxify them (Alessio, 1993). Left unchecked, these ROS may cause protein, lipid, and/or DNA damage. Numerous studies have shown that excessive exercise can result in oxygen radical-mediated injury and various biochemical mechanisms of free-radical generation after strenuous exercise have been identified (*Hartmann et al., 1998*). Besides adverse effects on muscle tissue, exhaustive exercise is also capable of causing temporary immunomodulations such as changes in the populations and/or in the activities of immunocompetent cells. Rather, heavy exertion in contrast to moderate exercise has adverse effects on the immune system as well as on DNA damage leading to the formation of micronuclei which can lead to cancer (*Umegaki et al., 1998*).

The observations from the present study also indicate the genetic damaging effect from wrestling. In the literature available, various studies have also reported damage to the genetic material after exhaustive exercises. Sporting activities like treadmill running (*Niess et al., 1996*) and other endurance exercises also resulted in DNA damage (*Mastaloudis et al., 2004*). Exercise-induced DNA damage also has been reported in recreationally active individuals (*Hartmann et al., 1995; Mars et al., 1998; Niess et al., 1998*), as well as in trained (*Niess et al., 1996*) and untrained athletes (*Niess et al., 1996; Schiffl et al., 1997; Hartmann et al., 1998; Tsai et al., 2001*).

In the light of results of the present study and the literature reviewed, there is clear evidence that strenuous exercise for strength training (wrestling) can lead to chromosomal damage. Individuals training for such activities vignettes cautions in view of the consequences like cancer and disease resulting from genetic damage.

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Efficacy of Neural Mobilisation in Sciatica

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Abstract

The study was conducted on 30 patients, between age group of 40-65 years who were diagnosed cases of radiating low back pain. Subjects were randomly allocated to either group A or B. The patients of group A (n = 15) were treated with neural mobilization along with conventional treatment whereas group B (n = 15) was administered only conventional treatment. ROM and pain were assessed using goniometer and Visual Analog Scale (VAS). Neural mobilization along with conventional treatment was found to be more effective in relieving low back pain (t = 7.643) as well as improving the range of SLR (t = 5.848) than conventional treatment alone.

Key Words: Neural Mobilization, Low Back Pain, ROM, VAS

Introduction

Sciatica is a symptom not a diagnosis. It is a non-specific term commonly used to describe symptoms of pain radiating downward from the buttock over the posterior or lateral side of the lower limb. It is usually assumed to be caused by compression of nerve. Due to the dynamics of the human spine, lumbar disc syndrome and accompanying complaints of sciatica are long standing afflictions of our species (*Ionnis Karampelas et al, 2004*). It was not until 1943, with land mark publication of *Mixter and Barr* that the herniated lumbar disc was shown to be a major cause of sciatica *(Ionnis Karampelas et al 2004)*. At some time, up to 40 percent of people experience sciatic pain, which occurs, when sciatic nerve is trapped or inflamed (*Harvey Simon, 2003*). Prevalence of sciatic symptoms did not differ between males and females (*Kelsey & Ostfeld, 1975*). It was 5.1% for men and 3.7% for women aged 30 years or over (*Heliövaara et al., 1987* and *AHCPR, 1994*). It is occupation related also (*Magora, 1973, Videman Battie, 1999*). Traditional exercise therapy program for sciatica primarily focuses on pain relief. *Butler* (*1991*) recommends that neural mobilization be viewed as another form of manual therapy similar to joint mobilization. In order to pay heed to it manual methods should be used in order to restore the mechanical function of impaired neural tissue (intra-and extra neural impairment) in the lumbar-pelvic-lower limb complex. The focus of this study is to see the effectiveness of neural mobilization on individuals with sciatica and to judge its superiority over the conventional treatment.

Materials and Methods

Once the subjects registered themselves in the Out Patient Department with the complaint of radiating low back pain, they were assessed according to format given by *Andersson & Deyo (1996)*. Differential diagnosis with other back conditions mimicking sciatica was established. If the subjects were found to have sciatica, all inclusion and exclusion criteria were checked. The subjects were included in the study if all the inclusion criteria were met and no exclusion criteria were found. 30 subjects were selected between the age group 40 to 65 years, of which 14 were males and 16 were female, of these 20 had symptoms on right side and 10 had on left side. The subjects were told all about intervention and procedural details to be followed in the study and thereafter consent was obtained.

Range of motion was measured using goniometer. A Visual Analog Scale was used for assessing the pain. Patients were conveniently allocated either to group A or to group B

Group A (n=15) Experimental Group

- Sciatic Nerve Mobilization
- Traction
- TENS
- MHP

Group B (n=15) Control Group

- Traction
- TENS
- MHP

Before starting the intervention all the patients were checked for range of motion of SLR at the hip and pain with the help of standard goniometer and Visual Analogue Scale respectively. The control group (Group B) participated in a standard rehabilitation program or conventional physical therapy treatment (*Vroomen et al, 2000*) for the disease which included MHP for 10 min, traction for 10 min (intermittent) with 1/3 of body weight with the patient in supine and hip and knee flexed to 90^0. This was followed by High TENS for 10 min. The experimental group (Group A) participated in a standard rehabilitation program supplemented with neural mobilization program for sciatic nerve.

Neural mobilization was given for approximately 10 minutes per session including 30 sec hold and 1 min rest. The straight leg raise was done for inducing longitudinal tension as the sciatic nerve runs posterior to hip and knee joints.The leg was lifted upward, as a solid lever, while maintaining extension at the knee. To induce dural motion through the sciatic nerve, the leg was raised past 35 degrees in order to take up slack in the nerve. Since the sciatic nerve is completely stretched at 70 degrees, pain beyond that point is usually of hip, sacroiliac, or lumbar spine origin *(David, 1997)*. The unilateral straight leg raise causes traction on the sciatic nerve, lumbosacral nerve roots, and dura mater. Adverse neural tension produces symptoms from the low back area extending into the sciatic nerve distribution of the affected lower limb.

To introduce additional traction (i.e., sensitization) into the proximal aspect of the sciatic nerve, hip adduction was added to the straight leg raise. The average total treatment time was approximately 30-40 minutes per session and the whole treatment was given for 9 sessions. Pain free ROM at hip and VAS was recorded at the end of every 3^{rd}, 6^{th} and 9^{th} sessions. The patients were instructed not to do any type of exercise at home or take any medications.

Data was analyzed using the SPSS version 14 for Microsoft Windows. Independent t-test was performed to compare the ROM and pain on VAS scale between groups A & B at 0, 3^{rd}, 6^{th} and 9^{th} sessions. Paired t test was also performed to compare improvement on 0-3^{rd}, 3^{rd}-6^{th}, 6^{th}-9^{th} and 0-9^{th} sessions within the two groups. The significance (Probability-P) was selected as 0.05.

Results

Fifteen subjects were taken in each group A and B with the mean age of 56.1 and 58.3 years respectively (Table 1).

Table 1: Subject information

Serial No.	Group	N	Age, yrs (Mean ± S.D.)
1	A	15	56.1 ± 4.95
2	B	15	58.3 ± 4.37

At zero session the mean of ROM of group A was 39.67 and that of group B was 42.33. When comparison of mean ROM was done between Group A and Group B at zero session the t value was found to be 0.794 which was insignificant. Thus there was no disparity in ROM at the starting of the treatment session between the two groups (Table 2).

Table 2: Comparison of mean values of ROM between group A and group B

S. No	Group	N	ROM Mean ± SD S 0	S 3	S 6	S 9
1	A	15	39.67 ±7.90	53.00 ±6.49	71.00 ±7.37	86.33 ±6.67
2	B	15	42.33 ±10.33	50.00 ±11.80	59.33 ±11.16	67.33 ±10.67
3	T Value		0.79	0 .863	3.38	5.85

S Stands for Seesion Number

At the end of 3rd session mean of ROM of group A was 53.00 and that of group B was 50.00, the difference in the means was insignificant. At the end of 6th session mean of ROM of group A was 71.00 and that of group B was 59.33, the t value was 3.38 and was significant. At the end of 9th session mean of ROM of group A was 86.33 and that of group B was 67.33 the t value was 5.85 and was significant (Table 2).

Similarly the reduction in pain was noted through VAS score and was evaluated using independent t test. At zero session the mean of VAS of group A was 7.4 and that of group B was 7.13 and the t value was found to be 0 .587 which was insignificant (table 3).

Table No 3: Comparison of mean of VAS score between group A and group B

S. No	Group	N	VAS Mean ± SD S 0	S 3	S 6	S 9
1	A	15	7.40 ±1.24	5.27 ±1.22	3.47 ±0.99	1.67 ±0.98
2	B	15	7.13 ±1.25	6.20 ±1.42	5.53 ±1.13	4.60 ±1.12
3	T Value		0 .59	1.926	5.34	7.64

S Stands for Seesion Number

At the end of 3rd session the mean±SD of VAS of group A was 5.27±1.22 and that of group B was 6.20±1.42 and the t value was found to be 1.926 which was insignificant. At the end of 6th session the mean±SD of VAS of group A was 3.47±0.99 and that of group B was 5.53±1.13 and the t value was found to be 5.34 which was significant. Similarly at the end of 6th session the mean±SD of VAS of group A was 1.67±0.98 and that of group B was 4.60±1.12 and the t value was found to be 7.64 which was significant. Thus ROM and VAS showed significant results only by the end of 6th and 9th sessions, whereas the results at the end of 3rd session were insignificant (table 3).

Paired T test was done to compare the improvement between 0-3rd, 3rd-6th, 6th-9th and 0-9th sessions. The mean difference of ROM of group A between 0 to 3rd session was 13.33±4.87 whereas that of group B was 7.67±4.17 and their t values were 4.82 and 4.32 respectively. Thus group A showed more significant improvement than group B from 0 to 3rd session. Similarly between 3rd and 6th session the mean difference of group A was 18.00±2.50 whereas that of group B was 9.33±4.58 and the t values were 5.28 and 4.47 respectively. Between 6th to 9th sessions the mean difference of group A was 15.33±4.42 and that of group B was 8.00±4.14. The t values were 5.01 and 4.39 respectively. Between 0 and 9th session the mean difference of group A was 46.67±4.49 and of group B was 25.00±8.45. The t values were 5.33 and 4.89 respectively (table 4)

Table No 4: Comparison of Mean Difference of ROM within Group A and B

S.No	Session	Group	Mean ± SD	T Value
1	0-3	A	13.33 ± 4.87	4.82
		B	7.67 ± 4.17	4.32
2	3-6	A	18.00 ± 2.50	5.28
		B	9.33 ± 4.58	4.47
3	6-9	A	15.33 ± 4.42	5.01
		B	8.00 ± 4.14	4.39
4	0-9	A	46.67 ± 4.49	5.33
		B	25.00 ± 8.45	4.89

Table No 5: Comparison of Mean Difference of VAS within Group A and B

S.No	Session	Group	Mean ± SD	T Value
1	0-3	A	2.13 ± 0.35	5.25
		B	0.93 ± 0.70	3.75
2	3-6	A	1.80 ± 0.56	4.96
		B	0.67 ± 0.82	0.76
3	6-9	A	1.80 ± 0.41	5.14
		B	0.67 ± 1.23	1.98
4	0-9	A	5.73 ± 0.88	5.27
		B	2.27 ± 1.58	3.9

Comparison of improvement in VAS score was calculated similarly using the paired t test. The mean difference of VAS for group A between 0 to 3rd session was 2.13±0.35 and that of group B was 0.93±0.70, their t values were 5.25 and 3.75 respectively. Thus group A demonstrated more significant improvement than group B. Similarly between 3rd and 6th sessions the mean difference of group A was 1.80±0.56 whereas that of group B was 0.67±0.82 and the t values were 4.96 and 0.76 respectively. Between 6th and 9th sessions the mean difference of group A was 1.80±0.41 whereas that of group B was 0.67±1.23 and the t values were 5.14 and 1.98 respectively. Between 0 and 9th session the mean difference of group A was 5.73±0.88 and of group B was 2.27±1.58. The t values were 5.27 and 3.9 respectively (table 5).

Discussion

The result of this study shows that neural mobilization technique is effective in increasing range of motion at hip and decreasing pain thus reducing the symptoms of sciatica. The mean value of group A where neural mobilization was given shows more significant increase as compared to group B. When the comparison of means of ROM and VAS was done between group A and B by the end of 3rd session there was no significant increase in the ROM (t=0.863) or decrease in the VAS (t=1.926) scores. Thus it is concluded that the effectiveness of neural mobilization was observed only by the end of 6th session for ROM (t=3.379), as well as pain (t= 5.339). By the end of 9th session again there was a significant increase in ROM (t= 5.84) and decrease in VAS score (t= 7.634). Thus neural mobilization technique given to group A proved more effective than the conventional treatment for sciatica administered to group B.

Effectivity of neural mobilization is thought to be due to neural "flossing" effect, that is, its ability to restore normal mobility and length relationship, and consequently, blood flow and axonal transport dynamics in compromised neural tissue. Neural mobilization is very effective in breaking up the adhesions and bringing about mobility. The results of this study also depict the same. The conventional treatment effectively reduces pain and increases ROM at the joint but is unable to eliminate the root cause of the problem. According to *Carey et al (1995),* it helps in providing symptomatic relief only.

Limitations

- Lesser number of subjects
- No group had similar patients with same degree of involvement
- Age variation from 40-50 years
- Patient's built was variable
- Proper strengthening program was not followed after neural mobilization sessions due to lack of time

Clinical Implication

This study provides some evidence for use of Neural Mobilisation as an adjunct to conventional exercise therapy regime in Sciatica. This study suggests that Neural Mobilisation is effective in the treatment of Sciatica.

This study provides preliminary evidence that neural mobilisation is effective in the treatment of Sciatica.

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A Comparative Study of Motor Development Patterns of Trained and Untrained Indian Girls

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Abstract

The primary purpose of the study was to compare the motor development patterns of trained and untrained girls of 10-16 years of age. The present investigation was carried out on 752 trained girls and 957 untrained girls from different games and sports (trained) and from different part of India (untrained) falling in the age range of 10-16 years. Six components of motor development namely Explosive Leg Strength, Abdominal Strength, Trunk Flexibility, Speed, Agility and Endurance were assessed using standard techniques. The results in general indicate a trend of improvement in all the motor performance components of trained and untrained girls belonging to 10-16 years of age. Further, the results also indicate that trained girls are superior to untrained girls on selected motor performance at every age level. The trend of improvement is rapid upto 13 or 14 years of age, after that the trend seems to be slow or stagnated or deteriorated.

Key Words: Motor development pattern, Strength, Flexibility, Speed, Agility Endurance, Trained, Untrained.

Introduction

The keen struggle among the nations of the world to win more and more medals in competitions has led to profound changes in the training and competition system. Sports Coaches, Teachers of Physical Education, Sports Scientists, etc. all over the world are in search of better ways and means for sporting talent and for systematic and scientific training to them. It is an established fact that high performances are possible only after a regular and systematic training of about 8-10 years. *Singh (1991)* suggested that the systematic training must begin in childhood itself. Therefore, the science of growth and development has become an important aspect for performance sports. It is being studied from difficult aspects to utilize the children and youth to achieve world level performance when they grow up.

The growth and development of motor abilities and their accurate assessment definitely helps in identifying the talented children and also in formulating scientific training programme for the children and youth of various ages, so that it leads to the achievement of high performance at the right age and also to minimize any negative effect of training on them.

India, unlike the countries of Europe and America is a vast country inhabited by people of different racial origins, and living under vastly different geographical, economical and social-cultural conditions. This feature, therefore, make the study of motor development pattern of Indian children more important.

Espenschade (1968) observed that the general motor ability of girls did not improve after the age of 14, whereas, body shows steady improvement up to 18 year of age. *Morehouse and Miller (1968)* concluded that the athletic ability in girls reached a maximum at the age of 13 or 14 years then tended to decline up to 18 years of age. *Berry (1974)* concluded in his study that the power performance of girls improves up to the 13 years. *Anyanwu*

(1977) and Bennett et al. (1983), concluded in their studies that trained girls possess better fitness levels at every age in comparison to untrained girls. Therefore, there is a need to study the motor development patterns of trained and untrained Indian girls of 10-16 years of age, so that their rate of development is properly utilized to improve sports performance in different games and sports.

Materials and Methods

The study has been conducted on a cross sectional sample of One Thousand Seven Hundred & Nine trained and untrained girls of 10-16 years. The total sample includes 752 trained and 957 untrained girls. The trained girls for the study were selected from various sports promotion schemes of Sports Authority of India, Sports Schools, Sports Hostels, Sports Wing, Regional and District Coaching Centres, Sub-junior and Junior National Coaching Camps. Whereas, the untrained girls were selected randomly from the various schools those who have not been undergoing any systematic and regular sports training.

Various components of motor development pattern were measured using standard techniques as mentioned in table-1.

Table 1: Measured motor components

Motor Development Components	TEST USED
Explosive Strength – Leg	Standing Broad Jump
Abdominal Strength	Bent Knee Sit-ups
Trunk Flexibility	Forward Bend and Reach
Speed	40 Meters Dash
Agility	6x10 Meters Shuttle Run
Endurance	800 Meters Run/walk

Results

Descriptive Statistics and Comparative Statistics were use to analyse the data in relation to motor development pattern of trained & untrained Indian girls. The mean and standard deviation of each individual age group for trained girls have been presented in Table-2. Results and analysis pertaining to each selected motor performance components have been presented separately.

Explosive Strength–Legs

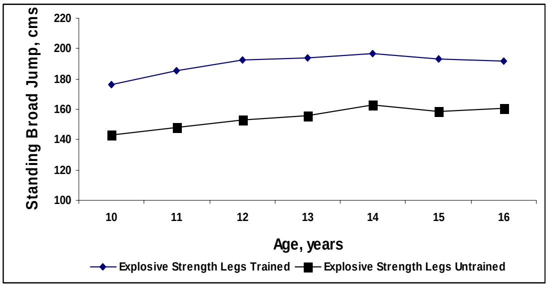

Figure 1: The Pattern of abdominal strenth development in untrained and trained Indian girls

An examination of Leg-strength pattern clearly shows that the trained girl's performance improves progressively up to 14 years of age. From 14 to 16 there is deterioration in the performance of leg strength. This deterioration is not in accordance with the general agreement. However, this might be because of the fact that the girls seems to reach their peaks in performance around 12 or 13 years. This is also the age of Menarche for many girls. The another factor which the investigators feels is, that in this age group of growth and development, enough stress to develop explosive leg strength might not have been given in their day-to-day training programme.

The similar trend is also seen in case of untrained girls. It might be attributed to the fact that there is a continuous increase in height, body weight and different circumferences taking place and energy is diverted towards the process of growth and development. The untrained girls due to the social and cultural factors tend to avoid physical activities and become physically more inactive then the early age.

The trend girls of all ages were superior in leg strength then the untrained girls. Such a pattern of development has been already reported by *Espenschade (1968); Morehouse and Miller (1968) and Malina and Rarick (1973).*

Table 2: **Means and Standard Deviations of Selected Motor Development Patterns of Trained and Untrained Indian Girls**

M.D.C. / AGE			10	11	12	13	14	15	16
No. of Subjects	**T**	**N**	79	97	93	92	95	104	192
	UT	**N**	154	148	161	153	113	115	113
Explosive Strength - Legs	**T**	**Mean**	176.46	185.07	192.75	193.65	196.72	193.03	191.47
		± SD	±7.07	±9.33	±10.99	±10.33	±13.60	±10.23	±9.27
	UT	**Mean**	142.81	147.91	152.96	155.75	162.93	158.41	160.41
		± SD	±16.54	±14.69	±16.85	±16.72	±11.57	±10.29	±11.74
Abdominal Strength	**T**	**Mean**	36.47	37.85	40.67	42.57	42.89	42.42	42.05
		± SD	±6.12	±6.21	±5.97	±6.73	±6.11	±7.32	±6.78
	UT	**Mean**	13.95	16.57	17.86	19.56	20.81	20.01	21.77
		± SD	±3.56	±4.15	±4.42	±4.71	±4.32	±4.87	±4.27
Trunk Flexibility	**T**	**Mean**	13.44	14.12	13.92	15.21	14.39	13.17	12.67
		± SD	±2.96	±3.63	±4.16	±4.54	±3.96	±4.01	±4.16
	UT	**Mean**	5.57	5.53	5.89	5.71	5.82	4.94	4.89
		± SD	±3.39	±3.27	±3.29	±3.82	±3.85	±3.61	±3.21
Speed	**T**	**Mean**	7.04	6.78	6.63	6.64	6.61	6.61	6.67
		± SD	±0.31	±0.26	±0.34	±0.30	±0.28	±0.24	±0.26
	UT	**Mean**	8.06	7.89	7.78	7.69	7.66	7.64	7.51
		± SD	±0.42	±0.45	±0.46	±0.42	±0.49	±0.44	±0.40
Agility	**T**	**Mean**	17.02	16.71	16.61	16.57	16.54	16.52	16.60
		± SD	±0.30	±0.41	±0.42	±0.40	±0.43	±0.41	±0.37
	UT	**Mean**	18.78	18.60	18.40	18.22	18.08	18.70	18.70
		± SD	±0.80	±0.78	±0.90	±0.83	±0.68	±0.84	±0.81
Endurance	**T**	**Mean**	198.63	190.48	183.84	184.96	182.38	186.33	185.69
		± SD	±9.80	±12.80	±13.79	±14.91	±14.48	±15.70	±18.21
	UT	**Mean**	256.83	255.78	254.01	251.33	256.08	248.33	243.69
		± SD	±17.41	±23.81	±27.95	±32.04	±28.18	±19.65	±17.13

UT stands for untrained girls, T stands for trained girls & S.D. for Standard Deviation

Abdominal Strength

An examination of table-2 & fig 2, clearly depict that the abdominal strength of trained girls of 10-16 years of age improves with age. Abdominal Strength in trained girls improves steadily up to 14 years and after that the rate of improvement either decreases or stagnates. It is highly training dependent ability, the reason for the deterioration or stagnation in the performance might be less stress on abdominal strength training being given to the trained girls in their day-to-day training programme.

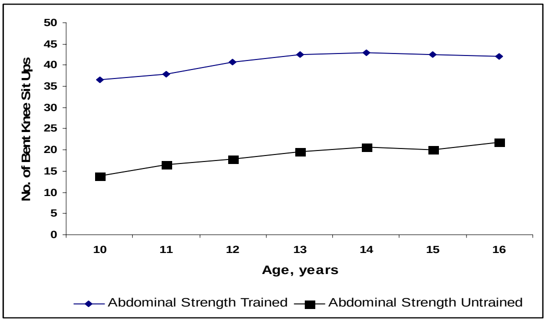

Figure 2: The Pattern of abdominal strenth development in untrained and trained Indian girls

The abdominal strength of untrained girls also improves progressively with age. The rate of increase is not quite visible at the age of 14 and 15 years. It is observed from the figure 2 as well as the results that the trained girls show remarkable dominance over the untrained girls in all the age groups. For a good performance in abdominal strength the individual should have sound abdominal muscles. Apart from these facts abdominal muscles grow till adolescence. *Stemmler and Pavok (1971)* have pointed out that abdominal muscles are normally less used muscles; hence, with adequate training their strength performance improves very slowly. However, the increase in the lean body mass and anaerobic capacity of muscle fiber may contribute towards the improvement in abdominal muscle strength *(Fox et al., 1989).*

Trunk Flexibility

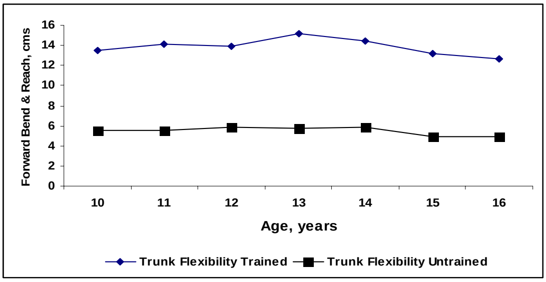

Figure 3: The Pattern of trunk flexibilty development in untrained and trained Indian girls

An examination of table-2 & fig 3, clearly shows that the trunk flexibility of trained girls of 10 to 16 years of age improves progressively with age up to 13 years, with some minor fluctuation in between. From 14-16 years there is a drop in the performance of trunk flexibility of trained girls. The investigator presumes that the reason for this might be that the flexibility training being given to the trained girls in their day to day routine might have been less stressed. Non uniform training age of the subjects in different age groups might have influenced the result in the trunk flexibility performance of the trained girls.

It is evident that there is no uniformity in the flexibility scores of untrained girls. The performance from 10-14 years of age does not tend to show any clear cut improvement, there are a lot of ups and downs in the performance score. It seems that the performance in trunk flexibility of untrained girls leveled off at 14 years of age. From above analysis it s clear that the trunk flexibility of untrained girls increases slightly with age upto 14 years. Though this is an established fact that flexibility is a highly training dependent ability, children in early ages are more supple and flexible in comparison with adolescents *(Singh, 1991).* However, flexibility tends to decrease due to the fact that with advancement of age anatomical, physiological and chemical changes take place in the body and the longitudinal growth of bones, muscles, ligaments, tendons and joints restrict/limit the development of flexibility, if not exercised regularly.

The trained girls clearly dominated over the untrained girls in all the age groups. Results show that there are fluctuations and variations in the rate of development of trunk flexibility of both the groups. The trained girls with continuous participation in physical activities develop a good amount of flexibility and maintain it according to the intensity, duration and quality of activities they perform. According to *Sermeev (1966),* flexibility can be developed at any age given the appropriate training. There is evidence that even adults benefit from flexibility training. The findings of the present study of trunk flexibility development of untrained and trained girls are in consonance with the findings reported by *Leard (1984).*

Speed

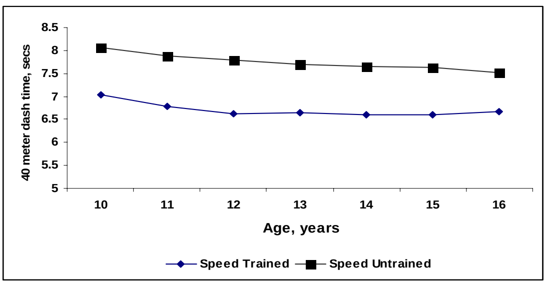

Figure 4: The Pattern of speed development in untrained and trained Indian girls

An examination of table-2 also shows that the speed performance of trained girls of 10-16 years of age improves progressively with age upto 14 years with negligible drop in between. From 14-16 years the speed performance seems to be stagnated and then deteriorates. Speed of untrained girls improves with age from 10-16 years. The pattern of development of the speed performance in untrained girls is as expected. Speed abilities improve at a better pace before puberty. With onset of puberty, speed abilities tend to be negatively affected. Another factor which might have contributed to this trend is the rapid development in strength with onset of puberty. Strength, as well known, is a strong determining factor for speed performance. Rapid increase in leg length (Body height) in 11-12 year old girls might also be one of the contributory factors. Pubescent and adolescent girls, due to social and cultural factors, tend to avoid vigorous physical activity and become physically more inactive. *Singh (1991)* and *Morehouse and Miller (1968)* have reported similar findings in their studies.

It is apparent from figure 4 that the trained girls have dominance over the untrained girls in all the age groups. The maximum development spurt in speed performance was observed between 10-11 years in both trained girls (0.26 Sec.) and untrained girls (0.17 Sec.). Speed is a very complex conditional ability, which depends to a considerable extent on the central nervous system, power, stretch ability, elasticity and recovery level of muscles. Despite less trainability and specificity, it has high importance in games and sports. The better performance of trained girls in all the ages is thought to be due to their regular and systematic physical training. Therefore, increased muscular strength and explosive power produces an increase in speed performance *(Singh, 1991).*

Agility

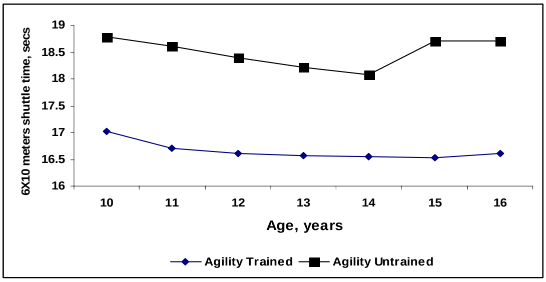

Figure 5: The Pattern of speed development in untrained and trained Indian girls

Table-2 also shows that the agility performance of trained girls of 10-16 years of age improves progressively with age upto 15 years; from 15-16 years there is a slight drop in the performance. With onset of puberty or with advancement of age the rate of yearly development markedly slows down, or rather, it shows a very clear stagnation in the agility performance, which does not seem to be in general agreement of the studies reported. Performance in agility run (Shuttle Run) depends upon factors like speed of movement, acceleration ability, stride length and the ability to change direction quickly in the shortest possible time. The investigator feels that the stagnation observed in case of trained girls in agility performance might be due to two causes. Firstly, enough or proper weightage to this type of agility training may not have been given during these phases in their routine training. Secondly, the specificity of the movement structure of different games and sports might have contributed partly in the stagnation in the agility performance.

Agility of untrained girls improves with age from 10-14 years whereafter a significant deterioration and stagnation in the agility of untrained girls is noticed. This pattern of development of agility in untrained girls is in accordance with the normal trend. Agility improves at a better pace during childhood and early stage of puberty. During pubescence, girls tend to put on more weight and length of the different body parts also increases which contributes negatively in movement execution. Apart from these factors the social and cultural factors also play a great role.

Figure-5 shows that trained girls have dominance over the untrained girls in agility performance in all the age groups. The maximum rate of agility performance development was observed between 11-12 years (0.20 Sec.) in case of untrained girls while in trained girls between 10-11 years (0.31 Sec.) of age. The better performance of trained girls in all the age group is thought to be due to the fact that coordinative ability (agility) is primarily dependent on neuro-muscular coordination. Improvement of these abilities is only possible through regular and systematic physical training and through participation in multidimensional physical activities of different games and sports.

Endurance

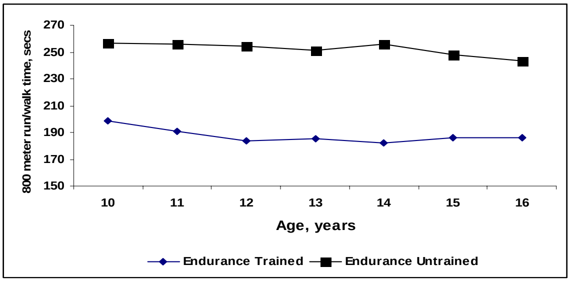

Figure 6: The Pattern of endurance development in untrained and trained Indian girls

An examination of table-2 also shows that the endurance of trained girls of 10-16 years of age improves progressively with age upto 14 yeas with a minor drop between 12-13 years of age. From 14-16 years there is a sharp drop in the endurance performance of trained girls. As already investigated, the endurance performance, apart from other factors depends mainly upon physiological factors like heart rate, stroke volume, cardiac output, VO_2max, Hemoglobin concentration and Arterio-venous oxygen differences, etc. The phase of deterioration in trained girls might be due to the fact that enough weightage/stress to develop cardio-respiratory endurance training might not have been given in their sports training programme during this phase.

It is also observed from the table-2 that the endurance performance of untrained girls improves with age upto 14 years, from 14-15 years there is a slight decrease in the endurance performance. But from 15-16 years the performance seems to be increasing. The changes in endurance performance were progressive in nature and were in general line of growth and motor development, because as the age advances the development in heart and respiratory system functions positively affect Cardio-respiratory endurance. As cardio-vascular endurance is a gradual process of development, therefore no significant changes from year to year performance were observed in the untrained girls.

From figure-6, it is apparent that the trained girls have dominance over the untrained girls in endurance performance in all the age groups. As depicted in figure-6, untrained and trained girls performance improves upto 14 years of age and then there is a drop in performance. The maximum development of endurance was observed between 10-11 years (8.15 Sec.) in trained girls while in untrained girls between 13-14 years (5.25 Sec.). The improvement of cardio-vascular endurance in the trained girls over untrained girls might be attributed to the total improvement in the muscles to undertake training load for longer period. The result of the study of endurance development is in consonance with the studies carried out by *Eriksson and Thoren (1978).*

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Physical Fitness and Growth Performance of Menstruating Girls Belonging To Upper and Lower Socio-economic Status

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Abstract

The present investigation has been conducted on 327 subjects ranging in age from 11-15 years attending various schools of Patiala (Punjab) to evaluate the effect of socio-economic status on the physical fitness and growth performance of menstruating girls. Body weight, height, five skinfolds (biceps, triceps, subscapular, suprailiac and calf) and five physical fitness tests of AAHPER Youth Fitness test bettery were measured. The information of their socio-economic status including their father's education, profession and the monthly income was collected and the subjects were divided into upper and lower socio-economic status (SES). A total of 224 subjects were included for upper and 103 were for lower socio-economic group. The retrospective method was used for collecting the information regarding their menarcheal status. Upper SES girls run significantly faster than the lower SES girls in shuttle run and 50m dash. The upper socio-economic girls perform better and jump longer distance in standing broad jump than the lower SES group. Only in case of flexed arm hang the lower SES girls could perform this feat for a significantly longer duration than the upper SES counterparts. The upper SES girls are significantly taller and heavier than their lower SES counterparts. The upper SES girls have shown significantly greater thickness of (biceps, triceps, subscapular, suprailiac and calf) skinfolds. The upper SES girls have significantly greater amount of body fat than their lower SES counterparts who in turn have significantly greater amount of LBM. The BMI is significantly greater in upper SES girls than lower SES girls.

Key Words: Socio-economic Status, Body Fat, Physical Fitness, Body Mass Index

Introduction

Physical fitness is generally considered to encompass three components viz. strength, stamina and flexibility. *World Health Organization (1947)* defines physical fitness as "a state of complete physical, mental and social well being…not merely the absence of disease". The growth performance of children is influenced by a number of factors including the social stratification & family environment. The findings throughout the World have indicated a better growth performance of children belonging to upper social strata *(Bogin & Macvean 1981; Singh et al. 1987; Eveleth & Tanner 1990 and Prista et al. 1997).* The reason for the better growth performance of higher social strata children include better family environment, good and nutritious diet, better hygiene, availability of the recreation and leisure activities. Studies on this aspect reveal that the children from affluent families tend to be heavier and taller in contrast to those from non-affluent families. But during adolescence, girls from lower SES from developed countries tend to be heavier than those belonging to upper SES *(Malina et al. 1985).* This change is reflected through their preferences for slenderness in the girls' belonging to upper SES families. It has also found that the larger families tend to putt pressure on the growth of children.

Similarly the higher social class children generally performed better in physical fitness tests. In a study by *Kaur (1982)* a comparison of physical fitness of public school students versus Govt. school students indicated that the former had better physical fitness. *Mokha et al. (1998) & Eiben et al. (2005)* concluded that the urban girls were slightly taller and heavier than the rural counterparts whereas the running ability was more in rural girls as compared to the urban girls. These differences between urban and rural girls decreased with increasing age. The urban children of both the sexes experienced puberty spurt one year earlier than their rural counterparts. The urban boys and rural girls were having more subcutaneous fat than rural boys and urban girls. The performance in all the strength tests was better in boys. In early childhood the performance of boys and girls were nearly same. Thereafter the performance in boys increased gradually bur in girls however, it increased slower and at a decreasing tempo and became stable at a lower level with their age at menarche. The urban children performed better than their rural counterparts *(Eiben et al. 2005).* It is also revealed by *Mokha et al. (2006)* and *Kaul & Corrunccine (1985)* that the age at menarche was delayed in rural girls as compared to urban girls.

Numerous authors have studied the effect of socioe-conomic factors and urbanization on the physical growth in height and weight and demonstrated that the upper SES children grow favorably than the lower SES class children *(Rona, 1981; Singh et al., 1987; Eveleth & Tanner, 1990; Obeidallah et al., 2001; Singh, 2002; Junqueira Do Lago et al., 2003; Eiben & Mascie- Taylor, 2004 and Walker et al., 2006).* It has universally been found that the children belonging to upper SES grow faster than the lower SES and are taller & heavier also. The effect of urbanization has also indicated a favorable growth of children of urban areas. The present investigation has been conducted to evaluate the effect of socio-economic status on the physical fitness and growth performance of menstruating girls.

Material and Methods

To compare the menstruating girls from upper and lower socio-economic status the present study was conducted on 327 subjects ranging in age from 11-15 years attending various schools of Patiala (Punjab). Body weight, height and skinfolds (biceps, triceps, subscapular, suprailiac and calf) were taken according to the standard technique of *Weiner and Lourie (1969).* Five physical fitness tests according to *AAHPER (1976)* Youth Fitness test bettery were taken to examine the physical fitness of the girls. The information of their socio-economic status including their father's education, profession and the monthly income was collected. The subjects were divided into upper and lower socio-economic status on the basis of modified standard given by *Kuppuswami (1981).* A total of 224 subjects were included for upper and 103 were for lower socio-economic group. The retrospective method was used for collecting the information regarding their menarcheal status. The percentage of fat was calculated by using the equation of *Slaughter et al. (1988).*

Results

Table 1: Physical fitness parameters in menstruating girls belonging to upper and lower socio-economic status.

VARIABLES	Upper SES Group		Lower SES Group		DIF	t-test
	Mean	SD	Mean	SD		
Flexed Arm Hang (sec)	8.71	9.95	11.04	9.73	2.33	1.98*
Shuttle Run 10x4 yards (sec)	20.31	3.81	21.27	3.04	0.96	2.25*
Standing Broad Jump (cm)	166.2	58.9	136.9	36.8	29.3	4.80***
50m dash (sec)	14.30	4.57	15.06	4.82	0.76	2.47*
600m run/walk (sec)	365.4	57.4	369.9	60.1	4.5	0.65

* p<0.0 5, *** p <0.001

The various physical fitness parameters of menstruating girls from upper and lower social strata have been shown in table 1. Upper SES girls run significantly faster than the lower SES girls in shuttle run and 50m dash. The upper SES girls perform better and jump longer distance in standing broad jump than the lower SES group. Only in the case of flexed arm hang the lower SES girls could perform this feat for a significantly longer duration than their upper SES counterparts.

Table 2: Anthropometric characteristics of menstruating girls belonging to upper and lower socio-economic status.

VARIABLES	Upper SES Group		Lower SES Group		DIF	t-test
	Mean	SD	Mean	SD		
Weight (kg)	43.62	7.67	40.62	5.71	3.00	3.56***
Height (cm)	152.6	6.18	151.2	5.29	1.4	2.00*
Biceps (mm)	6.99	4.25	4.95	1.94	2.04	4.64***
Triceps (mm)	11.70	5.51	8.51	2.84	3.19	5.55***
Subscapular (mm)	14.08	5.08	12.14	4.31	1.94	3.36**
Suprailiac (mm)	10.72	3.97	8.90	2.82	1.82	4.19***
Calf (mm)	14.29	5.02	12.00	3.58	2.29	4.17***

* p<0.0 5, *** p <0.001

Table 3: Percent fat, %LBM, BMI, absolute fat and absolute LBM in menstruating girls belonging to upper and lower socio-economic status.

VARIABLES	Upper SES Group		Lower SES Group		DIF	t value
	Mean	SD	Mean	SD		
% Fat	22.07	5.38	18.91	4.46	3.16	5.20***
% LBM	77.93	5.38	81.09	4.46	3.16	5.20***
BMI	18.68	2.83	17.69	2.23	0.99	3.10**
Fat, kg	9.89	3.82	7.80	2.70	2.09	5.00***
LBM, kg	33.67	4.58	32.60	3.27	1.07	2.13*

*p<0.0 5, **p <0.01 *** p <0.001

Table 2 shows the mean values of height, weight & five skinfold measurement of menstruating girls belonging to upper and lower SES. The upper SES girls are significantly taller and heavier than their lower SES counterparts. The upper SES girls have shown significantly greater thickness of (biceps, triceps, subscapular, suprailiac and calf) skinfolds.

The upper SES girls have significantly greater amount of body fat than their lower SES counterparts who in turn have significantly greater amount of LBM. The BMI is significantly greater in upper SES girls than lower SES girls (table 3).

Discussion

The present study was conducted to test the hypothesis that the menstruating girls from upper and lower socio-economic status have similar physical fitness and body composition. But the results of this study reject this hypothesis because the girls belonging to upper socio-economic status have greater values of almost all the physical fitness parameters and all the anthropometric measurements. *Bhatnagar et al. (1987) & Kumar (1989)* reported that the girls belonging to upper socio-economic status girls mature earlier as compared to lower socio-economic status girls. They attributed it to better living conditions, nutritional status and medical facilities available to children of upper SES group. The effect of socio-economic conditions was reflected almost equally in all the parameters of growth at most of the ages. The subjects from higher SES were advanced in all the maturity markers. They had more percentage of body fat, LBM, biacromial diameter, hand and calf circumferences. Higher

SES group of children were taller, heavier and found to be ahead in each developmental stage of facial hair, dental age and in secondary sex character age. However the subjects' from lower SES group have more sitting height vis-à-vis stature as compared to their counterparts from upper SES.

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Influence of Yogic Practices and Aerobic Exercises on Serum Protein Level

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Abstract

The purpose of the study was to find out the relative influence of yogic practices and aerobic exercises on serum protein level. Forty five players from Thiru.Vi.Ka. Govt. Arts College, Tiruvarur, were randomly selected as subjects. The subjects were divided equally into three groups namely control group, aerobic exercise group and yogic practices group. The aerobic exercise group and yogic practices group underwent selected aerobic exercises and yogic practices respectively. The experimental period was 12 weeks, six days a week, 40 minutes per day. But the control group was not given any sort of special training. The criterion measure selected for this study was serum protein level and it was tested before and after the experimental period. The initial and final scores of all three groups were obtained. To find out the significant mean differences, the analysis of co-variance statistical technique was employed. Further the scheffe's post-hoc test was used to identify which group has shown better. The training effect of yogic practices and aerobic exercises evidenced significant influence over the serum protein level. When compared, the yogic practices group had better impact than aerobic exercise group.

Key Words: Yoga, Aerobic, Serum Protein

Introduction

Yoga is the oldest known science of self-development. Yogic exercises are confined to minimum motions involved with a low temperature. Further by influencing the automatic nervous system, the yogic exercises ensure better food utilization and improved nourishment besides proper relaxation due to voluntary control of individuals. Aerobic exercise refers to energetic physical activity that requires high levels of oxygen. It involves rhythmical action of the body over a distance or against gravity as occurs in dancing, jogging, running, swimming or certain calisthenics. Performing aerobic exercises directly affect the physiological aspects of the body *(Martha Davis, 1996).*

Protein is an organic compound formed from amino acids. It is a basic food stuff which forms muscle tissue, hormones, enzymes, etc., Proteins are used as auxiliary fuels during muscular work. Some stored amino acids link with fats and form lipoproteins. The proteins are more essentials for the growth and repair of the tissues of the body *(Mariakutikan, 2003).* Players regularly indulge themselves in physical activities to achieve their goal. In order to maintain repair and growth of the tissues, the protein is more essential. Apart from regular diet and ingestion of protein, the yogic practices and aerobic exercises enhance the protein level of the player. Hence the investigator decided to find out the relative influence of yogic practices and aerobic exercises on serum protein level among players at college level.

Materials and Methods

Forty-five male college players from Thiru.Vi.Ka. Govt. Arts College, Tiruvarur, affiliated to Bharathidasan University, Tiruchirappalli, Tamilnadu were randomly selected as subjects for this study. Their age ranged from 18 to 25 years. The selected subjects were divided into three groups namely control group, aerobic exercise group and yogic practices group. The aerobic exercise group underwent Easy run, Interval run, Fartlek run, Steps climbing, Cycling and jumping rope. The yogic practices group underwent Asanas namely Padmasana, Vajrasana, Paschimothasana, Matsyasana, Vakrasana, Yogomudra, Chakkarasana, Ardha Sirasana, Bhujangasana, Salabasana, Sarvangasana, Dhanurasana, Halasana and Savasana. They were also made to perform Pranayama namely Nadi Sudhi, Nadi Shodhana, Sitali and Kapalabhathi as well as meditation which included Breath counting meditation and Mantra meditation. The experimental period was 12 weeks, six days a week – 40 minutes per day where as the control group was not given any sort of special training. The criterion measure – serum protein level was tested before and after experimental period and the initial and final scores of all the three groups were obtained.

To study the outcome between yogic practices group and aerobic exercise group along with control group and to find out the significant mean differences the Analysis of Co-Variance statistical technique was employed. Further, the Scheffe's post-hoc test was computed to find out which group has grown up better. *(Clarke and Clarke, 1972).*

Results

In table 2, the results of One-way ANOVA for both initial and final test scores of serum protein level are presented. From the table it can be seen that the calculated F value of 0.049 for initial test among three groups were insignificant ($P > 0.05$) indicating that the random sampling was successful. The calculated F value of 12.845 for final test among the control, aerobic exercise and yogic practices groups were greater than the table value of 3.222 indicating that it was significant at 0.05 levels ($P < 0.05$). The final F value indicated that there were significant differences in serum protein level among the groups in the final test because of the treatment effect. Since the F value for final test was significant the ANCOVA was computed.

Table - 1: Mean and Standard Deviation for Initial and Final Test Scores of Serum Protein (g/dl)

Group	Initial		Final	
	Mean	S.D.	Mean	S.D.
Control	6.504	0.291	6.251	0.134
Aerobic Exercise	6.505	0.364	6.541	0.371
Yogic Practices	6.471	0.353	6.839	0.387

Table - 2: Results of ANOVA between Control, Aerobic Exercise and Yogic Practices Groups with respect to Serum Protein

Test	Source of Variance	Sum of Squares	D.F.	Mean Square	F - Ratio
Initial	Between Groups	0.011	2	0.005	0.049
	Within Groups	4.793	42	0.114	
Final	Between Groups	2.599	2	1.299	
	Within Groups	4.249	42	0.101	12.845*

*$P < 0.05$ Table F, df (2,42) (0.05) = 3.222

In table 3, the results of the ANCOVA for serum protein level are presented. In analysis of co-variance the final means were adjusted for differences in initial means and the adjusted means of control group, aerobic exercise group and yogic practices group on serum protein levels were tested for significance.

From the table it can be seen that the calculated F value of 20.044 among three groups was gerater than the table value 3.226 indicating that it was significant (P < 0.05) for the degrees of freedom (2,41) at 0.05 level. The calculated F value indicated that there were significant differences in serum protein level among the groups because of the trainging effect of yogic practices and aerobic exercises. Since the F value was significant the scheffe's Post-hoc test was further computed to find out which group has grown up better *(Clarke, 1972).*

Table - 3: Results of ANCOVA between Control, Aerobic Exercise and Yogic Practices Groups with respect to Serum Protein

Source of Variance	Sum of Squares	D.F.	Mean Square	F
Between Groups	2.759	2	1.379	20.044*
Within Groups	2.822	41	0.0656	

* P < 0.05 , Table F, df (2,41) (0.05) = 3.226

Table - 4: Scheffe's Post-hoc Test for Mean Differences Between Groups

Control Group	Aerobic Exercise Group	Yogic Practices Group	Mean Difference	F-Ratio
6.245	6.535		0.29*	10.513*
6.245		6.841	0.596*	44.432*
	6.535	6.841	0.306*	11.720*

*P < 0.05, Confidence interval value (0.05) = 0.236

Table F(0.05) = 6.452

In table 4, the results of scheffe's Post-hoc test are presented. From the table it can be seen that the mean differences between control group and aerobic exercise group was 0.29 (P < 0.05) and the calculated F value was 10.512 (P < 0.05). The mean differences between control group and yogic practices group was 0.596 (P < 0.05) and the calculated F value was 44.432 (P < 0.05). The mean differences between aerobic exercise group and yogic practices group was 0.306 (P < 0.05) and the calculated F value was 11.720 (P < 0.05). From that it can be clearly noticed that the yogic practices group responded to the training with more positive influences on serum protein level when compared with aerobic exercise group and control group. The aerobic exercise group responded better when compared with the control group.

Discussion

From the above findings it can be clearly seen that the level of serum protein has shown that there was an increase of serum protein level of players due to the training effects of both yogic practices and aerobic exercises.

Amino acids combine with one another to form proteins. The quantity of amino acids present at any given moment is the sum total of the absorbed amino acids and those derived from the break down of tissue protein. It is observed that yogic practices and aerobic exercises enhance the protein level in the blood because the players after exercise are in post absorptive state that is the amino acids absorbed by the intestine are taken up by blood to the various tissues for proper utilization. Meanwhile the tissue proteins are broken down in order to give energy but the amino acids liberated by the muscle, during exercise are not used as fuels instead they are stored in blood as protein (Rama Rao, 1998, Udupa, 1996)

Regarding the better improvement of yogic practices group when compared with the aerobic exercise group, yoga is practiced in static manner as well as slow dynamic manner according to its nature. The power of yoga lies in its stillness and hence oxidation of fuel is lesser *(Krishnaraman & Suresh, 2003).*

Conclusion

Within the limitations, the results of the present study permit the following conclusion.

The training effect of aerobic exercises and yogic practices evidenced significant influences over the serum protein level. When the positive influences of the two methods were compared yogic practices had better influence than the aerobic exercise. Hence it can be deduced that the yogic practices and aerobic exercises have enhanced the serum protein level there by improving the vital function of growth and repair of body cells of the players.

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Comparison of Physical Fitness status of Rural and Urban Male Collegiate students in Kurukshetra

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Abstract

The main purpose of the study was to compare the physical fitness level of urban and rural male collegiate students in Kurukshetra. A battery of five tests i.e, Harvard Step Test, Zig Zag run, Sit and reach, Shot Put throw and 50 Meter Sprint- was used to collect the required data. The results indicated that in cardiorespiratory endurance, agility, flexibility, power and speed rural students were significantly different ($p>.05$) from urban students.

Key Words: Physical Fitness, Male collegiate students, Urban, Rural

Introduction

All-round fitness is a key to quality of life. To be able to carry out daily tasks without undue fatigue or to enjoy leisure-time pursuits requires a certain degree of fitness. A physically fit person looks better, feels better and thinks better and so lives better. Likewise, physical fitness is closely associated with good health. *Blair et al (1989)* showed that people with "good" fitness level have less heart disease risk than those with "low" fitness. Compared with inactive, people moderately or vigorously active people are less likely to suffer premature all-cause mortality; cardiovascular diseases (CVD) such as coronary heart disease (CHD), stroke, and high blood pressure; colon cancer; non-insulin dependent diabetes mellitus (NIDDM); and osteoarthritis *(USDHHS, 1996). Plowman (1992)* suggests that muscle fitness is necessary to prevent back-pain. A higher level of physical fitness is associated with a lower risk of developing hypertension, which is related to coronary heart disease *(Marti, 1991).* Furthermore, adequate flexibility and sufficient muscular strength and endurance may reduce risks of low back pain as well as muscular and joint injuries *(Liemohn et al, 1988).* Recent research shows that physical activity is one of the most important factors related to maintaining good health *(Corbin & Pangrazi, 1993; USDHHS, 1996).* Physical activity can help 'control body weight' *(Epstein & Wing, 1980)* and 'reduce risks of cardiovascular diseases' *(Morris et al, 1980).* In July 1992, the American College of Sports Medicine and the Centers for Disease Prevention and Control (CDC), in cooperation with the Presidents Council on Physical Fitness and Sports recommended that a level of physical activity is sufficient for reducing the risk of morbidity and premature mortality from a range of diseases like CVD, NIDDM.

For developing a good level of physical fitness the U.S. Center for Disease Control & Prevention and American College of Sports Medicine (1992) recommends, a minimum of 30-minute of moderate intensity physical work out activities such as walking up stairs (instead of taking the elevator), gardening, raking leaves, dancing, and walking all or part of the way to work over a course of days. Jogging, playing tennis, playing soccer, swimming and cycling are also found beneficial. Another example of lifestyle exercise that can be used to meet CDC/ACSM guidelines is a two-mile walk daily.

Several studies evaluated physical fitness profiles of people in different categories, including college students in United States and European countries. However, relatively little information is available about physical fitness profiles of the Indian collegiate students. Whatever little information that is available on physical fitness is on the Indian collegiate students documented outside Kurukshetra. This situation called for an investigation to determine physical fitness level of urban and rural male students in colleges in Kurukshetra, Haryana state.

Materials and Methods

A total of 100 male college going students of 18-21 years were randomly selected as sample. The sample consisted of 50 urban and 50 rural students drawn from University College Kurukshetra, Bhagwan Parshu Ram College, DAV College Pehowa and IG National College Ladwa. No consideration was shown to subjects' participation or any other characteristics or attributes.

The data were collected with the assistance of coaches and lecturers in Physical Education of various colleges. The tests used for the purpose of study included:

1. Harvard Step Test to measure the Cardiorespiratory endurance
2. Zig Zag run to measure the agility
3. Sit and reach test to measure the flexibility of the lower back
4. Shot Put throw to measure the power, and
5. 50m Sprint to measure the speed

The tests and purpose of the study were explained to the students. They were given sufficient time for warming up and readying themselves for testing. Tests were administrated in proper sequence. Only standard equipments were used for the tests.

In this study descriptive and inferential statistics were used to analyse data. Means and standard deviations described physical fitness profiles of subjects. The value of t-test was tested for (N_1+N_2-2) d.f. at .05 level of significance. Student's t-test for difference of mean was used to test whether significant difference existed between the mean of rural and urban male students in each of the five fitness components. The statistically treated scores were not compared to any established norms.

Results and Discussion

Table. Mean, S.D. and T-Ratio of Physical Fitness of Rural (n=50) and Urban (n=50) college Students

Test Item	*Subject*	*Mean*	*SD*	**n>M*	***%age*	*t-cal*
50m Sprint (sec)	**Rural**	6.89	.67	23	46	7.86
	Urban	7.86	.54	19	38	
Shot Put throw (m)	**Rural**	7.84	.55	20	40	11.51
	Urban	6.35	.73	25	50	
Zig Zag Run (Sec.)	**Rural**	9.90	.69	28	56	6.57
	Urban	10.65	.64	23	46	
Sit and reach (Cm.)	**Rural**	28.60	4.09	33	66	2.44
	Urban	26.74	4.92	29	58	
Harvard Step test	**Rural**	78.50	3.09	30	60	13.06
	Urban	71.25	2.57	35	70	

* Number of subjects scoring higher than group mean
** % of subjects scoring higher than group mean
t-cal 0.05 level of significance at 98 df

Table shows that the rural students had a mean of 6.89 seconds in the 50 m sprint with more than two-fifths of the subjects' (46%) scoring higher than the group mean. In shot put, they recorded a mean of 7.84 meters, with more than one-third (40%) subjects' scoring higher than the group mean. A mean of 9.90 seconds was recorded by rural students' with more than half (56%) scoring higher than the group mean in zig-zag run. In sit-and-reach, they had a mean of 28.60 centimeters with about two-thirds (66%) scoring higher than the group mean. Results showed these rural students had a mean of 78.50 scores, with about three-fifths (60%) scoring higher than the group mean in the Harvard step test.

Table also indicates that the urban students had a mean of 7.86 seconds in 50m sprint; slightly more than one-thirds (38%) scoring above the group mean. In shot put, they showed a mean of 6.35m, with half (50%) scoring above the group mean. The urban students had a mean of 10.65 seconds with more than two-fifths (46%) scoring above the group mean in zig zag run. More than half (58%) scored above the group mean of 26.74 centimeters in sit-and-reach. A majority (70%) scored above the group mean of 71.25 score in the Harvard step test.

Table further shows that the differences in mean scores of these rural and urban college male students in 50m sprint, shot put throw, zig-zag run, sit-and-reach test and Harvard step test are significant at 5% level and results favored the rural students.

Conclusion

Within the limits and limitation of the study, it was concluded that rural students are significantly more fit than the urban students.

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Comparative Efficacy of Selected Physiotherapy Treatment and Yogic Asanas on Low Back Pain among Male Physical Education Students

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Abstract

Low back pain is very common among general population and sportspersons. The structure of lumbosacral spine is such that predisposes it to mechanical injury. The sportspersons, in particular are subjected to repetitive bending, twisting or compressive stresses to the spine causing low back pain. Purpose of the present study was to see the comparative efficacy of selected physiotherapy treatment and yogic asanas on low back pain among male physical education students. Thirty male students having low back pain were randomly selected and divided into two equal groups; Experimental Group I and Experimental Group II. Experimental Group I was given Physiotherapy treatment, which included Pulsed Short Wave Diathermy and selected flexion and extension regimes of therapeutic exercises for three weeks. Experimental Group II received hot fomentation followed by selected Yogic asanas namely, Bhujangasana, Dhanurasana, Pavanmuktasana, Paschimottasana and Shavasana. The statistical analysis was done to see the significance of difference between the treatments. For this purpose 't' ratio was applied at 0.05 level of significance. Data analysis revealed that in both Experimental Groups I and II, low back pain reduced significantly. However, no significant difference was found between the groups (i.e., physiotherapy treatment and yogic asanas).

Key Words: Physiotherapy, Yogic asanas, Pulsed Short Wave Diathermy, Low Back Pain

Introduction

Low back pain is so common that according to an estimate about 60-80% of the people experience low back pain sometime during their lifetime. The structure of lumbosacral spine is such that predisposes it to mechanical injury causing low back pain. Any movement or series of movements, which places abnormal stress or abnormal loading on the spine, can injure it. This may be a sudden overload or a cumulative overload. Various studies have confirmed that lower back problems are second only to foot problems in order of incidence to humans throughout their lives. It is a common complaint among the overall population and athletes. Low back pain is more common among the sportsmen as they are subjected to repetitive bending, twisting or compressive loading stresses to the spine. In athletes, reported incidence rates of lumbar pain vary between 7% and 27% *(Spencer & Jackson, 1983 and Varlotta & Birnbaum, 1995).*

Although low back pain is very common, however the exact cause of low back pain cannot be identified in 80% to 90% of the patients. An exact diagnosis cannot be made due to a loose association among symptoms, physical examination and anatomical findings. Low back pain is most often due to an incompetence of the soft tissue structure, and the onset of pain is believed to be caused by a mechanical injury *(Mooney, 1996).* Several factors may contribute to low back pain including muscular deficiencies (specifically insufficient abdominal strength and trunk flexibility) and incorrect posture and body mechanics. Mckenzie classified back pain as of two types i.e. mechanical or chemical (non-mechanical) in origin. Mechanical pain is produced by deformation of structures containing nociceptive nerve endings, and there is a clear correlation between certain body positions and patient's symptoms. Conversely, non-mechanical pain is of a constant nature. This may be exacerbated by movement or position, but importantly, no position will be found which completely relieves the symptoms *(Norris, 1993).* The non mechanical category may include inflammatory, infective, vascular, visceral, metabolic, psychologic or other conditions that may produce low back pain.

There are various types of healing therapies, and each one claims to give best results in the low back pain. Physiotherapy treatment and Yogic asanas are both excellent means of promoting flexibility to the joints and soft-tissues. They also help improve muscular strength, endurance, controlled muscular actions and relaxation.

The important role that physiotherapy and remedial exercises have on improving or restoring muscle-strengths, flexibility and body mechanics in preventing or remediating back problems have been well documented by many including *Melleby (1982), Getchel (1983) and Liemohn (1988). Jasmine & Mhatre (2006)* in a study conducted on 20 patients suffering from mechanical low back pain showed that the group of the patients that received training of core stabilizer muscles improved significantly in pain relief and functional ability. *Shah and Gohel (1989)* conducted a study on 100 patients with low back pain having age 31-50 years and the patients were treated with various modalities like Short Wave Diathermy, flexion exercises/extension exercises alone, or in combination, and found that the maximum number of patients got relief by a combination of Short Wave Diathermy and flexion exercises.

Signifying the yoga as a great source of health and fitness, Dr. Salk, Noble Prize Winner rightly said, "Medicine is Science of disease and Yoga is the Science of health". Asanas forms only one of the basic components of complete astanga yoga. Each asana is a series of scientifically developed slow, rhythmic and graceful movements of various joints and muscles of the body aimed at attaining a definite posture as related to that particular asanas. Various studies have confirmed the usefulness of yogic asanas in preventing as well as curing many ailments and diseases. With reference to the positive effects of yogic asanas in back related problems, few studies are cited here. Many researchers have shown that with yogasanas like Konasana, Suptavajrasana, Bhujangasana, Shalabhasana and Chakrasana, favourable response was shown in patients suffering from low back pain with improved functional capacity. *Jothiharan (1998)* indicated a significant change in the postural deviations of spinal column due to influence of yoga and remedial exercises. *Thirumalaisamy (1996)* found that low back pain may be subsided by means of selected yogic practices.

Purpose of present study was to see the comparative effect of selected

Physiotherapy treatment and Yogic asanas on low back pain among male physical education students.

Material and Methods

Thirty male physical education students, aged 17-24 years studying at Lakshmi Bai National Institute of Physical Education, Gwalior were randomly selected for the study during 2001-2003. These subjects having complaint of low back pain reported to Physiotherapy centre of the Institute for treatment. The subjects were divided into two equal groups; Experimental Group I and Experimental Group II. Experimental Group-I was given Physiotherapy treatment which included Pulsed Short Wave Diathermy application for 10 minutes and Flexion and Extension regimes of spinal exercises. Experimental Group-II received hot fomentation for 10 minutes to low back region followed by selected yogic asanas namely Bhujangasana, Dhanurasana, Pavanmuktasana, Paschimottanasana, and Shavasana. Both groups received treatment for three weeks (5 days a week). Short Wave Diathermy model Thermatur-200 manufactured by Uniphy, Netherlands was used with drum shaped treatment head (14cm diameter) for the study. Flexion regime of exercises included posterior pelvic tilt, Knees to the chest, and sit up straight and obliquely from supine crook lying position. Extension regime of exercises included the prone press up with hands clasped behind the back, and alternate leg extension from prone position.

The selected yogic asanas were done empty stomach (under the supervision of a qualified yoga expert). Duration of holding the asanas was gradually increased as per the tolerance of each subject.

Low back pain was assessed before and after the treatment and scoring was done with a five point ordinal scale by the interview technique. As per table-1, according to the degree of pain subjects were given points and the score was made before the treatment started, and after the treatment of three weeks.

Table-1 Five Point Ordinal Scale

Pain Level	Points
No pain	1
Mild pain	2
Moderate pain	3
Severe pain	4
Excruciate pain	5

The data from both the groups were statistically analysed for before the treatment and three weeks after the treatment and to see the significance of difference between the paired means, t-ratio was applied and the level of significance set at 0.05 level of confidence.

Results & Discussion

Findings of the present study are shown in Tables 2-5.

Table 2: Significance of difference between Pre means of Experimental Group-I and Experimental Group II.

Group	Pre-Mean	S.D.	D.M.	σD.M.	't' Ratio
Experimental Group I	3.00	0.76			
			0.13	0.255	0.51
Experimental Group II	3.13	0.64			

$t_{0.05}(28) = 2.05$

Difference in the Pre-Means of Experimental Group I and Experimental Group II is statistically insignificant (t=2.05). Therefore, there is no difference between the Experimental Group I and Group II prior to the treatment.

Table 3: Significance of difference between the Pre and Post Means of Experimental Group-I (Physiotherapy treatment).

Experimental Group I	Mean	S.D.	D.M.	σD.M.	't' Ratio
Pre-Treatment	3.00	0.756			
			1.60	0.2345	6.82*
Post-Treatment	1.40	0.507			

* significant, $t_{0.05}$ (28) = 2.05

Finding of table-3 shows that there is significance of difference between the Pre and Post Means of Experimental Group I. Since the obtained value of 't' (6.82) is much greater than the required value (2.05) at 0.05 level of significance with 28 degrees of freedom, therefore, it can be concluded that Physiotherapy treatment comprising of Pulsed Short Wave Diathermy and Exercises for a duration of three weeks (five days a week) relieves the low back pain significantly.

Table 4: Significance of difference between the Pre and Post Means of Experimental Group II (Yogic asanas).

Experimental Group II	Mean	S.D.	D.M.	σD.M.	't' Ratio
Pre-Treatment	3.13	0.640			
			1.53	0.2317	6.60*
Post-Treatment	1.60	0.632			

* significant, $t_{0.05}$ (28) = 2.05

Finding of table-4 reveals that there is significance of difference between the Pre and Post Means of Experimental Group II. Since the obtained value of 't' (6.60) is much greater than the required value (2.05) at 0.05 level of significance with 28 degrees of freedom, therefore, it can be concluded that the yogic treatment consisting of heat and yogic asanas for a duration of three weeks (five days a week) relieves low back pain significantly.

Table 5: Significance of difference between Post Means of Experimental Group-I and Experimental Group II.

Group	Post-Mean	S.D.	D.M.	σD.M.	't' Ratio
Experimental Group I	1.40	0.507			
			0.20	0.209	0.957
Experimental Group II	1.60	0.632			

$t_{0.05}$ (28) = 2.05

Finding of table-5 shows that the 't' value between the Post-Means of Experimental Group I and Experimental Group II is (0.957) much less than the required value for significance (t=2.05). Therefore, it can be concluded that there is no difference between the Experimental Group I and Group II after treatment.

From the statistical analysis it is revealed that there is significant reduction and relief in low back pain in both the Experimental Group I and Experimental Group II which received Physiotherapy treatment, and Yogic asanas treatment respectively.

The relief of pain in Experimental Group-I could be attributed to the therapeutic effect of Pulsed Short Wave Diathermy because of increased blood circulation, acceleration of healing process, and selection of planned regimes of exercises. The findings of the present study are in consonance with the findings of *Melleby (1982), Getchel (1983), and Jasmine (2006).* Further, the relief of pain in Experimental Group II may be due to the effect of heat on pain relief as well as the ability of yogic asanas in improving flexibility of joints and muscular strength. Holding of asana for a certain period of time involves static posture, which is very important for efficient conditioning of the body. Findings of the present study are also in consonance with the findings of *Tirumalaisamy (1996).*

The insignificant difference in the Means of pain score after the treatment between Experimental Group I and Experimental Group II could be attributed to the selected physiotherapy exercises and yogic asanas which resemble more or less the similar body postures. Both the groups involved one or the other kind of heat application, and this also could relieve the low back pain. In Experimental Group-I the use of PSWD might have produced additional benefit of placebo effect. However, the shavasana used in Experimental Group II might have derived additional therapeutic effect in pain relief. Hence, no significant difference was found between both the groups in the present study.

Conclusion

In the present study it may be concluded that both the Experimental Groups that received Physiotherapy and Yogic asanas treatment separately, low back pain reduced significantly. Future studies may be conducted with a combined approach of Physiotherapy and Yogic practices. General population as well as the sports persons must be educated for correct body mechanics and posture at work, study, play field or while sleeping so that the low back pain can be prevented.

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Effect of Different Mechanical Compressive Forces on MNCV of Median Nerve in Normal Females

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Abstract

The study was conducted on 30 normal females ranging in age from 19-20 years to evaluate the effect of different mechanical compressive forces (50 mm Hg & 100 mm Hg) on motor nerve conduction velocity (MNCV). Conduction Velocity of left Median Nerve was measured at normal body temp. MNCV was measured three times in each subject. First testing of MNCV was done without applying any proximal compression force while second and third MNCV measurements were taken by applying proximal compressive forces above the elbow level equal to 50 mm Hg & 100 mm Hg respectively. The results indicate significant decline in the MNCV after applying compression to the nerve. The decline was related to the magnitude of compression.

KEYWORDS: Motor nerve conduction velocity, Mechanical compression, Median nerve

Introduction

The nerve conduction studies have an important role in the evaluation of peripheral and entrapment neuropathies by confirming the clinical suspicion of neuropathy. Identifying the predominant pathophysiology such as conductive block, axonal degeneration or demyelinating; sensory or motor; and temporal course of disease i.e. acute, sub acute or chronic, and the Nerve Conduction studies provide an objective and qualitative measure of nerve function and help in predicting the prognosis of neuropathy *(Michael, 1999).*

Rydevik et al (1981) and Lung Borg et al (1982) illustrated that direct nerve compression at 30 mm Hg for 2-4 hours produces reversible changes, whereas prolonged compression above this time period at the same pressure level may cause irreversible damage to the nerve. *Parry et al (1981)* reported that during transient paralysis experimentally induced in humans by an inflated cuff around the arm, the conduction velocity falls by as much as 30 percent. A complete conduction block occurs after 25-30 minutes of compression.

The main objective of the present study was to find the changeability in the nerve conduction velocity before and after the compression of the peripheral nerve.

Materials & Methods

Two hundred girl students studying in the Department of Physiotherapy, Sardar Bhagwan Singh Post Graduate Institute of Biomedical Sciences and Research (SBSPGIBSR), Balawala, Dehradun were chosen as the study for population. Thirty subjects were selected from the department of physiotherapy based on the inclusion and exclusion criteria. Normal (medically fit) girl students between 19-20 years of age, having 5.3-5.5 feet height and weighing between 40-45 kg were chosen as the subjects. Subjects who were using medicine or irradiation or having history of any neurological, muscular, metabolic and systemic disorders, or having history of any injury during past 6 months or subjects unwilling to continue were excluded from this study. The study was performed in the air conditioned laboratory of Department of Physiotherapy at SBSPGIBSR, Balawala, Dehradun. Room temperature was maintained between 21-23^{o}C for creating ideal testing conditions. The body /skin temperature of the subjects' was keept 36^{o}C-37^{o}C by an infrared lamp and by warm water Immersion during MNCV measurement.

For the measurement of MNCV, the recording electrode was placed close to the motor point of abductor pollicis brevis and reference electrode three centimeters distal to first metacarpophalangeal joint. Supramaximal stimulation was given at wrist 3 cm proximal to distal wrist crease and at elbow near the volar crease of brachial pulse *(Mishra & Kalita, 2004).*

For evaluation of the proximal segment of median nerve, the stimulation was also given at axilla and Erb's point. The distal latency, nerve conduction velocity of different segments and compound muscle action potential amplitudes were measured following stimulation at different levels. Conduction velocity in meters/sec was calculated as per the following formula.

$$\textbf{Conduction Velocity} = \frac{\text{Conduction distance (cm)}}{\text{Proximal latency - Distal latency (msec)}}$$

Sphygmomanometer was used to produce mechanical compression. The pressure used in the procedure is 50mm of Hg and 100mm Hg. MNCV was measured as per the procedure described above.

Results and Discussion

Table 1 enlists the mean values of motor nerve conduction velocity of median nerve before and after the application of compression force of 50 & 100 mm Hg. Initially without compression, the mean MNCV value was observed to be 56.19 m/sec. Application of mechanical compression to the tune of 50 mm Hg caused the MNCV to decline to an average value of 53.42 m/sec. This decrease calculates to 2.77 m/sec, which is significant at 5% level (table 2). Further increase in compressive force above the elbow level to 100 mm Hg resulted in further decrease in motor nerve conduction velocity of the median nerve. The slowing of conduction velocity is statistically significant.

Table 1: Mean values of MNCV of Median Nerve before and after the application of compression forces

	N	MNCV (m/sec) Mean ± SD
Before Mechanical Compression (BMC)	30	56.19 ± 4.03
At Compression force of 50 mm Hg (CF 50)	30	53.42 ± 4.74
At Compression force of 100 mm Hg (CF 100)	30	51.60 ± 4.91

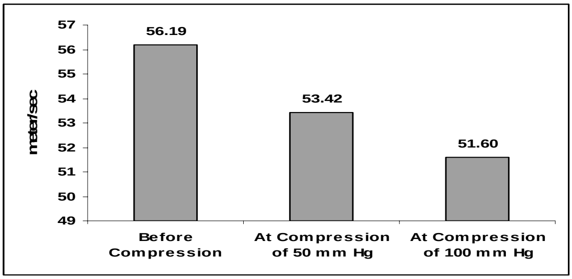

Figure 1: Comparison of the effect of application of compression of left median nerve on motor nerve conduction velocity

Table 2: Statistical evaluation of the Mean difference of MNCV of Median Nerve before and after the application of compression forces

Test Pair	Paired Differences			t
	Mean	SD	SEM	
MNCV BMC – MNCV CF 50	2.77	3.40	0.62	4.47*
MNCV BMC – MNCV CF 100	4.58	3.48	0.64	7.22*
MNCV CF 50 - MNCV CF 100	1.82	1.12	0.20	8.87*

* t values significant at 5% level

The study reveals that there was decrease in the nerve conduction velocity with compression of peripheral nerve. Increase in the compression force on the median nerve further decreased the values of nerve conduction velocity. In terms of percentage, 5% slowing was observed at compression of 50 mm Hg which increased to more than 8% on further increase of compression to 100 mm Hg. The results of the study are in agreement to *Parry et al (1981)* who reported that during transient paralysis experimentally induced in humans by an inflated cuff around the arm, the conduction velocity falls by as much as 30 percent.

Conclusion

The subjects were found to have significant changes in MNVC of the median nerve on compression. The significant differences could be attributed to diagnosis of early entrapment, conduction block or other neuropathies. The MNCV showed changes according to the degree of compression. The study proved beneficial for diagnostic purpose, to give a baseline for the changes in MNCV according to the compression force applied. The study has implications in finding out whether the compression force is stagnant or progressive.

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Effect of Selected Hathayogic Practices in Enhancing Kicking Ability in Soccer Playing

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Abstract

The objective of the present study was to analyze the effect of selected yogic practices in enhancing the kicking ability among the men soccer players. With the assistance and help of the experts in the field of yoga, sports and previous researches on these areas a comprehensive and suitable yoga package was evolved. Thirty men soccer players at the inter-collegiate level were selected at random to be treated under the designed training package to find out the training impacts and outcomes. The selected soccer players underwent twelve weeks of intensive yogic training besides their regular sports training. The kicking ability was measured before and after the treatment by administering the Warner Test of Soccer Skills. The data were analyzed by using 't' ratio for interpretation. The designed training package was suitable and made positive training impacts on kicking ability among the soccer players.

Key Words: Soccer, Kicking Ability, Yoga, Asana, Pranayama, Meditation

Introduction

There is no country in the world where soccer is not played in some form or other. There is definitely something very inherent in the game, which possesses a great appeal both to the players and to the spectators. Soccer is a game, which calls for strenuous, continuous thrilling action and therefore appeals to youth, the world over. Soccer or Football, as popularly known worldwide is a game where the foot is used much more than other part of the body. As Bernard Shaw would put it in his critic comment that "The Footballers think with their feet" is quite true.

The skills in football can be performed efficiently only when the players keep their physical fitness tremendously high. Cardiovascular fitness is quite necessary to play soccer, moreover soccer is considered to be one of the best and popular endurance games, which require fabulous endurance to survive till the end of the game, as playing area and playing strategy are wide. Another important aspect is that, legs, the lowest extremity is to be used to execute most of the skills in soccer. It is evident from the practical experiences in soccer coaching that a tremendous range of flexibility is very much required for efficient execution of soccer skills both on and off the grounds.

Yoga one of the ancient Indian disciplines provides a stable and sustaining body system when done in a systematic manner. Asanas, a component in the yogic system tunes the range of flexibility of the practitioner. The science of yoga proclaims that yogic techniques and practices aim at selective as well as wholesome shaping of human body and mind. Hence a selective package of yogic practices of Asana (Physical Postures), Pranayama (Breathing Practices) and Meditation (Mental Practices) would prove a positive impact among the soccer players in executing the skills for the better playing performances.

Govindarajulu (2003) studied the effects of Yoga practices on flexibility and cardio respiratory endurance on high school girls where he found out a significant improvement on those selected variables after the training period. *Shirley et al (1994)* conducted a study on the Improvement in Static Motor Performances following Yogic training in School Children, which showed a significant difference after the training period. *Bhole (1977)* reported the effects of Yoga practices in sports persons as a complementary to sports training programme. The results of his study divulge that regular yoga practices could contribute to the development and enhancement of skill related variables and could complement the sports training methods for skill acquisition.

Selection of hathayogic practices

Table – 1 Hathayoga practice schedule with time split

Yogic Practice		Name	Duration
Asanas	1	Padmasana	25 – Min.
	2	Vajrasana	
	3	Paschimottanasana	
	4	Matsyasana	
	5	Vakrasana	
	6	Bhujangasana	
	7	Sarvangasana	
	8	Shalabhasana	
	9	Pavanmuktasana	
	10	Dhanurasana	
	11	Halasana	
	12	Arthakatti Chakrasana	
	13	Trikonasana	
	14	Shantiasana	
Pranayama	1	Nadi Suddhi	15 – Min.
	2	Nadi Sothana	
	3	Ujjayi	
	4	Bhramari	
	5	Sitali	
	6	Sitakari	
Meditation		Any one meditation technique (Mantra/Object /Breathing/ Yoga Nidra)	10 - Min

The Scientific basis of yoga offers a wide range of variations in asana, pranayama and meditation on how to utilize the effects of yoga for various needs. An intensive review of related literature on these area and consultations with the experts in yoga, a selected yoga-training package was designed for the soccer players and is presented in Table-1.

The study was conducted to analyze the effect of selected yogic practices in enhancing the kicking ability among the men soccer players.

Material and Methods

Thirty soccer men players were selected at random as subjects for the study. The designed yogic practices were taught step-by-step for one week as orientation to understand and to get acclimatized with the yogic practices. The initial test on kicking ability was measured by administering Warner Test of Soccer Skills (Item-No. I) and the scores were recorded.

The treatment i.e. the selected Hathayogic practices as shown in Table 1 was given to the subjects for weekly three days viz. Monday, Wednesday and Friday. The treatment was given to them for 12 weeks. These practices were performed only in the early morning. After the 12 weeks of treatment again the final test on the kicking ability was conducted and the scores were recorded.

The obtained scores were statistically analyzed by using the paired sample ‘t’ test as suggested by *Cark and Clarke (1972)*.

Results and Discussion

The calculation of mean of the yogic group before and after treatment is presented in the table 2. Using the means, standard deviation of the group ‘t’- ratio was computed to find out whether there was any significant difference among the scores of initial and final tests. The mean kicking ability score of the yogic group containing soccer players before the treatment was 37.1 and the mean after the treatment was 39.53. There is a significant difference between the scores of before treatment and after treatment. The significant difference is due to the selected hathayogic practices that included asanas, pranayamas and meditation undergone by the group for a period of twelve weeks.

Table 2: Computation of analysis of 't' ratio of pre-treatment and post-treatment on kicking ability in soccer

Group	Mean	Diff. between mean	SD	SEM	SE of diff. of the ean	t-ratio
Before Yogic Treatment	37.1		2.43	0.44		
		2.43			0.56	4.36
After Yogic Treatment	39.53		1.84	0.34		

Table Value (N-1) (30-1) 29 = 2.04, Significant at 0.05 levels

The practice of hathayogic techniques like asanas stretches the muscles and joints in the body, besides providing gentle massage to the vital internal organs. Thus it enhances the smooth and free flow of blood circulation throughout the body physiologically and enhances the flexibility.

Pranayama is the practice of breathing exercise that works in a progressive manner on the breathing mechanism centrally and the effects spread to the periphery too. Lungs, intercostal muscles, diaphragm and ribs are highly exercised during the pranayama practices. Thus it may enhance the lung functions in the body, which paves a way for the development of endurance. The meditation technique works upon the central nervous system particularly on the autonomic nervous system that brings tranquility to the mind. Having evidenced the scientific positive outcomes through the selective hathayogic practices the designed training schedule is comprehensive and have contributed to the development of skill execution in soccer.

Conclusion

The designed hathayogic practices did contribute to the development of flexibility among the soccer players, which consequently enhanced the kicking ability in soccer.

Based on the finding it is concluded that selected hatha yogic practices could be of great contribution to sports training sessions as a complementary training method for improving and developing skill execution in soccer.

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Energy Intake and Energy Expenditure Pattern in Middle Aged Females 30-50 Years of Age Living in Urban Slums of Punjab

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Abstract

The purpose of the study was to examine if any discrepancy exists between energy intake & expenditure in females (N=600) between 30-50 years of age living in urban slums of Punjab. Daily dietary record and energy expenditure data was collected for three consecutive days for all the subjects. The subjects of the present study gain weight with increase in age. On an average, the females especially after the age of 40 years, exhibit greater caloric intake than their energy expenditure.

Key Words: Daily Dietary Energy Intake, Energy Expenditure, Energy Balance

Introduction

Urbanization is an inevitable and unavoidable feature in the process of development. In India the influx of rural poor to urban slums in search of livelihoods is changing demographic, social, and economic profiles of the country. The key problems of the slums therefore are; the nutrition and health behavior of slum families; and develop intervention programs to improve their access to food, income, and utilization of health services provided by government and nongovernment agencies. Women and children, who proportionally spend more time at home, are the ones most adversely affected by poor living conditions caused by the lack of potable water, sanitation facilities, proper solid waste disposal, etc. More than 25 percent of slum residents are home-based workers, mostly women. For these families, access to decent living conditions and basic urban infrastructure and services is important not only for their health and welfare, but also for their ability to remain economically productive.

Adolescent girls and adult women who are not pregnant or lactating are often out of focus in most of our public health programmes which are beamed predominantly to pregnant women and children. The importance of nutrition of adolescent girls is now being appreciated. Women constitute nearly half the population and their health status apart from their reproductive health should be a matter of concern. There is little concrete research available concerning food behavior and dietary intake and expenditure during middle years of life. At this stage of life, concern about maintaining health often precipitates a new surge of interest in the type and quality of food eaten and weight control. Many adults subtly gain few kilograms each year *(Durnin & Womersley, 1974; Rogers & Evans, 1993; Snow Harter; 1991).* This causes modern nutritional drawback in their eating behavior which includes lack of variety, high calcium density, high sugar contents, high proportion of saturated fat, high sodium contents and preponderance of refined food and lack of food sources of fiber *(Kendler, 1984; Anderson & Clarke, 1986; Byers, 1986; Herbert, 1987; and Sentora, 1987).* Recent developments in the field of nutrition has revealed differential needs of nutrients during different stage of human life and as a result special dietary needs are emphasized for humans depending upon their age, sex and other conditions *(Riggs & Melton, 1992 and Disgora et al, 1994).*

In India a number of surveys conducted on diets consumption revealed that majority of population depends on cereal based diet. Because cereals being the cheapest source of calories contribute 70-80 percent of the total calories in diet *(Gopalan et al, 1985).* The consumption pattern in Andhra Pradesh was studied by *Pushpamma et at (1984)* who reported that the average intake of fruits and vegetables was below the recommended level because fruits were taken occasionally in that states.

Hira et al (1991) conducted a study on 160 farming families from 8 villages of Ludhiana district of age group 30- 60 years. The results showed that the energy consumption was low in landless low-income group (0-5 acres) than middle income group (5-10 acres). The proteins intake was more than the RDA in all the groups. A number of other investigators have rported a linkage between the energy consumption and socio-economic status of the subjects *(Rao et al, 1986; Rao, 1987 and Kang, 1990).*

In general, it can be said from the above reviewed studies that deviations are reported in daily dietary intake from the normally recommended dietary allowances in Indian females. There is need to interpret these findings in the light of functional changes with age in females as well as changes in their lifestyle and the social environment.

Keeping in view the above, the present investigation has been planned to study the dietary intake and energy expenditure profiles of middle aged women belonging to 30-50 years age group with the following aims and objectives.

1. To report daily dietary intake of nutrients by the females from age 30-50 years.
2. To study the daily energy expenditure profiles in women from 30-50 years of age
3. To examine if any discrepancy exists between energy intake & energy expenditure in females between 30-50 years.

Materials and Methods

Table-I

Age Group (Years)	(N)	Age range (Years)	Mean Decimal Age (Years)
30-35	150	30.00-35.00	32.57
35-40	150	35.00-40.00	38.02
40-45	150	40.00-45.00	43.39
45-50	150	45.00-50.00	48.56

Keeping in view the aims of the present study, the females ranging in age from 30-50 years, have been selected to cover the early and middle adulthood phase of life. In addition to this, female subjects were studied from urban slums of Punjab in Ludhiana, Patiala, Ropar and Jullandhar. To study the changes in the dietary profiles and energy expenditure profiles through middle age in the females, the subjects have been divided into four, 5 yearly age groups as under :-

The following equipments were used for the recording of general information, daily dietary intake and daily energy expenditure:

1. Performa for recording general information
2. Performa for recording daily dietary food intake.
3. Performa for recording energy expenditure

Three days consecutive dietary records of each subject was taken and fed into the computer for dietary analysis of food for calculating composition of its nutrients with the help of Dine Healthy Software

Results and Discussion:

Daily Energy Intake

Table 2: Comparison of Mean Daily Total Energy Intake and Daily Total Energy Expenditure among females belonging to different age groups

	Age Group	N	Mean	S.D.	S.E.M.
Daily Dietary Energy Intake (Kcal)	30-35	150	2098.84	167.95	13.71
	35-40	150	2134.68	174.94	14.28
	40-45	150	2169.09	175.57	14.34
	45-50	150	2238.98	194.44	15.88
Daily Energy Expenditure (Kcal)	30-35	150	2174.38	166.19	13.57
	35-40	150	2143.49	168.42	13.75
	40-45	150	2130.55	111.25	9.08
	45-50	150	2098.55	127.59	10.42
Daily Energy Intake (Kcal/Kg Body Weight))	30-35	150	38.68	4.24	0.35
	35-40	150	39.44	5.18	0.42
	40-45	150	39.15	7.33	0.60
	45-50	150	38.28	7.30	0.60
Daily Energy Expenditure (Kcal/Kg Body Weight))	30-35	150	40.11	4.68	0.38
	35-40	150	39.67	5.52	0.45
	40-45	150	38.51	7.05	0.58
	45-50	150	36.11	7.56	0.62

Average daily energy intake has been observed to increase with increase in age. Group-1 (30-35 years) females on an average consume 2098.6 kcal in their daily diet that increase to 2238 kcal in the age group-IV (45-50 years), thus demonstrate an increase of 6.67% (Table 2). Administration of ANOVA tests to the daily dietary energy intake data of different groups reveals the existence of significant differences between the various age groups (Table 3). Further exploration with the Schaeffe post Hoc test recognized significantly greater intake of daily dietary energy intake values by females belonging to the higher groups as compared to the lower age groups (Tables 4-6).

Expressions of daily dietary energy intake in relation to the body weight of the subjects' exhibit comparable mean values with statistically non significant differences (Tables 3).

Table 7 compares the mean dietary energy intake of slum females (present study) with the sedentary urban females studied by *Kaur et al (2002)*. Females' of the present study are observed to ingest 111 to 188 Kcal more in their daily diet than sedentary urban females at corresponding ages between 30-50 yrs.

Table 3: ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Daily Dietary Energy Intake	Between Groups	1605243	3	535081.1	16.80	**0.00**
	Within Groups	18988428	596	31859.8		
	Total	20593672	599			
Daily Energy Expenditure	Between Groups	443906.3	3	147968.8	6.99	**0.00**
	Within Groups	12611615	596	21160.4		
	Total	13055521	599			
Daily Dietary Energy Intake (Per kg body weight)	Between Groups	116.986	3	39.0	1.03	0.38
	Within Groups	22622	596	38.0		
	Total	22738.98	599			
Daily Energy Expenditure (Per kg body weight)	Between Groups	1442.915	3	481.0	12.07	**0.00**
	Within Groups	23743.74	596	39.8		
	Total	25186.65	599			

Table 4: Scheffe Post hoc for Mean differences in daily dietary ener gy intake

Age Group	35-40	40-45	45-50
30-35	-35.84	**-70.24***	**-140.14***
35-40		-34.40	**-104.30***
40-45			**-69.90***

* Significant at 5% level

Table 5: Scheffe Post hoc for Mean differences in Daily Energy Expenditure

	35-40	40-45	45-50
30-35	30.89	43.83	**75.83***
35-40		-30.89	12.94
40-45			32.00

* Significant at 5% level

Table 6: Scheffe Post hoc for Mean differences in daily energy expenditure/kg body weight

	35-40	40-45	45-50
30-35	0.44	1.60	**4.00***
35-40		1.16	**3.56***
40-45			**2.40***

As per the NIN recommendations for Indian women, the daily energy intake by the females between 30 to 50 years exhibit 10 to 16% higher calorie intake in their daily diets. Mean daily energy intake values observed in the present study are higher than the finding of some earlier investigations on Punjabi women *(Ahluwalia, 1981; Kaur, 1992; Chatha, 1996; Mann et al, 1997; Kaur, 2002).*

Daily Energy Expenditure

Comparable mean values of daily energy expenditure are observed in the females belonging to the first three age groups with statistically non significant outcome (Table 3). However, the total daily energy expenditure is observed to significantly decline in the last group i.e. 45-50 yr age group as compared to younger age groups (Table 2). After accounting for the increase in body weight by expressing the daily energy expenditure in relation to the body weight of the subjects, a comprehensible gradual decrease in energy expenditure with the increase in age is observed. ANOVA test establishes significant mean differences in this variable between different age groups (Table 3).

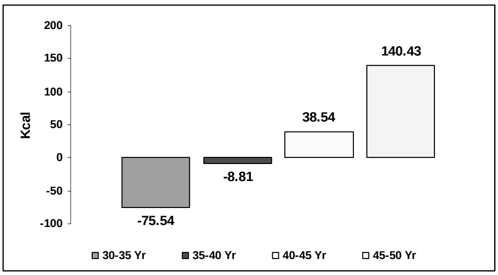

Figure 1: Comparison of mean daily energy balance in females

It is interesting to observe that females in the first two age groups spend more calories both in absolute terms as well as in relation to their body weight than what they consume while in the succeeding age groups (i.e. 40-45 and 45 to 50 years), the opposite is found to be the case (Fig 1). This means that after the age of 40 years the females tend to have a positive energy balance which if sustained for a long period of time can lead to further weight gain in them. The same trend has been reported by *Kaur (2002)* in her study on normal sedentary females of Punjab. Higher average daily energy expenditure both absolute and in terms of body weight in the first two age groups with concomitant negative energy balance though small in magnitude as compared to the sedentary urban female subjects of Kaur (2002), reflect a relatively more active lifestyle of the present group of females'. The slum females engage themselves in routine physical jobs for their livelihood and therefore exhibit elevated daily energy expenditure over the sedentary females of corresponding ages. This is supported by the results of average energy spending by females in various activity categories detailed and explained below.

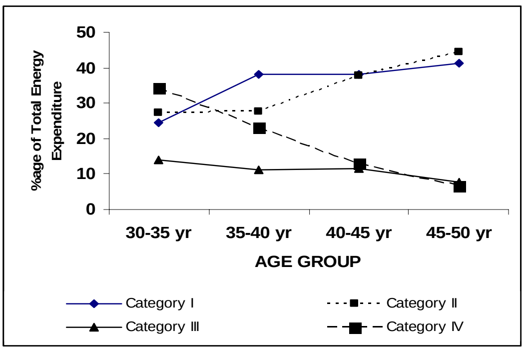

Figure 2: Comparison of % total energy expenditure by females belonging to different age groups in various categories

It is obvious form Fig 2, that females' belonging to 30 to 35 years age group spend 24% of their daily total energy expenditure in sleeping and resting in bed (Category-I) and with enhancement in age, the energy spent by the females in this category also increase to the level that females belonging to the last age group i.e.

45 to 50 years are observed to spend 41% of their daily energy expenditure in this category. In category-II which consists of activities like sitting, eating, listening writing etc. the same tendency of increase with age is observed as is noticed in the case of category – 1. Category - III comprises of light activity like standing, washing, shaving, combing hair, cooking etc. In this category the younger females spend more energy as compared to the older ones. In category – IV that consists of slow walking, driving, dressing, showering etc. the same trend is observed (Fig 2)

Table 7: Comparison of daily dietary energy intake and expenditure among sedentary Females (Kaur, 2002) and Slum Females (Present Study)

	Age Group	Sedentary Females (Kaur, 2002)	Slum Females (Present Study)
Daily Dietary Energy Intake (Kcal)	30-35	1911.06	2098.84
	35-40	1942.64	2134.68
	40-45	2057.35	2169.09
	45-50	2117.73	2238.98
Daily Energy Expenditure (Kcal)	30-35	2048.78	2174.38
	35-40	2066.85	2143.49
	40-45	2005.10	2130.55
	45-50	1923.29	2098.55

High daily energy intake is a major factor in the development of obesity in western societies. Many researchers have confirmed in their studies that if the every day diet include high amount of dietary fat, affinity to gain weight develops more easily *(George et al 1990; Kendall et al 1991; Scotellaro et al 1991; Sheppard et al, 1991).* However they further report that when the intake of carbohydrates and fiber is high, it is easier to, lose body weight.

The results of the present study clearly indicate that females especially after the middle age consume greater calories in their daily diets both total as well as in relation to their body weight and also exceed the recommended values. The energy expenditure profiles point to positive energy balance in these group of females with increase in age.

All these factors are indicative of a negative life style lead by them and increase the risk of obesity and other related diseases. It is therefore, felt necessary to form strategy to curb this unhealthy trend among subjects of present study and preventive measures in this regard are necessitated. These include the intake of healthful diets containing optimal amounts of various nutrients both major and minor as well as increase in the physical activity in their daily life.

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