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Editor's Page

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

I am happy that the Volume 4, No. 1 issue of **Journal of Exercise Science and Physiotherapy** ***(JESP)*** is out for the readers. This issue of JESP contains ten articles on diverse important aspects of exercise science. **Nande et al from Nagpur** studied Energy Balance among Female & Male Players Engaged in Different Sports Disciplines and interestingly observed negative energy balance in them. Through the results of their study, they emphasize that good nutrition is not only required for players during the season of their sport but for effective athletic performance, good nutrition is critical at all times. **Banerjee & Banerjee from Kalyani** also touched a very important area of research in Physical education. They investigated the influence of Physical Education Teachers Training Programme on Leadership Quality of trainee females and reported that organised Physical Education programme in which the subjects had participated, significantly improved their physical fitness and psychological qualities but failed to develop desirable leadership qualities up to the best possible level.

Exercise has been generally known to cause beneficial effects on the human body. **Bandyopadhyay et al from Malaysia** report the other face of exercise. They concluded that the high intensity endurance training resulted in decrease in total count of red blood cells, hemoglobin concentration and Packed Cell Volume among the volleyball players and further reported that such decrement was significantly correlated with the training duration. **Maiya et al from Manipal** reported the importance of losing weight in obese infertile women with polycystic ovarian syndrome (PCOS) through aerobic exercise. According to them, the graded aerobic exercise helps in reducing the cyst size, increasing the ovulation, pregnancy rate as compared to control group. **Kumar et al from Aurangabad** examined sports injuries in relation to the field position of competitive football players. They observed that football players directly involved in attack or defence are more likely to be injured. Lower limb injuries were found to be predominated, muscle injuries being the most common type, collision is common cause of injuries. The results of their research provide a useful insight into the injuries in relation to field position, nature and sites of injury in competitive football players. **Desalgen & Verma from Patiala** concluded that significant differences are demonstrated by different category of players and physical education students in their blood pressure and heart rate responses to varying intensities of exercise and at different points of recovery. **Mazumdar & Verma from Punjab** examined the effects of aerobic exercises on patients of early coronary artery disease and reported a gradual increase in cardiovascular fitness but decrease in exercise tolerance.

Singh & Kaur from Jalandhar showed that *Shaktipat* Meditation is an effective practice to improve self-confidence. The current issue of ***JESP*** contains two more research articles, the one by **Singal et al** reveals changes in body mass index, blood pressure and haemoglobin levels in Jat Sikh children ranging in age from 10 to 16 years and the other by **Sharma et al** reports frequency of occurrence of accessory head of flexor pollicis longus muscle, its morphology, its relation to the structures of the proximal forearm and the clinical significance thereof.

S.K. Verma

A Study on Energy Balance among Female & Male Players Engaged in Different Sports Disciplines

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Abstract

The study deals with assessment of energy intake & expenditure of players. Female [N=13] & male [N=46] players, aged 18-22 years, engaged in different sports disciplines were selected. All players were found regularly participating in specific games in which they were involved. Data was collected using questionnaire-cum-interview schedule. Mean ± SD & R values were calculated. Student's 't' test was used for comparisons. Irrespective of sex & games, all players were found significantly shorter than the respective standard heights for their age [t = 3.75 for females & 9.52 for males]. Majority of female players were not meeting the standards of weight for height. Based on 24 hour's dietary recall method, it was found that all players fell short of meeting the recommended dietary allowances [RDAs] for energy, carbohydrates, protein & fat. Total time spent on routine activities [TTSRA] by female players was computed as 1290 minutes/day & TTSRA by male players was found to range between 1260 – 1320 minutes/day. Energy expenditure [EE] reflected a direct relationship with body weight, time spent & type of activities. Highest values for EE on routine activities & EE on sports activities were found to be 1901 & 892 kcal as well as 2027.88 & 1358.78 kcal for female & male players, respectively. Negative energy balance was observed in all players.

Key Words: Energy Intake, Energy Expenditure, Energy Balance, Recommended Dietary Allowances

Introduction

Good nutrition at all times is essential for effective athletic performance. During adolescence, individuals undergo significant growth & maturation, & unique changes take place in the body, thus, causing an increase of nutritional needs. An adolescent athlete have energy needs that are different from the needs of adult athlete, one should pay attention not only to energetic suitability, but also to the intake of protein & fluids before, during & after the exercise *(Fox, 1994; Thompan, 1998).*

Nutrition not only plays a role in performance, but it can also help to prevent injuries, enhance recovery from exercise, help maintain body weight, & improve overall health. It is important for all sports person to have a good working knowledge, understanding of exercise science & sports nutrition so that these can help in their own performance potential *(Bakulin & Efimo, 1996; Loucks, 2004).*

The need of an athlete in energy & nutritional substances essentially differ depending first of all on the kind of sport & the amount of work performed *(Astrand & Rodahl, 1988).*

In athletic training performance, carbohydrate & fat are the major sources of energy. The amount of fat used during exercise depends upon the duration & intensity of exercise, degree of prior training & the composition of the diet. Exercise performed under aerobic conditions will promote fat use as a source of energy. There is a good reason to increase body's ability to burn fat as fuel; using fat as a source of energy will spare muscle glycogen *(Grodner et al., 1996).* How long the activity lasts also determines what substrate is used during

the exercise bout. For example, the longer the time spent exercising, the greater the contribution of fat as the fuel. Athletes who consume a high fat diet typically consume fewer calories from carbohydrates *(Mahan & Escott – Stumps, 2004).*

Although the carbohydrates & fats are the main major fuels used for energy, studies indicate that protein use increases during exercise, & under certain conditions protein may contribute significantly to energy metabolism. Two factors that influence the use of protein as an energy source are the length of exercise & the carbohydrate content of the diet. The body may depend on protein for an increased percentage of energy in prolonged exercise (greater than 90 minutes), particularly when carbohydrate intake is low *(Dreon, 1989).*

Nutrition plays an important role in rendering the highest effectiveness of sports training, in accelerating the advances of restoration processes, in the upkeep of workability during competition loads and other problems of sports practice. Proper nutrition is essential to help athletes recover from workouts and competitions. In athletes, an adequate intake of nutrients are essential for the maintenance of an appropriate nutritional status, optimal performance & recovery as well as the reduction of health risks associated with regular highly intensive exercise *(Fred Brouns, 2003).*

Material and Methods

The present study deals with energy balance among male & female players involved in different sports disciplines.

Selection & Grouping of Sample:

Players [both males & females] who were engaged in regular practice & participated in professional sport tournaments were taken as samples for the present study. The athletes were young players from different sports disciplines such as athletics, volleyball, cricket, judo, gymnastics, weight lifting, hurdle racing, half marathon, badminton, cross country etc. The subjects aged between 18-22 years were from a well known Physical Education Institution. Athletes who were participating in regular practice schedules & in many sports events from the past few years [players were in the field from last 3 – 7 years] were mainly of choice, data of which is shown in Table 1.

Table 1: Data on Meritorious Achievements of Female & Male Players classified Game-Wise

Sports Disciplines	University Level		State Level		National Level	
	No.	%	No.	%	No.	%
FEMALES [N = 13]						
Half Marathon (n=3)	3	100.00	3	100.00	0	0
Hurdle Racing (n=2)	2	100.00	2	100.00	0	0
Athletics (n=4)	3	75.00	3	75.00	0	0
Badminton (n=4)	2	50.00	2	50.00	0	0
MALES [N = 46]						
Athletics (n=7)	4	57.14	4	57.14	1	14.3
Badminton (n=4)	3	75.00	3	75.00	1	25
Cricket (n=6)	5	83.33	5	83.33	0	0
Judo (n=5)	4	80.00	4	80.00	0	0
Judo & Gymnastics (n=6)	4	66.66	4	66.66	0	0
Volleyball (n=14)	11	78.57	11	78.57	0	0
Weight Lifting (n=4)	2	50.00	2	50.00	0	0

A total of 13 females & 46 males from various sports disciplines were chosen & surveyed. Game wise classification of subjects is shown in Table 2.

Table 2: Game-Wise Classification of Subjects

Sr. No.	Sports Disciplines	No. of Subjects	Age (yrs) Mean ± SD
	FEMALES [N = 13]		
1	Half Marathon	3	19.89 ± 0.95
2	Hurdle Racing	2	20.13 ± 1.62
3	Athletics	4	19.27 ± 1.00
4	Badminton	4	20.45 ± 1.00
	MALES [N = 46]		
1	Athletics	7	20.52 ±1.30
2	Badminton	4	21.87 ±0.50
3	Cricket	6	20.98 ±1.40
4	Judo	5	21.02 ±1.70
5	Judo / Gymnastics	6	21.00 ±1.20
6	Volleyball	14	20.39 ±1.50
7	Weight Lifting	4	21.08 ±0.50

Study Protocol:

Major areas of the study protocol were as follows: -

- General Information
- Data on Sports
- Dietary Information
- Recording body weight & height of players
- Energy Expenditure (through Daily Activity Schedule)
- Statistical Analysis

For collecting information, an interview schedule was designed to elicit information from all players on their socioeconomic background, sport profile (information regarding time & duration of subject's engagement in the chosen sport/s, their daily routine, hours of practicing a game, their meritorious achievements etc.), dietary profile, anthropometric measurements such as body weight & height & energy expenditure pattern.

Players were nutritionally assessed as follows -

Dietary Survey:

Precise information on food consumption pattern of subjects was gathered through three day dietary recall method. The intake of macro nutrients viz., carbohydrate, protein & fat was computed using the values given in the Nutritive Value of the Indian Foods *(Gopalan et. al., 2004).* Energy intake was computed for all players. Means were derived & nutrient intakes were compared with their respective RDAs *(Satyanarayana, 1991).*

Under anthropometric data, following measurements were taken:-

- Body weight
- Standing height

Body mass index (BMI) values were calculated. Measurements were compared with NCHS/ICMR standards *(NCHS / ICMR Standards, 2004).*

Energy Expenditure Pattern:

The time allocation pattern (TAP) was used to calculate the total energy expenditure through three days daily activity schedule. The TAP i.e., recording of the time spent by each individual in various day–to-day physical activities both in occupational (training) & non-occupational (routine) hours was done for each athlete separately. The total daily energy expenditure (TEE) was measured by recording the TAP *(Venkata Ramana et. al., 2004).* This information was recorded by asking all the daily activities, he/she had performed. Energy expenditure of each subject was calculated using three days daily activity schedule & means were derived. Reference energy expenditure values of various activities were used for calculation *(Katch & McArdle, 1983; Torun, 1989; Durnin, 1994; Ghafoorunissa & Krishnaswamy, 2004).* Energy expenditure/minute values were

adjusted to body weight of subjects & then for each routine & sports activity, energy expenditure was calculated & compared with energy intake.

Statistical Appraisal of Data:

Data was collected, tabulated & grouped based on game-wise classification of subjects. Means & standard deviation values were calculated. Minimum, maximum, range values & percentages were taken out. Comparisons were made with the available standards. Student's 't' test was applied to see the differences. The difference was tested at both 1% & 5% levels of significance.

Results and Discussion

Table 3: Mean Height, Weight & Body Mass Index [BMI] Values of Sports Persons (Females & Males) Classified Game Wise

Sr. No.	Sports Disciplines	Mean Age (Years)	Height (cm)		Weight (kg)		BMI (kg / m²)
			Mean ± SD	* Std	Mean± SD	** Std	Mean ± SD
			FEMALES [N = 13]				
1	Half Marathon (n=3)	19.9	162.56 ± 1.22 *R = 160.62 - 162.56*	164	50.0 ± 3.6 *R = 47 - 55*	53	19.47 ± 1.06 *R =18.59 – 20.95*
2	Hurdle Racing (n=2)	20.2	158.75 ± 1.53 *R = 157.48 – 160.02*	164	51.5 ± 8.5 *R = 43 - 60*	55	22.5 ± 5.5 *R = 17.0 – 27.95*
3	Athletics (n=4)	19.3	152.4 ± 3.1 *R = 144.78 – 157.48*	164	44.8 ± 5.6 *R = 40 - 54*	41.4	20.02 ± 1.5 *R = 18.22 – 22.18*
4	Badminton (n=4)	20.5	157.48 ± 6.1 *R = 154.97 – 162.56*	164	43.0 ± 3.3 *R = 39 - 48*	49.7	20.01 ± 3.8 *R = 16.88 – 26.25*
			MALES [N = 46]				
1	Athletics (n=7)	20.6	167.64 ± 12.2 *R = 175.26 – 180.34*	177	60.0 ± 7.0 *R = 45 - 68*	55.3	20.4 ±1.6 *R = 16.9 – 21.7*
2	Badminton (n=4)	21.9	167.64 ± 9.2 *R = 167.67 – 172.72*	177	61.0 ± 8.5 *R = 51 - 74*	55.3	19.9 ± 2.3 *R = 17.7 – 23.7*
3	Cricket (n=6)	21.0	167.64 ± 9.2 *R = 154.94 – 170.26*	177	52.5 ± 1.2 *R = 51 - 54*	55.3	19.0 ± 1.6 *R = 17.6 – 21.0*
4	Judo (n=5)	21.03	165.1 ± 6.1 *R = 160.02 – 167.64*	177	61.2 ± 6.3 *R = 53 - 73*	52.6	21.6 ± 2 *R = 19.03 – 24.8*
5	Judo & Gymnastics (n=6)	21.0	165.1 ± 6.1 *R = 160.02 – 167.64*	177	50.5 ± 0.1 *R = 48 - 58*	52.6	20.0 ± 1.5 *R = 16.7 – 20.7*
6	Volleyball (n=14)	20.4	170.18 ± 6.1 *R = 162.56 – 175.26*	177	50.7 ± 0.2 *R = 50 - 75*	58	22.5 ± 1.5 *R = 19.4 – 24.6*
7	Weight Lifting (n=4)	21.1	170.18 ± 6.1 *R = 162.56- 175.26*	177	50.6 ± 0.2 *R = 52 - 74*	58	23.4 ± 2.7 *R = 19.2 – 26.4*

R- Range, Std- Standard, *- NCHS / ICMR Standards [height for age], 2004., **- NCHS / ICMR Standards [weight for height], 2004

Physical Attributes of Male & Female Players:

The height of an individual is influenced both by genetic (hereditary) and environmental factors *(Bamji et. al., 2005)*. Table 3 shows mean values of height, weight & body mass index of female & male players classified game-

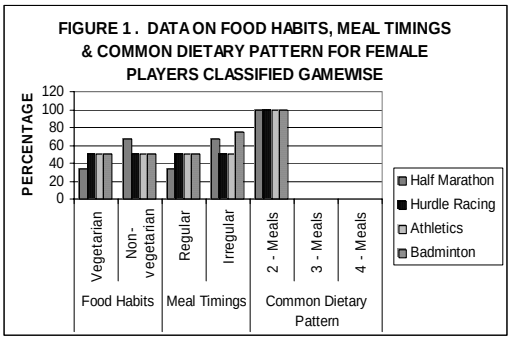
wise. For both females and males, NCHS/ICMR standards of height for age and weight for height were used for comparisons. From the table it can be seen that all females from different sports disciplines were shorter than the standard height for their age with significant difference at 1 % level ($t = 3.75$, $p<0.01$). For female players, it can be seen that players who were involved in half marathon were tallest among all (162.56 ± 1.22 cm) while female players involved in athletics were the shortest (152.4 ± 3.1 cm).

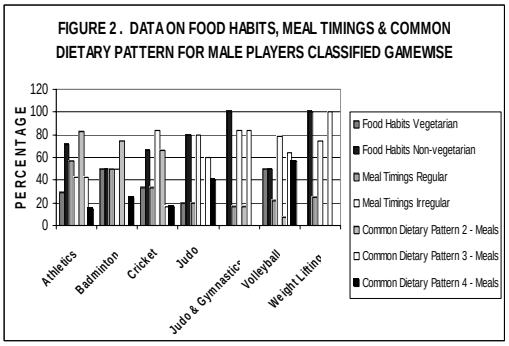
It was found that with the exception of players involved in athletics (44.8±5.6 kg), the rest of female players involved in different sports disciplines showed mean weight values less than the respective standards. However, the differences were insignificant at both 5 % and 1% levels of significance ($t = 0.42$).

It is evident from Table 3 that all seven groups of different sports disciplines of male players showed mean height values for their age significantly less than the respective standards at both 5% and 1% levels of significance ($t=9.52$). Male players from sports groups - athletics, badminton and judo had mean weights more than the given standards for their height.

An attempt had been made to calculate BMI for female & male players. With the exception of half marathon group, other three groups of female players had a mean BMI values as normal. Amongst male players almost all groups had normal mean BMI values. However, even though involved in University/State levels, few players, irrespective of sex & game, had BMI ranged between 16 (chronic energy deficient) to 19 (underweight). It is said that BMI correlates better with body fat than desirable body weight *(Bamji et. al., 2005)*.

Energy Intake of Male & Female Players:





Figures 1 & 2 depict data on food habits, meal timings & common dietary pattern for female & male players respectively. Majority of male players were found non vegetarian. Even though timely consumption of food is required for better athletic performance, maximum players – both females & males – showed irregular meal timings which can be attributed to college & practice schedules. 100% females had dietary pattern of two meals whereas variability was noticed for the same among male players.

Based on food intake data, intakes of energy were calculated for all groups of players. Macro nutrients viz., carbohydrate, protein & fat were computed. Data for females is shown in Table 4. One can clearly point out that irrespective of the sport group, female players showed mean intakes of energy

below their respective RDA's (t=3.62, p<0.01). Percent energy deficit among female players ranged from 8.54 to 58.94 for half marathon & athletics groups respectively. The main sources of energy in their diets were mainly cereals such as wheat and rice; pulses & legumes & oils.

Irrespective of the sports disciplines, male players failed to meet their energy requirements as mean energy intakes were found less than the respective RDAs (t = 8.05, p<0.01) (Table 5). Athletics was the group of male players with highest mean energy intake (2482.6 ± 243.7 kcal) and volleyball was the group with lowest mean daily intake of energy (2008.3 ± 300.4 kcal).

Table 4: Mean Daily Intake of Energy, Carbohydrate, Protein & Fat for Female Players Classified Game Wise

Sports Disciplines	Energy (Kcal)			Carbohydrate (gm)			Protein (gm)			Fats (gm)		
	Mean ± SD	RDA	% Excess or Deficit	Mean ± SD	RDA	% Excess or Deficit	Mean ± SD	RDA	% Excess or Deficit	Mean ± SD	RDA	% Excess or Deficit
Half Marathon (n=3)	**1240.3 ± 232.8**	**3021**	**-58.94**	**217.4 ±57.90**	**424**	**-48.73**	**47.4 ±1.30**	**95**	**-50.10**	**50.5 ±2.90**	**90**	**-43.88**
Hurdle Racing (n=2)	**1862.5 ± 0.5**	**3300**	**-43.56**	**291.9 ±6.71**	**440**	**-33.66**	**49.0 ±9.60**	**99**	**-49.69**	**51.3 ± 3.06**	**94**	**-45.42**
Athletics (n=4)	**1701.2 ± 133.6**	**1860**	**-8.54**	**254.9 ± 32.04**	**330**	**-22.76**	**47.7 ±2.03**	**75**	**-36.40**	**50.2 ±1.20**	**70**	**-28.28**
Badminton (n=4)	**1965.3 ± 251.6**	**2700**	**-27.21**	**306.2 ± 51.60**	**348**	**-12.01**	**57.8 ±15.6**	**75**	**-22.94**	**51.0 ± 4.20**	**85**	**-40.00**

RDA's referred from Satyanarayana (1991)

Table 5: Mean Daily Intake of Energy, Carbohydrate, Protein & Fat for Male Players Classified Game Wise

Sports Disciplines	Energy (Kcal)			Carbohydrate (gm)			Protein (gm)			Fats (gm)		
	Mean ± SD	RDA	% Excess or Deficit	Mean ± SD	RDA	% Excess or Deficit	Mean ± SD	RDA	% Excess or Deficit	Mean ± SD	RDA	% Excess or Deficit
Athletics (n=7)	**2482.6 ± 243.7**	**3318**	**-25.18**	**422.3 ±34.9**	**442**	**-4.45**	**67.9 ±4.03**	**99**	**-31.41**	**51.4 ±2.2**	**94**	**-45.31**
Badminton (n=4)	**2351.4 ±241.9**	**3318**	**-29.13**	**399.6 ±55.3**	**442**	**-9.59**	**64.4 ±4.06**	**99**	**-34.94**	**51.7 ±2.9**	**94**	**-45.00**
Cricket (n=6)	**2322.8 ± 206.4**	**-**	**-**	**397.9 ±52.2**	**-**	**-**	**64.4 ±8.4**	**-**	**-**	**49.5 ±3.0**	**-**	**-**
Judo (n=5)	**2273.8 ± 131.9**	**2998**	**-24.15**	**375 ± 37.2**	**420**	**-10.54**	**58.7 ±6.0**	**105**	**-44.09**	**52.08 ± 4.2**	**90**	**-42.13**
Judo & Gymnastics (n=6)	**2092.4 ± 404.2**	**2788**	**-24.06**	**342.2 ± 101.2**	**420**	**-18.52**	**55.1 ±5.3**	**105**	**-47.52**	**51.3 ±3.2**	**90**	**-43.00**
Volleyball (n=14)	**2008.3 ± 300.4**	**3596**	**-44.15**	**325.8 ± 73.0**	**464**	**-29.78**	**53.6 ±5.6**	**127**	**-57.79**	**49.2 ±4.3**	**99**	**-50.3**
Weight Lifting (n=4)	**2170.5 ± 295.4**	**3596**	**-39.64**	**258.02 ± 49.8**	**464**	**31.41**	**61.09 ± 2.02**	**127**	**-51.89**	**50.3 ±2.9**	**99**	**-49.19**

RDA's referred from Satyanarayana (1991)

Intake of Energy Yielding Nutrients:

It is noticed from Tables 4 & 5 that irrespective of sports disciplines, all

female & male players showed mean intakes of carbohydrate ($t = 0.87$, $p>0.05$ for females & $t = 1.79$, $p>0.05$ for males), protein ($t = 5.1$ $p<0.01$, for females & $t = 8.8$, $p<0.01$ for males) & fat ($t = 7.4$, $p<0.01$ for females & $t = 9.66$, $p<0.01$ for males) less than their RDAs. The main sources of protein in their diets were mainly pulses & those who were non-vegetarian were occasionally consuming egg, chicken, mutton or fish.

Range of % deficit in female & male players was found to be between 12.01–48.73 % & 4.45–31.41 % respectively for carbohydrate; 22.94–50.1 % & 31.41–57.79 % respectively for protein & 28.28–45.42% & 42.13–50.3 % respectively for fat intake.

To maintain concentration and replacement of muscular glycogen, carbohydrate intake should be of 500-800 gm/day. Low-carbohydrate diets may compromise physical performance, causing negative effects in those who practice physical activities *(Coleman, 1989; Sherman, 1989; Harkins, 1993; Position Statement of the American Dietetic Association and Canadian Dietetic Association, 1993; Burke, 1997).* Highest mean intakes amongst female players were found to be 306.2±51.6 g for carbohydrate, 57.8±15.6 g for protein & 51.3±3.06 g for fat respectively. Highest mean intakes amongst male players were found to be 422.3±34.9 g for carbohydrate, 67.9±4.03 g for protein & 52.08±4.2 g for fat respectively.

Table 6: Percentage of Energy Derived From Carbohydrates, Protein & Fat for Female & Male Players Classified Game Wise

Sports Disciplines	Percent Energy Derived From		
	Carbohydrate	Protein	Fat
Half Marathon	**49.0**	**15.0**	**36.0**
Hurdle Racing	**62.8**	**12.4**	**24.8**
Athletics	**60.0**	**13.2**	**26.8**
Badminton	**62.8**	**16.8**	**20.4**
Athletics	**68.6**	**12.8**	**18.6**
Badminton	**68.0**	**11.0**	**21.0**
Cricket	**68.5**	**12.3**	**19.2**
Judo	**67.1**	**12.0**	**20.9**
Judo & Gymnastics	**66.9**	**10.8**	**22.3**
Volleyball	**66.8**	**11.2**	**22.0**
Weight Lifting	**67.1**	**11.0**	**21.9**

Percent Energy Derived From Carbohydrate, Protein & Fat:

An attempt had been made to calculate the percent of calories derived from mean intakes of three major nutrients for both female & male players classified game-wise. Table 6 shows the percent values of energy derived from carbohydrate, protein & fat for female & male players' classified game wise. Percent energy derived from carbohydrate was found to range between 49–62.8 % for females & 66.8–68.55% for males. The amount of carbohydrate required depends on the athlete's total daily energy expenditure, type of sport, gender, & environmental conditions.

Mean % energy derived from protein was found to range from a minimum of 12.4 % to a maximum of 16.8 % amongst male players involved in different sports disciplines. Judo & gymnastic group of males showed lowest mean energy % value from protein. It is evident from Table 6 that almost all groups of males had energy % from protein on lower side. A minimum of 12.4% & a maximum of 16.8% calories from protein were calculated for female players. More recent work suggests that persons who exercise at a higher intensity have protein needs that might be greater *(Tarnopolsky, 1994; Rasmussen, 2000; Tipton, 2001).* However, organizations such as the American College of Sports Medicine (ACSM), American Dietetic Association (ADA), and Dietitians of Canada (DC) have concluded that athletes have only slightly higher protein requirements than do non athletes *(Mahan & Escott – Stumps, 2004).*

Athletics is the group of male players with less mean percent of energy derived from fat (18.6%) & judo & gymnastics is the group which had highest mean percentage of energy derived for fat (22.3%). Among female players, half marathon group had highest mean % energy derived from fat (36%). Because each athlete is different; some may eat less and some slightly more than 30% of their calories from fat. Many athletes cannot get calories they need without eating a little extra fat. However, fat intakes greater than 35% of total calories have been associated with increasing risk of certain diet-related diseases. High fat intakes also have been shown to reduce endurance capacity *(Position Statement of the American Dietetic Association and Canadian Dietetic Association, 1993; Boyle, 2000).*

Energy Expenditure Pattern of Male & Female Players:

Physical activity by means of training or competition increases the daily energy expenditure depending on physical fitness, duration, type & intensity of sports. For this reason, athletes must adopt their energy intake by increased food consumption, according to the level of daily energy expenditure, in order to meet energy needs. This increased food intake should be well balanced with respect to the macronutrients (carbohydrate, fat & protein) & micronutrients (vitamins, minerals & trace elements) *(Fred Brouns, 2003).*

Energy Expenditure for Routine Activities:

Tables 7 & 8 show mean time spent and energy expenditure for a day for different routine activities respectively by female and male players classified game-wise. Differences were noted for time spent on different routine activities by different sports groups. It can be seen that majority of female and male players spent considerable amount of time for chatting, grooming and personal needs as well as for reading, watching T.V. and sleeping. Other different routine activities included ascending stairs, descending stairs, drinking, eating, driving as well as reading, writing, walking and cycling; personal needs included bathing, brushing, toileting etc.

For female players, mean total time spent (TSS) on routine activities is similar i.e. 1290 minutes/day. However, irrespective of same amount of TSS on routine activities by female players, EERA differed. It can be seen from Table 8, that athletics is the group of females who expended highest amount of energy on routine activities (1901.45 kcal).

However, this group did not have highest mean body weight. Female badminton players had the lowest mean value of EERA (1433.25 kcal).

Table 7. Mean Time Spent (minutes / day) For Different Routine Activities by Female & Male Players Classified Game Wise

Sports Disciplines	Mean Time Spent On Routine Activities (minutes / day)																* T.T.S
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
FEMALES [N = 13]																	
Half Marathon (n=3)	8.4	21.7	8.4	50	31.7	8.4	11.5	16.5	18.4	30.0	100.0	60.0	590	35.0	160	140.0	1290
Hurdle Racing (n=2)	2.5	15.0	5.0	112	12.5	3.5	5.0	10.0	0.0	15.0	185.0	123.5	600	30.0	128	42.5	1290
Athletics (n=4)	7.5	23.8	7.5	186	31.0	7.5	15.3	17.5	3.8	32.5	157.5	63.8	480	31.3	135	90.0	1290
Badminton (n=4)	7.5	16.3	7.5	180	2.5	42.0	16.4	13.8	0.0	25.0	97.5	78.5	560	35.0	140.5	67.5	1290
MALES [N = 46]																	
Athletics (n=7)	4.3	17.9	9.3	183	21.5	4.3	13.6	15.0	47.2	30.0	197	93.0	463	49.3	77.2	34.3	1260
Badminton (n=4)	8.8	13.8	6.3	220	30.0	8.8	15.0	12.6	7.5	36.3	135	94.5	450	55.8	95.6	85.0	1275
Cricket (n=6)	9.2	15.0	7.6	207	15.9	9.2	14.2	12.6	70.0	30.0	160	47.6	480	46.7	75.0	60.0	1260
Judo (n=5)	7.5	17.0	8.0	267	22.0	7.5	15.0	13.0	60.0	27.0	144	57.0	480	63.0	60.0	72.0	1320
Judo & Gymnastics (n=6)	8.4	12.6	5.9	205	17.6	8.4	15.0	13.4	65.0	30.7	190	45.0	490	33.0	130.0	50.0	1320
Volleyball (n=14)	5.3	17.2	8.6	187	16.8	5.3	15.4	14.5	48.9	30.0	197	81.5	450	45.5	85.8	51.5	1260
Weight Lifting (n=4)	7.0	22.5	7.6	205	11.5	7.0	17.6	17.6	35.4	29.0	210	67.6	405	37.2	105.0	75.0	1260

NOTE :-

A	Ascending Stairs	D	Chatting	G	Dressing	J	Eating	M	Sleeping
B	Bathing	E	Cycling	H	Drinking	K	Grooming & Personal needs	N	Walking
C	Brushing	F	Descending Stairs	I	Driving	L	Reading	O	Watching TV
*T.T.S.	Total Time Spent On Routine Activities (minutes/day)							P	Writing

Table 8: Mean Energy Expenditure (kcal / day) for different Routine Activities by Female & Male Players Classified Game Wise

Sports Disciplines	Weight (kg) M ± SD	Energy Expenditure For Routine Activities (kcal/day)																*EERA
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
FEMALES [N = 13]																		
Half Marathon (n=3)	50.0 ± 3.6	30.2	45.6	24.4	56.5	113.8	18.9	24.0	20.1	38.5	33.9	173.0	67.8	448.4	73.5	180.8	158.2	1507.6
Hurdle Racing (n=2)	51.5 ± 8.5	9.2	32.4	15.0	130.5	46.1	8.1	10.8	21.5	0.0	26.7	329.3	143.8	468.0	64.8	148.5	49.3	1503.8
Athletics (n=4)	44.8 ± 5.6	24.1	44.9	19.5	187.9	99.5	15.0	28.6	38.7	3.8	50.4	244.1	64.4	326.4	58.8	136.4	558.9	1901.5
Badminton (n=4)	43.0 ± 3.3	23.1	29.3	18.8	174.6	7.7	80.6	32.3	21.2	0.0	37.0	144.3	76.1	325.0	63.0	136.3	263.9	1433.3
MALES [N = 46]																		
Athletics (n=7)	60.0 ± 7	18.5	45.1	32.5	247.3	92.5	11.5	34.0	21.9	118.0	40.5	407.8	125.6	421.2	123.3	104.2	46.3	1890.1
Badminton (n=4)	61.0 ± 8.5	38.4	34.8	22.4	301.4	131.1	24.0	38.1	18.6	19.1	49.7	284.9	129.5	414.0	142.8	131.0	116.5	1896.2
Cricket (n=6)	52.5 ± 1.2	34.6	33.0	23.2	244.3	59.8	21.6	31.1	16.1	153.3	35.4	289.6	56.2	364.8	102.7	88.5	70.8	1624.9
Judo (n=5)	61.2 ± 6.3	32.9	43.7	28.5	368.5	96.6	20.6	19.2	19.4	188.4	37.3	303.8	78.7	446.4	161.9	82.8	99.4	2027.9
Judo & Gymnastics (n=6)	50.5 ± 0.13	30.2	26.7	17.3	233.7	63.7	19.0	31.7	16.5	137.2	35.0	235.6	51.3	372.4	70.0	148.2	57.0	1545.4
Volleyball (n=14)	50.7 ± 0.16	19.3	36.5	25.4	212.6	61.2	12.0	32.5	17.8	103.2	345.1	345.1	92.9	346.5	96.9	97.8	58.7	1903.4
Weight Lifting (n=4)	50.6 ± 0.19	25.4	47.7	22.3	233.7	41.7	15.8	37.1	21.6	74.7	367.5	367.5	77.1	77.1	78.9	119.7	85.5	1693.3

NOTE

A	Ascending Stairs	E	Cycling	I	Driving	M	Sleeping	O	Watching T.V.
B	Bathing	F	Descending Stairs	J	Eating	N	Walking	P	Writing
C	Brushing	G	Dressing	K	Grooming & Personal needs	FERA	Energy expenditure for routine activities (kcal)		
D	Chatting	H	Drinking	L	Reading				

Table 9: Mean Time Spent (minutes/day) For Different Sports Activities by Female & Male Players Classified Game Wise

Sports Discipline	Mean Time Spent On Sports Activities (minutes / day)												* PERT	** T.T.S
	A	B	C	D	E	F	G	H	I	J	K	L		
FEMALES [N = 13]														
Half Marathon (n=3)	4	4.4	0	12.4	12.4	65	30	0	0	8.4	8.4	0	5	150
Hurdle Racing (n=2)	3.5	4	0	12	10	70	0	5	20	7.5	7.5	0	10.5	150
Athletics (n=4)	6	7.5	0	10	15	50	18.8	16.3	7.5	3.8	3.8	0	11.3	150
Badminton (n=4)	5	5	0	5	3	80	12	15	5	5	5	0	10	150
MALES [N = 46]														
Athletics (n=7)	6	6	11	15.8	11.5	38.5	31	25.2	16	2.9	6	4.3	5.8	180
Badminton (n=4)	6.2	8.5	11.2	8.8	16.3	16.3	25.8	26	12.6	1.3	6	11	15	165
Cricket (n=6)	6	5	11	11	21	21	30	31	16	0	6	11	11	180
Judo (n=5)	12	12	20	4	15	15	0	15	2	8	8	9	0	120
Judo & Gymnastics (n=6)	10	15	15	0	10	31	0	16	0	6	6	11	0	120
Volleyball (n=14)	15	15	10	15	30	60	0	10	5	10	10	0	0	180
Weight Lifting (n=4)	15	15	20	10	10	60	0	0	0	20	10	10	10	180

NOTE

A	Bending (Sitting)	E	Jumping	I	Running Fast	*PERT	Post Exercise Resting Time
B	Bending (Standing)	F	Practice (Light)	J	Stretching (Standing)		
C	Dips	G	Practice (Heavy)	K	Stretching (Sitting)	**T.T.S.	Total Time Spent On Sports Activities (Minutes/Day)
D	Jogging	H	Running Slow	L	Sit-ups		

Table 10: Mean Energy Expenditure (kcal / day) For Different Sports Activities by Female & Male Players Classified Game Wise

Sports Discipline	Weight (Kg) M ± SD	Energy Expenditure For Routine Activities (kcal/Day)												* PERT	** EESA
		A	B	C	D	E	F	G	H	I	J	K	L		
FEMALES [N = 13]															
Half Marathon (n=3)	50.0± 3.6	20.8	22.5	0.00	138.9	72.5	282.8	252.3	0.0	0.0	43.7	37.8	0.0	19.2	890.4
Hurdle Racing (n=2)	51.5 ± 8.5	18.72	21.4	0.00	138.0	60.2	312.9	0.00	30.3	195.6	40.1	34.4	0.0	41.4	892.9
Athletics (n=4)	44.8± 5.6	27.9	34.9	0.00	100.3	78.6	194.0	116.7	85.9	63.8	17.7	15.1	0.0	38.8	773.7
Badminton (n=4)	43.0± 3.3	22.4	22.4	0.00	48.15	15.1	298.4	46.9	75.9	42.1	22.4	19.1	0.0	32.9	645.6
MALES [N = 46]															
Athletics (n=7)	60.0± 7.0	37.4	37.4	83.2	212.4	80.7	200.2	243.7	177.9	182.4	18.1	32.0	26.7	26.6	1358.8
Badminton (n=4)	61.0± 8.5	39.3	53.9	86.0	120.2	116.2	86.2	174.7	186.9	146.0	8.2	32.5	69.6	70.1	1189.8
Cricket (n=6)	52.5± 1.2	32.6	27.2	72.7	129.4	128.9	95.6	90.0	191.6	159.5	0.0	28.0	59.8	44.2	1059.5
Judo (n=5)	61.2± 6.3	76.5	76.3	154.2	54.8	107.4	79.7	0.0	108.0	19.2	50.9	43.5	57.2	0.0	827.6
Judo & Gymnastics (n=6)	50.5± 0.1	52.5	78.8	94.5	000.0	59.0	135.8	0.0	95.0	0.0	31.5	26.9	57.6	0.0	631.6
Volleyball (n=14)	50.7± 0.2	79.1	79.1	63.8	170.3	177.9	264.0	0.0	59.7	48.2	52.7	45.1	0.0	0.0	1039.7
Weight Lifting (n=4)	50.6 ± 0.2	78.9	78.9	127.4	113.3	59.2	263.4	0.0	0.0	0.0	105.0	45.0	52.5	38.7	962.3

NOTE

A	Bending (Sitting)	E	Jumping	I	Running Fast	*PERT	Post Exercise Resting Time
B	Bending (Standing)	F	Practice (Light)	J	Stretching (Standing)		
C	Dips	G	Practice (Heavy)	K	Stretching (Sitting)	**EESA	Energy Expenditure For Sports Activities (kcal)
D	Jogging	H	Running Slow	L	Sit-ups		

Table 11: Data on Mean Body Weight, Total Energy Intake, Total Energy Expenditure & Energy Balance for Female & Male Players Classified Game-Wise

Sr. No.	Sports Disciplines	Body Weight (kg)	Total Energy Intake (kcal)	Total Time Spent On Routine Activities [minutes]	Total Time Spent On Sports Activities [minutes]	Total Time Spent [minutes]	Energy Expenditure (kcal) * EERA	** EESA	*** TEE	Energy Balance (kcal)
					FEMALES [N = 13]					
1	Half Marathon	50.0	1240.3	1290	150	1440	1507.57	890.38	2397.95	-1157.65
2	Hurdle Racing	51.5	1862.5	1290	150	1440	1503.83	892.96	2396.79	-534.29
3	Athletics	44.8	1701.2	1290	150	1440	1901.45	773.67	2675.12	-973.92
4	Badminton	43.0	1965.3	1290	150	1440	1433.25	645.56	2078.81	-113.51
					MALES [N = 46]					
1	Athletics	60.0	2482.6	1260	180	1440	1890.07	1358.78	3248.85	-765.25
2	Badminton	61.0	2351.4	1275	165	1440	1896.19	1189.84	3086.03	-734.63
3	Cricket	52.5	2322.8	1260	180	1440	1624.94	1059.47	2684.41	-361.61
4	Judo	61.2	2273.8	1320	120	1440	2027.88	827.62	2855.50	-581.7
5	Judo & Gymnastics	50.5	2092.4	1320	120	1440	1545.35	631.65	2177.00	-84.6
6	Volleyball	50.7	2008.3	1260	180	1440	1903.44	1039.70	2943.14	-934.84
7	Weight Lifting	50.6	2170.5	1260	180	1440	1693.27	962.30	2655.57	-485.07

*EERA- Energy Expenditure for Routine Activities, **EESA- Energy Expenditure for Sports Activities, ***TEE –Total Energy Expenditure

For male players involved in different sports disciplines, it can be seen from Table 8 that judo and & gymnastics groups had highest total mean time spent on routine activities (1320.0 minutes/day). Males engaged in judo showed highest mean EERA (2027.88 kcal). The same group also showed highest value of mean body weight (61.2 kg). Even though, being one of the groups with highest mean TSS on routine activities judo & gymnastic group of males showed lowest mean EERA(1545.35 kcal) which can be attributed to low mean body weight (50.5 kg).

Energy Expenditure for Sports Activities:

Tables 9 & 10 show mean time spent and energy expenditure for different sports activities respectively for female and male players classified game-wise. Mean time spent on various sports activities such as work-outs like jumping, jogging, dips, running (fast/slow), sit-ups, stretching exercises, post exercise resting etc. was recorded.

For female players it can be seen that almost all sports groups spent considerably larger amount of time on individual game practice (both light and heavy). Similar observations were made for male players engaged in different sports disciplines. It is clear from Table 10 that irrespective of the sex & game considerable amount of energy was expended on jogging & jumping. EE on light practice by females was found to be less than that on heavy practice. Similarly, among male players, athletics & badminton showed higher mean value of EE on heavy practice. These findings could be attributed to the fact that longer the time spent for game practice higher the energy expenditure.

Many athletic events are characterized by extremely high exercise intensities. As a result, energy expenditure over a short time period may

be extremely high *(Fred Brouns, 2003)*. It was noticed that considerable amount of calories were expended on running (fast/slow) and stretching exercises by both female & male players engaged in different sports disciplines. Mean EE for post exercise recovery time (PERT) was computed which was found out to range between 19.15–41.37 kcal for females & 26.62–70.05 kcal for male players.

Energy Balance:

Table 11 presents data on mean body weight, total energy intake, total energy expenditure & energy balance for female & male players classified game-wise. One can see that total time spent on sports activities ranged between 120-180 minutes, irrespective of sex & games. All groups of female players spent 1290 minutes/day on routine activities. For male players mean total time spent on routine activities ranged between 1260 to 1320 minutes/day.

Athletics is the group of female players which showed highest TEE which can be attributed to its highest mean value of EERA (2675.12 & 1901.45 kcal respectively). Even though with similar amount of mean TTS on sports activities, female badminton players showed lowest mean EESA & TEE values (645.56 & 2078.81 kcal respectively) which can be attributed to the group's lowest mean body weight (43 kg) & highest mean EI (1965.3 kcal). Highest EESA by female hurdle racers could be because of their highest mean body weight (892.96 kcal & 51.5 kg respectively). However, similar group had lowest EERA (1503.83).

Higher is the body weight larger is the EE seems to be true for male judo players as far is EERA is concerned (61.2 kg & 2027.88 kcal). Lower the body weight lower the EE was the case for male judo & gymnastic players for EESA (50.5 kg & 631.65 kcal) & EERA (1545.35 kcal) despite the higher TTS on routine activities (1320 minutes). Sport demands considerable higher EE. Athletics group of male players showed highest mean EESA, TEE & EI values (1358.78, 3248.85 & 2482.6 kcal respectively). Calorie requirements vary greatly from person to person and are affected by activity level, body size, age and climate. Body size impacts on calorie requirements more than any other single factor. Some sports demand high energy expenditure, others do not. If intake is consistently above or below an athlete's requirement, weight gain or weight loss will occur, both of which can affect performance *(Venkata Ramana et. al., 2004)*.

100% of female & male players engaged in different sports disciplines showed negative energy balance, the minimum of which was for badminton group for females & judo & gymnastics for males (-113.51 & -84.6 kcal respectively) and that of maximum was recorded for half marathon group among females & volleyball among males (-1157.65 & 934.84 kcal respectively). The needs of an athlete in energy & nutritional substances essentially differ depending first of all upon the kind of sport & the amount of work performed. The energy derived from carbohydrate, protein & fat should always be in proportion to that of energy expenditure by an individual athlete with respect to his/her energy requirements for whole day activity schedule & to the process of performing physical exercise *(Chandrashekhar & Bhargava, 1988; Simopoulous & Pavlou, 1993)*.

Energy expenditure for routine activities (EERA), & sports activities

(EESA) by both female and male players was found to be influenced by mean body weight, amount of time spent and the type & intensity of sport in which the players were engaged.

Energy intake of the players therefore should be regulated with specific distribution of carbohydrate, protein & fat calories so as to maintain their body weight, meet the energy requirements of both routine & sports activities as well as enhance their performance.

Conclusion

The importance of the relationship between nutrition & exercise performance is obvious. Good nutrition is essential to proper growth & development. Too often, coaches think of good nutrition only during the season of their sport. Actually, for effective athletic performance, good nutrition is critical at all times.

For the present study, irrespective of the game, all female & male players were found to be shorter than the required height for age. Similar results were obtained for body weights for female players. Male players showed better body weight profile. Irrespective of sex & sports disciplines, mean intakes of energy were found to be considerably less than the respective RDAs for sports persons. EE was found to be directly related to time spent on activities, type & intensity of exercise & body weight. Highest TEE was found to be related with highest EERA in case of female athletics group. Lowest mean EESA, EERA & TEE value of female badminton players could be attributed to lowest mean body weight of the group. Body weight was found to be directly proportional to EE in case of male judo players whose EERA was computed as highest with highest mean body weight. However, judo & gymnastic male players whose EESA & EERA values were computed as lowest also had lowest mean body weight. All female & male players engaged in different sports disciplines reflected negative energy balance.

For competitive athletes, the diet must provide the optimal mix of energy yielding nutrients to fuel their special needs. To maximize performance, athletes strive to achieve an optimum sport specific body size, body composition & minimum of energy stores. To peruse these objectives, athletes need to manage fat, protein & carbohydrate balance. To guide their progress, athletes need to eat by discipline.

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Accessory Head of Flexor Pollicis Longus Muscle

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Abstract

The superior extremity of man has undergone various modifications during evolution. The flexor pollicis is an important muscle of the hand. A cadaveric dissection study of 60 upper extremities was done to determine the incidence of occurrence, morphology and relations of the accessory head of the flexor pollicis muscle. The accessory head of the flexor pollicis longus was found to be present in 24 (40%) upper extremities. In all cases (except two where they were getting origin from the fascia around the median nerve) it was found to be fused with the other muscles of the flexor pronator group of the forearm. In one case two accessory bellies were present. The tendon of accessory belly was merging with the tendon of flexor pollicis longus in all cases. In a case where two bellies were present in that the tendon of second belly was merging with the tendon of flexor digitorum profundus. The accessory belly was getting nerve supply from median nerve in 8 cases (33.33%) directly and from the anterior interosseous nerve in 16 cases (66.7%). The accessory belly per se may cause entrapment neuropathy of median and anterior interosseous nerve.

Key Words: Flexor muscles, Human cadavers, Accessory head, Evolution, Volar incision, Entrapment neuropathy

Introduction

The superior extremity of man has undergone various modifications during evolution. The flexor pollicis is an important muscle for the function of hand. It is absent in primates such as gorilla and chimpanzee in whom a well developed flexor hallucis longus perform the same function as that of flexor pollicis longus performs in man *(Mangini, 1960).*

The flexor pollicis longus muscle is described as arising chiefly from grooved anterior surface of the radius extending from below its tuberosity to the upper attachment of pronator quadratus muscle and adjacent interosseous membrane. In addition the flexor pollicis longus muscle may have additional origin from the medial border of the coronoid process of the ulna or from the medial epicondyl of the humerus. As the muscle is traced downwards, the origin expands to cover the entire width of the anterior surface of the radius. A short distance above the wrist the tendon becomes rounded and free of muscle attachment and then passes behind the flexor retinaculum. The flexor pollicis longus inserts on the palmar surface of the base of the distal phalanx of thumb *(William et al., 2000).*

The accessory belly of muscle runs distally and obliquely from medial to lateral side underneath the flexor digitorum superficialis to join the principal flexor pollicis muscle and its tendon *(Hemmady, 1993).*

The flexor pollicis longus muscle is a comparatively recent acquisition in the evolution of hand. The study of its morphology is interesting from many view points, especially since it has definite clinical significance in injuries and surgical approaches around the elbow joint *(Mangini, 1960).*

The current study is concerned with the frequency of occurrence of accessory head of flexor pollicis longus muscle, its morphology, its relation to the structures of the proximal forearm and the clinical significance thereof.

Materials and Methods

For this study, 60 upper limbs of adult human cadavers (56 males and 4 females) were dissected. The dissection was done by using a volar incision extending from the distal arm to the insertion of flexor pollicis longus muscle. The accessory head was brought into view upon reflection of skin, superficial fascia, palmaris longus, flexor carpi radialis and flexor digitorum superficialis muscle. An attempt was made to trace the accessory head to its origin and its relation with other structures of the forearm was studied.

Results

Figure 1: Accessory Head of Flexor Pollicis Longus

An accessory head of flexor pollicis longus was present in 24 (40%) upper extremities. In 11 cases (10 males and 1 female cadaver) it was bilaterally present and in two cases (both male cadavers) it was present only on one side. Out of these two cases one belly was lying on right side of one cadaver and in another it was lying on left side. The proximal attachments of accessory head are tabulated below:

Total Number of Extremities Dissected	60	(%)
Accessory Head Present	24	40
Humero-Ulnar Origin	7	29.2
Humeral Origin Only	10	41.7
Ulnar Origin Only	1	4.2
From Under Surface Of Flexor Digitorum Superficialis	4	16.7
From Sheath Around The Median Nerve	2	8.33

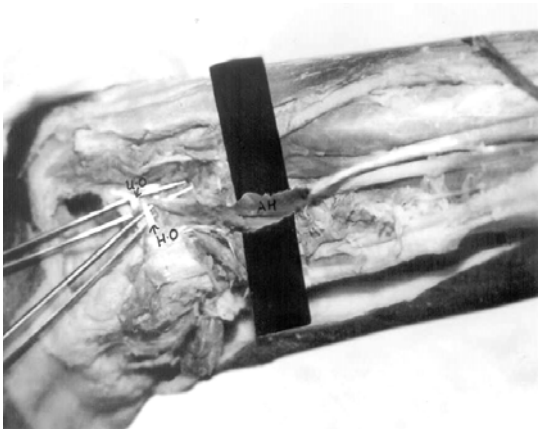

Figure 2: Humero-ulnar origin

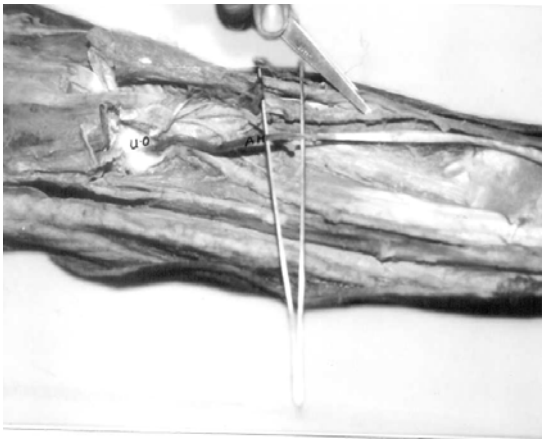

Figure 3: Ulnar origin

Figure 4: From under surface of flexor digitorum superficialis

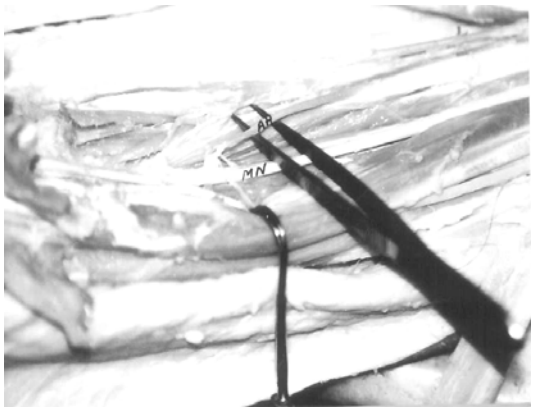

Figure 5: From sheath around the median nerve

In one case (41.2%) two accessory bellies were present. Both of them were gaining origin from the undersurface of flexor digitorum superficialis. In all cases (except two where they were getting origin from the fascia around the median nerve), it was found to be fused with the other muscles of the flexor pronator group of the forearm, probably because phylogenetically they have a common origin from the pronator flexor group of Hamphrey. In some cases they were so intimately blended that separation was extremely laborious. In all cases, the tendon of accessory belly was merging with the tendon of flexor pollicis longus on superior aspect of medial side except in one case where two bellies were present on left side. In that, tendon of one belly was merging with tendon of flexor pollicis longus on superior aspect of medial side and tendon of second belly was merging with tendon of flexor digitorum profundus about 3 cm above the wrist on lateral side.

The accessory belly was lying between median and anterior interosseous nerve. The nerve supply of accessory belly was from median nerve in 8 (33.33%) cases directly and fibres were entering from superficial surface of the belly and from anterior interosseous nerve in 16 (66.67%) cases entering through deep surface of belly.

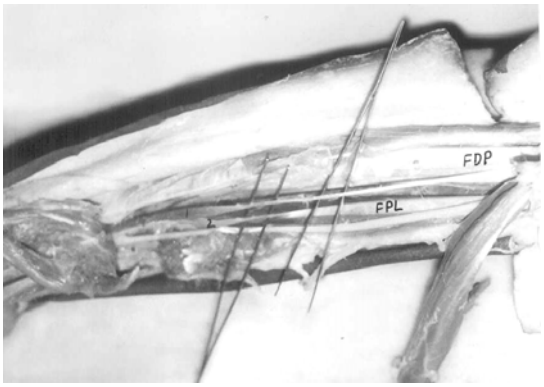

Figure 6: Two accessory bellies

Figure 7: Median nerve supplying the belly

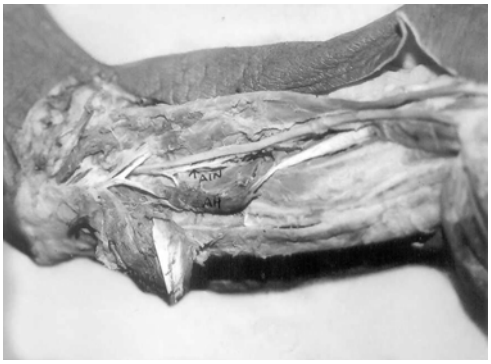

Figure 8: Nerve supply from anterior interosseous nerve

Discussion

The accessory belly of flexor pollicis longus was seen to be present more frequently (40%) than absent. The morphology and relations of this belly are of great importance from clinical point of view.

The accessory belly per se may cause entrapment neuropathy of the anterior interosseous nerve *(Crenshaw, 1992)*. Also cicatricial contraction of the accessory belly of the flexor pollicis longus muscle (as seen in Volkman's ischaemic contracture or following surgical or non-surgical trauma around the proximal forearm and elbow) may lead to entrapment of the median and anterior interosseous nerves since they are so closely related to this belly. In addition, the median nerve may get entrapped between the humeral origin of the accessory belly and flexor carpi radialis.

The presence of accessory belly has to be borne in mind during anterior approaches to the proximal radius and the elbow joint as also during a decompressive fasciotomy for compartment syndrome of the forearm.

Kaplan (1942) has described a case of a long standing flexion contracture of the interphalangeal joint of the thumb following a fracture dislocation of the elbow which was later found to be due to the cicatricial contraction of the accessory belly of the flexor pollicis longus and had to be subsequently elongated to correct the deformity. Hence in a flexion deformity of the thumb involvement of the accessory belly has to be kept in mind.

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Influence of Physical Education Teachers Training Programme on Leadership Quality of Trainee females

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Abstract

Participation of women in sports is gradually gaining acceptance in the society. Women can find an opportunity to develop leadership quality through Sports and Physical Education. In the present article an attempt has been made for possible development of leadership quality through Physical Education teachers' training programme. Eighteen female trainees of Physical Education course (B.P.Ed.) were the subjects'. Throughout one academic year of the course the subjects were monitored. Physical fitness, Sports Achievement motivation, anxiety and leadership quality were the criteria. Tests for all these aspects were measured before onset of the course and after completion of the course. Organised Physical Education programme in which the subjects participated has significantly improved physical fitness and psychological qualities but failed to develop desirable leadership qualities up to the optimum level.

Key Words: Female, Leadership, Teacher's Training, Achievements.

Introduction

The fact that girls and women can successfully compete in strenuous athletic activities without psychological and physiological harm is gradually gaining belated acceptance in our society. In the past female participation in sports and physical activity was discouraged mainly due to aesthetic and cultural reasons. The serious research on the consequence of female participation in competitive sports has just been utilized. Women have an ambivalent relationship to sport. Many women have experienced sport only through their school physical education programme, and found this, at best, a temporary pleasure, and at worst, painful irrelevances to the rest of their life. Worldwide opportunities in sports at all levels – locals to international are increasing for girls and women. Taboos and myths of the past are slowly being reversed.

Like many other countries in India scope and opportunities in physical education and sports were not only limited for women but also there were great social barrier mainly due to conservative attitudes of the males. The change in the global perspective from late 1950's made the education reformers to think positively towards physical education for women. Many women in India were courageous enough to select physical education as their profession against many social odds. Physical education and sports is the field where women not only find opportunity to be leaders in developing human values but also assume an assertive role as a professional leader.

Leadership has been thought of as a specific attribute of personality, a personality trait, that some persons possess and others do not, or at least that

some achieve in high degree and others scarcely at all *(Gibb, 1947).*

Leadership depends on attitude and habits of dominance in certain individuals and submissive behaviour in others *(Warren, 1934).* Leadership quality can be defined as the ability and readiness to inspire and guide others, individuals or groups, towards specific objectives. Leadership is partly a learned ingredient and is composed of a matrix of qualities. Since all learning is a result of doing and since leadership is partly a learned attributed there must be practice and training in leading. In physical education professional institutes such training is being provided so that the trainee become a professional and at the same time to develop qualities to lead the profession. A number of researchers have shown that appropriate training can improve the fitness status and relevant health benefits are equal to the women as it is to the men *(Shaffer & Edwards, 1963, Hassmen and Backman, 1992).*

Similarly *Shephard (1982), Laurenson et al., (1993)* and others have shown improvement in physiological potentialities following regular participation in physical activities in females. Following training in physical activity, a number of researchers have shown positive co-relation between physical fitness and psychological traits *(Pauly et al., 1982, Lazarevic and Bacanac, 1985, Kamlesh et al., 1987).* However, literature relating to influence of physical education training on leadership quality on females are negligible.

In this article an attempt has been made to find out the qualitative improvement in leadership among the trainee females in physical education professional (teachers training) course.

Material and Methods

The study was conducted on trainee females undergoing B.P.Ed. Course at Kalyani University. The subjects were 18 female students aged 22 through 24 years. Most of the subjects had a past experience in games and sports at colleges' level but at the same time the subjects were different in socio-economic and cultural background. Academic background was however identical.

Selected physical fitness, psychological and leadership qualities were the criteria. Standard tests and measurement were conducted to evaluate training influence.

The total duration of the training programme underwent by the subjects was ten months (July 1st to May next year). The structure of the training was two and half hour's morning activity session, two hours afternoon activity session and four hours theoretical session. Moreover, there were a number of outdoor education sessions which included camping, picnic, officiating, tour, social service etc. Around 50 hours teaching practice was an integral part of training.

According to the schedule of the Department of Physical Education, Kalyani University, the subjects were introduced to various activities in a systematic manner. In the month of July when the training session began, after 10 days of initial introduction the physical fitness tests & psychological tests were conducted in the same day for all subjects. The post-test was conducted in the month of March next year in the same day for all the subjects.

For fitness dimensions AAHPER youth fitness test battery was considered and tests for all the six components were

conducted. The raw data collected from each test was converted to percentile scores according to AAHPER youth fitness norms.

For psychological variables (Sports Achievement Motivation Test) anxiety and leadership quality were used. The specific questionnaire of sports achievement motivation (SAMT) developed by *Kamlesh (1987)* was used for this study. For measuring the anxiety both state and trait anxiety inventory questionnaire designed and developed by *Speilberger and Lushene (1970)* for our population was used.

To measure the leadership quality a questionnaire was adopted from *Dey & Chatterjee (1989)* which was in turn developed from *Gibb (1947).*

Results & Discussion

Data relating to the test conducted and relevant statistical information are given in table 1 & 2.

Table 1: Mean & SD of the pre and post-test data of fitness variables and their comparison.

Variables	Pre-test Mean ± SD	Post-test Mean ± SD	SED	Obtained 't' values
Flexed Arm Hang	52.33 ± 29.68	67.61 ± 22.72	3.21	4.76*
Sit Up	52.56 ± 19.67	72.78 ± 20.40	3.18	6.36*
Shuttle Run	77.44 ± 10.95	86.27 ± 5.83	2.52	3.49*
Standing Broad Jump	69.72 ± 5.68	72.55 ± 6.17	0.53	5.32*
50 Yard Dash	64.44 ± 19.67	81.43 ± 15.37	3.67	4.65*
600 Yard run-walk	74.89 ± 13.51	83.11 ± 16.37	1.07	7.65*

* Significant at .05 level.

It appears from the table 1 that the post-test scores were higher in all six fitness test items than that of pre-test scores. However, the magnitude of the improvement was not equal in all the test items. Maximum improvement was observed in the sit up test (38.50%) followed by flexed arm hang test (29.20%) and obtained 't' values in all the six test items were found statistically significant. The magnitude of improvement was lowest in standing broad jump test (4.06%) followed by 600 yard run walk test (10.97%). It means the arm & shoulder strength and abdominal muscle strength was in higher orders than the leg explosive strength and general cardiorespiratory performance. In overall analysis it appears that female trainee subjects improved their physical fitness ability following the training programme adopted by the professional physical education training institute.

A number of researchers have shown that following well-planned organized physical training, performances in selected physical fitness attributes were improved significantly in women (*Edwards, 1974; Mcdonald, 1983 and Hassmen and Backmen, 1992).*

Table 2: Mean and SD of the pre-test and post-test of psychological variables and their comparison.

Variables	Pre-test Mean ± SD	Post-test Mean ± SD	SED	Obtained 't' values
Sports achievement motivation	23.8 ± 2.82	26.78 ± 4.24	0.66	4.52*
State Anxiety	40.39 ± 10.22	34.5 ± 7.04	1.60	- 3.68*
Trait Anxiety	42.33 ± 7.27	38.56 ± 7.37	1.20	- 3.14*
Leadership	50.72 ± 31.12	54.;89 ± 24.85	5.83	0.72

* Significant at .05 level.

It appears from table 2 that the mean pre-test score of SAMT was 23.8 with a variation of 2.82. According to the

SAMT Questionnaire subjects scoring below 34 are characterized as "low" in sports achievement motivation. Those scoring below 30 but above 24 are considered as moderate and those scoring above 30 are considered as highly motivated. Accordingly from the pre-test score it may be considered that the subjects of the study were "low" in sports achievement motivation. However, the mean post-test score, 26.78 with a variation of 4.24 signifies a positive improvement in sports achievement motivation.

The anxiety scores obtained from the test are presented in table 2. The scoring of the questionnaire of *Spielberger (1970)* usually range between 20 to 80 and higher the score, the greater is the level of anxiety. Therefore, both trait anxiety and state anxiety scores at the pre-test of the subjects may be considered as at moderate level. Table 2 revealed that following eight months participation in physical education training course the mean post test scores of both trait and state anxiety have reduced. It means significant reduction in both the anxieties has resulted among the subjects following training. *Morgan et al. (1970), Bird & Cripe (1986) and Cratty (1989)* have also shown that anxiety systematically reduced following long term participation in exercise.

The mean pre-test score of leadership quality was 50.72 with a variation of 31.12 which means that there is a wide variation in the leadership quality among the subjects. Following training the leadership quality has improved. Post-test mean score was 54.89 with a variation of 24.85, while the mean score is increased and the variation is decreased. However, the mean gain was statistically not significant since the 't' value comparing the pre and post-test means (0.72) was markedly less than the required value of 2.12 to be significant at 0.05 level.

From table 2, it may be seen that significant improvement was found in achievement motivation and significant reduction in anxiety following long-term participation in exercise.

Organized physical education programme in which the subjects participated has significantly improved physical fitness and psychological qualities but failed to develop desirable leadership qualities up to the optimum level. Physical education training programme has a definite role not only in developing physical qualities but also to develop a potential leader in physical education.

The subjects of the study were not a homogenous group. They were from various parts of the state and their socio-economic condition and cultural background were different. Many of them were from rural areas, obviously they were shy. However, the organized physical education training programme provided opportunity to express and show their leadership quality. This insignificant improvement in leadership quality may be due to their heavy burden of syllabus and some other factors which were beyond the scope of this research i.e. cultural, educational, socioeconomic, family background, etc.

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Red Blood Cell Variables in Volleyball Players of Kolkata, India

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Abstract

Intensive physical exercise often leads to suboptimal hematological status in humans as well as in animals. In some cases it may lead to anemia. Studies on training induced changes in red blood cell variables in Indian sportspersons are lacking, especially among volleyball players. The present cross-sectional study was conducted to measure the basic red blood cell variables in trained male (n=20) and female (n=16) state level volleyball players (18–25 years) of Kolkata, India, and to compare the data not only between two sexes but also with their sedentary (male = 20, female = 20) counterparts. Venous blood sample was drawn from the cubital vein and the red blood cell count (TC), packed cell volume (PCV), hemoglobin (Hb) concentration/, MCV and MCHC were determined by standard methods. The volleyball players of both sexes had significantly lower values of TC, PCV and Hb concentration than their control counterparts but MCV and MCHC depicted insignificant variation, indicating a probable effect of hemodilution among the players. The reduction in TC, PCV and Hb concentration among the volleyball players was significantly correlated with the duration of the training, except in case of PCV in the female group. The decrement in TC and PCV among the female players was less probably because of their significantly ($P<0.01$) lower training duration than the male players. It can be concluded that the high intensity endurance training resulted a decrease in TC, Hb concentration and PCV among the volleyball players and such decrement is significantly correlated with the training duration.

Key Words: **Hemoglobin, Red Blood Cell, PCV, MCV, MCHC, Volleyball, Training**

Introduction

There have been reports of suboptimal hematological status and even anemia resulting from intensive physical exercise in humans *(Biancotti et al. 1992; Hasilbeder et al. 1987; Magazanik et al. 1988; Radomski et al. 1980)* as well as in experimental animals *(Szygula et al. 1986).* These studies have investigated the acute effects of different types of intensive exercise as well as training on the red blood cell variables and reported a decrease in red blood cell count, hemoglobin concentration, packed cell volume, mean corpuscular volume and mean hemoglobin concentration *(Brodthagen et al. 1985; Gimenez et al. 1986; Cordova and Escanero, 1992; Laub et al. 1993) or an increase in red blood cell count (Schwandt, 1991; Cordova et al. 1993;).* There are other reports *(Hasilbeder et al. 1987; Magazanik et al. 1988; Schmidt et al. 1988; Schobersberger et al. 1990; Biancotti et al. 1992)* which concentrated on the effects of chronic high intensity training on these variables reported almost similar kind of observation as found in case of acute training or exercise. However, similar and contemporary studies are lacking in Indian sportspersons.

Volleyball is one of the popular sports in India and any kind of hematological deficiency may cause serious trouble among the volleyball players who come across a vigorous exercise protocol during their training session. Data on the hematological profiles, especially on red blood cell variables are not available on trained Indian volleyball players. The present study was therefore conducted to measure

the basic red blood cell variables in trained male and female volleyball players and to compare the data not only between two sexes but also with their sedentary counterparts.

Material and Method

Selection of participants:

The highly trained state level volleyball players (male= 20, female=16) belonging to 18-25 years of age with at least 3 years' participation in sports and intensive training *(Hasilbeder et al., 1987; Biancotti et al., 1992)* were selected for the study. The untrained or sedentary control counterparts (male = 20, female = 20) matched for age, height, weight and socio-economic background were selected from the post-graduate section of the University of Calcutta. They were explained about the entire experimental protocol to allay apprehension and their body height and body mass were measured by standard weighing machine fitted with a height measuring rod (Avery India Ltd., India). Body mass was measured to an accuracy of $\pm$ 0.250 kg and height to an accuracy of $\pm$ 0.50 cm. Subjects provided written informed consent and the entire study was approved by the ethical committee.

Collection of blood sample:

Venous blood samples were drawn from the cubital vein between 0700 and 0900 in accordance with the guidelines of the International Federation of Clinical Chemistry or IFCC *(IFCC 1984)*, 48 hours after the last training bout. The blood samples were placed in tubes containing EDTA (tripotassium salt) and were analyzed on the same day.

Measurement of red blood cell variables:

Total count of red blood cells (TC), packed cell volume (PCV) and hemoglobin (Hb) concentration were measured by using Neubauer hemocytometer *(Dacie and Lewis, 1985)*, hematocrit or Wintrobe's method *(Dacie and Lewis, 1985)* and cyanomethemoglobin method *(Drabkin, 1984)*, respectively. The mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC) were determined by the following equations *(Sembulingam and Sembulingam, 2006):*

$$\text{MCV (cu } \mu\text{)} = \frac{\text{PCV(ml.L}^{1}\text{ of blood)}}{\text{RBC Count(millions/cummof blood)}}$$

$$\text{MCHC (\%)} = \frac{\text{Hemoglobin Conc. (gm/dL) x 100}}{\text{PCV in 100 ml of blood}}$$

The whole experiment was performed at a temperature varying from 28–31°C and with the relative humidity ranging between 77% and 82%.

Statistical Analysis:

Two tail t-test was performed to test the significant variation between the mean values. Pearson's product moment correlation was computed to test the relationship between two variables. Level of significance was set at $P<0.05$.

Results & Discussion

The trained volleyball players had significantly lower values of TC, PCV and Hb concentration than their control counterparts, indicating that sport practicing strongly affected these variables in both the sexes (Table 1). However, no significant difference was found in MCV and MCHC when compared either between male and female volleyball players or between the

sedentary group and volleyball players of same sex.

Table 1. Physical characteristics and red blood cell variables in volleyball players and sedentary subjects of both sexes.

Variables	Males		Females	
	Volleyball Players (n=20)	Sedentary Subjects (n=20)	Volleyball Players (n=16)	Sedentary subjects (n=20)
Age (years)	**21.64 ±3.64**	**21.01 ±3.45**	**21.15 ±3.71**	**21.86 ±3.32 ##**
Body mass (kg)	**60.87 ±6.94**	**59.50 ±6.01**	**54.26 ±3.46 ##**	**55.64 ±4.56 #**
Body height (cm)	**173.10 ±4.19**	**171.89 ±3.90**	**169.21 ±5.17 ##**	**167.71 ±3.42 ##**
Training Duration (years)	**4.31 ±0.13**	-	**4.02 ±0.24 #**	-
RBC Count (million/mm^3)	**4.52 ±0.12**	**4.72 ±0.22 ****	**4.15 ±0.20 ##**	**4.31 ±0.16 * ##**
PCV (%)	**42.15 ±2.12**	**44.81 ±3.31 ****	**41.82 ±3.41**	**44.24 ±2.24 ***
Hb Conc. (gm%)	**12.67 ±1.62**	**13.51 ±1.90 ****	**11.92 ±1.32**	**13.04 ±1.75 * #**
MCV (cu µ)	**86.03 ±4.83**	**87.52 ±5.06**	**85.64 ±4.76**	**86.72 ±3.84**
MCHC (%)	**30.06 ±4.35**	**30.15 ±4.70**	**28.50 ±5.61**	**29.47 ±5.24**

Values are mean ± standard deviation
* P<0.01, ** P<0.001 (When compared with the sedentary group of similar sex)
# P<0.01, ## P<0.001 (When compared between males and females in the same category)

The variables were lower in the trained male volleyball players than the untrained males by 4.94% for TC (P<0.001), by 5.9% for PCV (P<0.001) and by 6.21% for Hb concentration (P<0.001). In case of the female volleyball players, the variables were also lower than their sedentary control subjects by 3.71% for TC (P<0.01), by 5.47% for PCV (P<0.01) and by 8.60% for Hb concentration (P<0.01). Therefore the female volleyball players exhibited lower extent of decrement in the TC and PCV than their male counterparts probably because of their significantly (P<0.01) lower training duration than the male players.

The correlation analysis showed that the reduction in TC, PCV and Hb concentration among the volleyball players of both sexes is significantly correlated with the duration of the training, except in case of PCV in the female group (Table 2).

Table 2: Correlation between the duration of training (years) and the difference in red blood cell variables among the volleyball players.

Variables	Male	Female
RBC Count (million/mm^3)	**0.58*****	**0.56***
PCV (%)	**0.53****	**0.43 NS**
Hb Conc. (gm %)	**0.61*****	**0.57****

Values are Pearson's product moment correlation coefficient (r)
***P<0.05, **P<0.02, ***P<0.01, NS = Not significant**

Discussion

The results of the present study corroborated with the previous findings *(Hasilbeder et al., 1987; Magazanik et al., 1988; Schmidt et al., 1988; Schobersberger, 1990; Biancotti et al. 1992)* that the major red blood cell variables undergo a change following any kind of chronic as well as intensive training regimen. Other studies

(Hasilbeder et al. 1987; Biancotti et al. 1992) indicated that these changes in males and females are also dependant on the specific game or training in which the subject participates. The present findings contradicted the observations of *Shiga et al., (1990)* in pubescent subjects that there are sex-dependant differences in TC, PCV and Hb concentration in both highly trained and untrained control individuals.

The correlation coefficients (r) among the volleyball players of both sexes were computed between the training duration and the reduction in the studied hematological variables in comparison with the mean values of the controlled untrained groups. Highest correlation was observed with the reduction in Hb concentration ($r= 0.61$, $P<0.01$) among the male volleyball players followed by the RBC count ($r= 0.58$, $P<0.01$) in the same group. Significant correlation with RBC count ($r= 0.56$, $P<0.05$) and Hb concentration ($r= 0.57$, $P<0.02$) was noted in the female group that in turn exhibited insignificant correlation with the PCV.

All early and late changes in the haematological variables after acute or chronic intensive physical exercise regardless of its characteristics (aerobic, anaerobic or mixed) are caused by factors associated mainly with the process of hemoconcentration and hemodilution, changes in plasma catecholamine concentration and the consequences of these mechanisms *(Schwandt et al. 1991; Laub et al. 1993).* In prolonged chronic exercises, the changes in red blood cell variables are associated with training protocol and the involved mechanisms are chronic intravascular hemolysis associated with strength sports and changes in plasma erythropoietin level *(Schwandt et al., 1991).*

Nevertheless, from the present study it is not feasible to explain the exact mechanism(s) involved among the male and female volleyball players for the changes in their red blood cell variables, but some speculations may be postulated. The blood volume increases with intense endurance training *(Schmidt et al. 1988; McArdle et al. 1996).* This is primarily resulted from an increase in blood plasma volume that occurs due to exercise induced increased secretion of antidiuretic hormone and aldosterone which in turn retains water from the kidneys *(Wilmore and Costill, 1999).* Endurance exercise also increases plasma protein concentration which helps to increase the plasma volume *(Yang et al., 1991).* However, increase in RBC volume also contributes towards increase in blood volume but the increase in the number of RBC is neither consistent nor proportional with the increase in plasma volume *(Green et al., 1991).* Therefore, the increase in plasma volume following endurance training is proportionately higher than that of the RBC count and this might have caused a hemodilution among the volleyball players. Consequently, in spite of absolute increases in RBC and plasma volumes, the RBC count and hematocrit value were decreased among the volleyball players following training *(Green et al. 1991; Wilmore and Costill, 1999).* Insignificant difference in MCV and MCHC between the trained and untrained groups also favours the justification of hemodilution among the volleyball players. *Schobersger et al. (1990)* also proposed that the specific differences in red blood cell variables is also related to the particular type of sport,

e.g., soccer, swimming, rowing, wrestling, athletics, etc., and the reduction of blood parameters in a specific sport shows similar trend in both sexes. This finding indicated that sports specific trend in the reduction of hematological parameters is irrespective of sex *(Biancotti et al., 1992)* as also found in the present study.

Conclusion

The present findings indicated that training has effects on red blood cell variables. The values of RBC count, hemoglobin concentration and packed cell volume were significantly lower among volleyball players of both sexes than their sedentary counterparts. Such reductions of red blood cell variables among volleyball players of both the sexes are significantly correlated with duration of the training period. Males exhibited significantly higher values of all these variables than their female counterparts. However, mean corpuscular volume and mean corpuscular hemoglobin concentration did not show any significant variation.

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Exercise-Induced Weight Reduction and Fertility Outcomes in Women with Polycystic Ovarian Syndrome who are Obese and Infertile: A Preliminary Report'

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Abstract

The influence of graded Aerobic exercise on obese infertile women with polycystic ovarian syndrome (PCOS), over a period of three months was studied. The study group consisted of 21 women with mean age (34.0±2.0 yrs) and control group consisted of 21 women with mean age (33.0±2.0 yrs) who were clinically, biochemically and ultrasonographically -confirmed cases of Obese, infertile & PCOS. The results of the both groups were compared initially and after three months. The results were analyzed with "t" test. The study group showed significant decrease in mean body mass index as compared to control group. In addition to the reduction in the body weight, the study group also showed increase in ovulation and pregnancy rate, and decrease in ovarian cyst size as compared to control group. The graded aerobic exercise was found to be a definite tool in obese infertile women with polycystic ovarian syndrome.

Key Words: **Obesity, Infertility, PCOS, Body Mass Index, Aerobic exercise**

Introduction

Body weight is not static and varies throughout the life in response to physical activity, environmental, nutritional, social and psychological factors. Obesity is associated with many abnormal hormonal dynamics. Menstrual disorders are common among women with obesity. It includes dysfunctional uterine bleeding and polycystic ovarian syndrome (PCOS). Often it is difficult to ascertain whether obesity is the cause of menstrual dysfunction or whether the underlying illness is playing the major role *(Henley & Vaitukaitis, 1985).*

Obesity can effect ovulation, pregnancy rate which leads to infertility or Polycystic Ovarian syndrome (PCOS). The fertility of obese women compared to normal weight women is lower in natural cycles and infertility treatment cycles. *Clark et al. (1995)* reported that even a small weight loss in anovulatory obese infertile women, achieved in a group setting over a six month period, resulted in an improvement in ovulation, pregnancy rate and pregnancy outcome, self esteem and endocrine parameters. Studies have demonstrated that a BMI greater than 27 is associated with an increased risk of ovulatory infertility. There is considerable evidence in the literature that young, middle aged and elderly women benefit from the endurance exercise training programme & study showed that with the aerobic exercise of 3 to 6 months with diet control had a beneficial effect of weight loss and it has the beneficial effect on reproductive system *(Guzick et al., 1994).*

Polycystic ovary syndrome (PCOS) is a heterogeneous clinical entity that is defined as the association of hyper androgenism with chronic anovulation in women without specific underlying diseases of the adrenal or pituitary glands. PCOS is also associated with a metabolic

disturbance (insulin resistance). The nature of the complex interrelation of obesity, insulin resistance and endocrine abnormalities in PCOS remains unresolved. However several studies link obesity, body fat distribution and nutritional habits with the hormonal and metabolic profiles of PCOS. Moreover, intervention studies have suggested that reducing weight either by diet alone or by a combination of diet and exercise improve hirsutism, fertility and the hormonal and metabolic profiles of PCOS *(ACOG, 2002).* There are studies which support the view that graded aerobic exercises has beneficial effect on the reproductive system and the weight loss and however, there exists a controversy whether aerobic exercise alone is effective in altering the reproductive function. Hence, it is worth to find out whether infertility rate will reduce by regular aerobic exercises along with weight reduction and improving the reproductive function.

Therefore, the aim of this study is to determine whether weight reduction through aerobic exercise will improve reproductive function, specifically, ovulation, pregnancy rate, and reduced ovarian cyst size.'

Material and Method

A prospective study of 42 women with history of obesity with PCOS and infertility were selected. All women were screened and diagnosed by physician and referred for physiotherapy. Preliminary screening was done to rule out any cardio respiratory and musculoskeletal problems. The subjects were divided in to study and control groups based on inclusion and exclusion criteria. The women who were willing to participate in the study and had obesity with infertility and PCOS, without any associated cardio respiratory, neurological or musculo skeletal complications & women who were not on any regular exercise regime were included in the study group. The women who were not willing to participate in the exercise program with above mentioned finding were included in the control group.

Both the group of women underwent detailed clinical evaluation for obesity like body mass index, waist-hip ratio and skin fold measurements before and at the end of the study. The ovarian cyst was measured before and after three months. Study group women were prescribed 3 months period of home based graded aerobic exercise program. All women were periodically assessed once in every three weeks during the study period and individualized graded exercise program was prescribed with the intensity between 50-80% MHR. All the women completed the study with out any complications. Both study and control groups were re-assessed at the end of three months. The data was statistically analyzed with t test.

Results & Discussion

The demographic features of 42 patients with PCOS are presented in the Table I.

Table 1: Demographic features of patients with PCOS in study and control group

Patients data	Study Group	Control Group
Age	34.0±2.0	33.0±2.0
Primary Infertility (N)	15	16
Secondary Infertility (N)	6	5

Table 2: Comparision of Body Mass Index before and After Exercise programme in Study Group

BMI	Study Group		95% Confidence Interval Of The Difference		t	P
	Mean	SD	Lower	Upper		
Pre	33.12	1.72				
			26.56	27.88	83.15	0.0001
Post	27.22	2.12				

The pre-exercise body mass index of study group was 33.12 ± 1.72 kg/m^2, the post exercise body mass index levels were 27.22 ± 2.12 kg/m^2 (Table 2).

Table 3: Comparision of Body Mass Index before and after three months in Control Group

BMI	Study Group		95% Confidence Interval Of The Difference		t	P
	Mean	SD	Lower	Upper		
Pre	30.63	1.09				
			28.85	29.42	206.32	0.0001
Post	29.82	0.91				

For control group the initial body mass index values were 30.63±1.09 kg/m^2. After three months of observation, the values were 29.82±0.91 kg/m^2 (Table 3).

Discussion

Obesity affects ovulation, response to fertility treatment, pregnancy rates and outcome. In our prospective study, aerobic exercise program was prescribed to find out whether it could help obese infertile women, irrespective of their infertility diagnosis, to achieve a viable pregnancy, ideally without further medical intervention. The subjects underwent a graded home based exercise programme aimed at reducing weight over a period of 3 months and those that did not participate in the exercise program were treated as a control group. Women in the study group lost an average of 8.2 kg, with 5 of the 21 anovulatory subjects resuming spontaneous ovulation, 7 achieving a pregnancy and 9 women had reduction in the cyst size, which was confirmed by ultrasound. In the control group, women lost an average of 2.1 kg, however, there was no change in the cyst size, none of the women achieved pregnancy.

Guzick et al. (1994) reported that weight loss in obese anovulatory women is often associated with resumption of menstrual function and with alterations in androgen, gonadotropin and insulin concentration. In the present study, aerobic exercise is observed to be effective in obese women with infertility and PCOS. The study group population showed significant decrease in body mass index as compared to control group.

Studies by *Mitchell and Rogers (1953)* and *Bates and Whiteworth (1982)* give credence to the idea that weight loss can restore ovulatory function in obese anovulatory hyperandrogenic subjects. *Bates and Whitworth (1982)* in their study on moderately obese anovulatory women also reported regained ovulatory function after weight loss. They further reported that the mean percent of ideal body weight at the time of conception in their subjects' was 123%. Similar results were reported by *Mitchell and Rogers (1953).*

Kopelman et al. (1981) reported improvement in menstrual function following weight loss induced by ileal jejunal bypass. *Kim et al. (1982)* observed persistent anovulation following a mean weight loss of 16% in four anovulatory massively obese women. However, despite the weight loss, these women remained significantly obese. It should be noted that in none of these studies was it noted at what age the subjects became obese or at what weight ovulatory function was lost. These factors

may prove in the future to be of extreme importance in counseling patients as to the effectiveness of weight loss with its feasibility. *Bates and Whitworth (1982)* have acknowledged that the eight women who refused the weight reduction program failed to conceive or remained anovulatory and were heavier at the initiation of the study than those who conceived.

In addition to sustained compliance, the effectiveness of an exercise program is to a large extent, predicated on an appropriate exercise prescription. There are three phases included in the typical exercise session: warm-up, stimulus phase, and cool down.

The stimulus or endurance phase serves to stimulate the oxygen transport system and maximize caloric expenditure. This phase should be prescribed in specific terms of frequency, intensity, duration and mode of exercise. In obese infertile women with PCOS the following exercise guidelines are required to reduce weight and thereby stabilizing the reproductive hormones function.

Frequency: 3-5 exercise sessions per week.

Intensity: 60% to 85% of maximal heart rate range corresponding to ratings of perceived exertion (RPE 6-20 scale) between “13” (some what hard) and “15” hard, respectively is advisable in the obese infertile and PCOS women *(Laeson et al., 1987).*

Duration: Initially start from fifteen minutes and it can be increased to forty five min of sustained activity during each exercise session in addition to warm-up and cool –down.

Mode: Any activity that employs large muscle groups, is maintained continuously, and is rhythmical in nature e.g. walking, jogging.

There is now considerable evidence in the literature that young middle-aged and elderly women benefit from endurance exercise training programs. The results show that women adapt to physical conditioning in the same qualitative manner as do men, demonstrating significant increases in aerobic capacity and anaerobic threshold *(Laeson et al., 1987),* with decreases in heart rate, blood pressure, and perceived exertion at standard sub maximal workloads *(White et al., 1984).* Other favorable changes in women exercisers include decreased cholesterol and blood pressure levels, reduced body weight and fat stores, improved strength, favorable effects on reproductive hormones and increased bone mineral content *(Lefebvre et al., 1997).* However, the mechanism by which exercise is effective in stabilizing the reproductive hormones in obese infertile and PCOS and decreasing the cyst size needs to be studied in future research.

Conclusion

1. Graded aerobic exercise is a definite tool in decreasing the body weight in obese infertile women with PCOS as compared to control group.

2. The graded aerobic exercise helps in reducing the cyst size, increasing the ovulation, pregnancy rate as compared to control group.

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Effect of Meditation on Self Confidence of Student- Teachers in Relation to Gender and Religion

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Abstract

The aim of present study was to find out effect of *Shaktipat* meditation on self-confidence of student-teachers. An experiment was conducted on 152 student-teachers of B. Ed. Course on the basis of non-randomized control group pre-test post-test design. Self Confidence Inventory (1987) developed by Rekha Agnihotry, Raven's Standard Progressive matrices (2000 ed.) were used for data collection. Analysis by ANCOVA showed that *Shaktipat* Meditation was an effective practice to improve self-confidence. Further, gender was found to be significantly effect self confidence whereas religion not. Both male and female (gender); and both Hindu and Sikhs (religion) student- teachers have equally benefited from meditation when pre- self confidence and general intelligence were statistically controlled.

Key Words: Shaktipat meditation, Self Confidence, Student-teachers

Introduction

Literally meaning of *Shaktipat* is "establishing power or energy in its actual place. It is fluctuating energy level, which is responsible for varying physical and mental states. The body's energy centers are called *Chakras*. There are seven major *Chakras* which reside along the spine and the head i.e. *Mooladhara, Swadishtan, Manipura, Anahata, Vishuddh, Ajna and Shahasrara*. Energy flows from the bottom to the top through the inter-mediate *Chakras*. Due to gravitational pull of the earth, flow of energy in most of human beings is downward. Spiritual teacher helps to change the flow of energy, from downward to upward, (by deep breathing techniques) which brings positive cognitive and affective changes in personality of meditator.

Effective classroom teaching depends upon mainly three C's i.e. content mastery, communication effectiveness and confidence on self.

The self is a composite of a person's thoughts and feelings, strivings and hopes, fears and fantasies, his views of what he is, what he has been, what he might become, and his attitudes pertaining to his worth. Self-confidence is a positive attitude of oneself towards one's self-concept. It is an attribute of perceived self. Self-confidence refers to a person's perceived ability to tackle situations successfully without leaning on others and to have a positive self-evaluation. In the words of *Basavanna (1975)* "self confidence refers to an individual's perceived ability to act effectively in a situation to overcome obstacles and to get things go all right".

Regarding effect of meditation *Aron et al. (1981)* found that participation in transcendental meditation classes produced significant increases on intelligence and increased social self-confidence, sociability, general psychological health, and social maturity. *Brown et al. (1993)* reported that students who meditated or who meditated and exercised had significantly greater inner-directedness than did those who only

exercised or who did neither. *Rozman (1994)* revealed that teaching children to meditate can improve their decision making. *Bal Yoga Mitra Mandal (1999)* reported efficiency of yoga practices on memory, creativity, self-esteem, self-discipline and self-confidence in 702 children. *Lesko (2000)* reported the mental and emotional changes resulting from Zen meditation practice. *Kritzell (2000)* showed that for the group of participants, who were primarily white, middle-class and married, meditation did significantly improve the participants' self-esteem and overall psychological functioning. *Shah et al. (2001)* found that there is a positive and significant effect of *Saral* meditation on intelligence, performance and confidence. *Gaur et al. (2003)* revealed that who practiced the Preksha Meditation for 25 days increased their ego strength, confidence self assurance, spontaneity and they become emotionally more stable, calm and able to face their reality and reduced their jealousy. *Singh et al. (2007)* revealed that *Shaktipat* Meditation was an effective practice to improve emotional maturity. Both sexes, all the socio-economic classes, above, below and average (intelligent) and both rural and urban students were found to be equally benefited from meditation

Sleeper et al. (1987) found overall, sex-of-subject differences in self-confidence are less powerful than the effects yielded by the sex of others in achievement settings. *Hall (1990)* found that self-confidence of females is not lower than that of males. *Isralowitz (1994)* found that moderate risk-takers displayed greater self-confidence regarding romantic relationships than low risk-takers. *Greenberg (1994)* found that the use of paradoxical symptom prescription can be effective in decreasing cognitive and somatic state anxiety, and increasing self-confidence in competitive athletes. *Fleming (1994)* reported that increasing field work experience (effects of reentry status) will improve the self-confidence of the program's participants. *Kalaian et al. (1994)* reported gender differences among secondary teacher candidates across three categories of criterion measures i.e. self-confidence in teaching, anticipated sources of professional knowledge, and educational orientations and beliefs. *Ross (1994)* found that technical expertise was the most important of those variables related to self-confidence. *Alsup (1995)* found that the mathematics instruction based on constructivism was effective in helping them overcome their mathematics anxiety, and in strengthening their confidence in teaching mathematics. *Einarson et al. (1996)* found gender and ethnic differences in academic self-confidence, academic self-efficacy. *Salinas et al. (1999)* suggested a positive effect of the teaching orientation for international teaching assistants (ITAS) on their perceived level of self-confidence about their ability to teach in English. *Ziegler et al. (2000)* indicated that girls already expressed significantly lower levels of self-confidence regarding chemistry than did boys. *Wilson (2000)* found that the perceived importance of various sources of sport-confidence differed between and within gender. *Huang et al. (2001)* reported that perceived respect from professors as the strongest determinant of female academic self-confidence whereas the perceived quality of teaching is the strongest predictor among male students. *Velazquez-Zamora (2001)* indicated that the variable gender was independent with regard to computer anxiety and computer confidence. *Purwar (2002)* reported that self confidence was found to be positively correlated with intelligence at .05 level of significance under uncontrolled conditions

only, but under controlled conditions the correlation coefficient was not significant at 0.05 level of significance. *Cheng et al. (2002*) revealed that Personality traits, self-confidence, friendship, and school grades were all significantly oppositely correlated with happiness and loneliness.

As discussed above there are seven *chakras* (energy centers) in human body. These major *chakras* emits along the spine and the head. There are two heart *chakras* called lower *anahat* and upper *anahat*. Lower *anahat* is disturbed by emotional hurt causing, loss of interest in life and upper *anahat* is affected by lack of confidence. This theoretical base compels the investigator to test the effect of meditation on these *charkas* by the measure of self-confidence.

Objectives

1. To study the effect of *Shaktipat* Meditation on self-confidence of student teachers.
2. To study the effect of meditation, gender and their interaction on self-confidence by taking pre- self-confidence as covariate.
3. To study the interaction effect of meditation and gender on self-confidence by taking pre-self-confidence and pre general intelligence as covariates.
4. To study the effect of meditation, religion and their interaction on self-confidence by taking pre- self-confidence as covariate.
5. To study the interaction effect of meditation and religion on self-confidence by taking pre-self-confidence and pre general intelligence as covariates.

Hypotheses

1. There will be no significant effect of *Shaktipat* Meditation on self-confidence.
2. There will be no significant effect of meditation, gender & their interaction on self-confidence by taking pre- self-confidence as covariate.
3. There will be no significant interaction effect of meditation and gender on self-confidence by taking pre-self-confidence and pre general intelligence as covariates.
4. There will be no significant effect of meditation, religion and their interaction on self- confidence by taking pre- self-confidence as covariate.
5. There will be no significant interaction effect of meditation and religion on self-confidence by taking pre-self-confidence and pre general intelligence as covariates.

Material and Methods

B.Ed. students from Lovely Institute of Education, Phagwara, Govt. College of Education, Jalandhar and G.N. College of Education Kapurthala, were selected on voluntary basis during the academic session 2005-2006. In Govt. College and G.N. College of Education only hostlers were approachable for meditation. Age range of students was between 20 to 32 years. A total of 152 subjects participated in the present study out of which 92 were in Experimental and 60 in Control group. The sample description is given in table 1

Table 1: Structure of Sample (Gender and Religion Wise)

		Control	Experimental	Total
		N	N	N
Male	Sikh	6	20	26
	Hindu	11	19	30
	Christian	1		1
Group Total		18	39	57
Female	Sikh	10	29	39
	Hindu	32	24	56
Group Total		42	53	85
Table Total		60	92	152

Thus, 152 subjects participated in the present study out of which 92 were in Experimental and 60 in Control group; 57 were male and 95 were female; and 65 Sikh, 86 Hindu and one Christian.

The present study was experimental in nature and its design was based on the lines of non-randomized Control group pre-test post-test design

The following tools were used

1. *Self Confidence Inventory (1987)* in Hindi developed by the Rekha Agnihotry was used. It contains 56 items. Reliability coefficient by spilt half method is 0.95, by K-R formula is 0.94 and by test retests method 0.88. Validity coefficient of this test is 0.82.

[#] **Note**: The lower the score, the higher is the level of self confidence and vice-versa.

2. Raven's Standard Progressive matrices developed by *Raven and Court (revised 2000).* It represents an attempt to measure intellectual functioning within the context of Spearman's concept of 'g'. The matrices consisted of sixty designs, which require completion. The testee has to choose from multiple-choice options, the design or the design part, which best fits. Numerous reliability coefficient quoted by Raven vary from 0.80 to 0.90. Validity of the test varied from 0.50 to 0.86.

Students, who voluntarily offered themselves to practice meditation, were divided (randomly) into two groups i.e. Experimental and Control groups, from each College. Before the start of the experiment, Self Confidence Inventory and Revan's standard progressive Matrices test were administered to collect Pre- Self Confidence and Intelligence scores. The experimental group students were practiced *Shaktipat* Meditation for three months (105 sittings i.e. first five days 4 sittings and rest days one sittings daily) at the rate of one hour per sitting under the supervision, direction & guidance of the expert (Mata Yog Amrit Ji from Amritdham Meditation Center, Hoshiarpur). In all Colleges Meditation was practiced through *Shaktipat Vidhi* only. At the end of the treatment the Self Confidence Inventory was administered separately to the students of both experimental and control groups. Scoring of all the tools were done as directed in their respective manuals.

Statistical Techniques

-First Hypothesis was tested with the help of ANCOVA.

-Interaction hypotheses were tested with the help of 2x2 and 2x3 factorial design of ANCOVA.

Results and Discussion

Table 2: Self confidence (Mean score) of Males and Females of Control and Experimental group

	Control		Experimental	
	Pre Test	Post Test	Pre Test	Post Test
Male	19.72	19.22	25.67	18.72
Female	26.10	26.64	30.11	23.25

Table 3 reveals that the adjusted F value for meditation is 10.46, which is significant at 0.01 level. It indicates that

adjusted mean score of self confidence of experimental group and control group differ significantly when pre self confidence was taken as covariate. In the light of this null hypothesis that there will be no significant effect of *Shaktipat* Meditation on self confidence, is rejected. It reflects that meditation practiced to experimental group was found to be significantly effective in improving self confidence level of student teachers when both group matched with respect to pre self confidence as covariate.

Table 3: Summary of 2x2, and 2x3 factorial design of ANCOVA for self confidence by taking pre self confidence as covariate

Source	Sum Of Squares	df	Mean Square	F	Sig.
Meditation	**801.40**	**1**	**801.40**	**10.46**	**0.00**
Gender	**603.41**	**1**	**603.41**	**8.20**	**0.00**
Meditation x Gender	**58.58**	**1**	**58.58**	**0.80**	**0.37**
Religion	**7.80**	**2**	**3.90**	**0.05**	**0.95**
Meditation x Religion	**39.57**	**1**	**39.57**	**0.51**	**0.48**

The adjusted F value for gender is 8.20, which is significant at 0.01 level. In this context null hypothesis that there will be no significant effect of gender on self confidence by taking pre- self confidence as covariate, is rejected.

The adjusted F value for interaction between meditation and gender is 0.80, which is not significant at 0.01 level. In the light of this null hypothesis that there will be no significant effect of interaction between meditation and gender on self confidence by taking pre- self confidence as covariate is not rejected.

The adjusted F value for Religion is 0.05, which is not significant at 0.01 level. In this context null hypothesis that there will be no significant effect of religion on self confidence by taking pre- self confidence as covariate, is not rejected.

The adjusted F value for interaction between meditation and religion is 0.51, which is not significant at 0.01 level. In the light of this null hypothesis that there will be no significant effect of interaction between meditation and religion on self confidence by taking pre- self confidence as covariate is not rejected.

Table 4: Summary of 2x2, and 2x3 factorial design of ANCOVA for self confidence by taking pre self confidence and pre general intelligence as covariates.

Source	Sum of Squares	df	Mean Square	F	Sig.
Meditation x Gender	**64.49**	**1**	**64.49**	**0.88**	**0.35**
Meditation x Religion	**34.41**	**2**	**34.41**	**0.45**	**0.50**

Table 4 shows that adjusted F value for interaction between meditation and gender is 0.88, which is not significant at 0.01 level. In the light of this null hypothesis that there will be no significant effect of interaction between meditation and gender on self confidence by taking pre- self confidence and pre general intelligence as covariates, is accepted.

The adjusted F value for interaction between meditation and religion is 0.45, which is not significant at 0.01 level. In the light of this null hypothesis that there will be no significant effect of interaction between meditation and religion on self confidence by taking pre- self confidence and pre general intelligence as covariates, is not rejected.

Findings

1. *Shaktipat* Meditation was found to be an effective technique to improve self confidence of student-teachers.

2. There was significant effect of gender on self confidence when pre self confidence was taken as covariate.
3. There was no significant effect of interaction between meditation and gender on self confidence when pre self confidence was taken as covariate.
4. There was no significant effect of interaction between meditation and gender on self confidence when pre-self confidence and pre general intelligence are taken as covariates.
5. There was no significant effect of religion on self confidence when pre self confidence was taken as covariate
6. There was no significant effect of interaction between meditation and religion on self confidence when pre self confidence was taken as covariate
7. There was no significant effect of interaction between meditation and religion on self confidence when pre-self confidence and pre general intelligence are taken as covariates.

Discussion

Meditation, in the present study, means 'silence of mind' which brings positive cognitive and affective changes in the personality. Other techniques of meditation also reported their effectiveness for psychological functioning like self-esteem *(Kritzell, 2000; Lesko, 2000),* concentration, decision making power *(Rozman, 1994),* intelligence *(Aron et al., 1981; Shah et al., 2001),* memory *(Miskimum, 1973).* It helps to remove negative emotions *(Gaur et al., 2003),* anxiety, complexes (inferiority or superiority) as it makes the mind silent. This change help to increase trust in the abilities and good qualities of the self i.e. self confidence. Previous studies supported this finding as *Aron et al. (1981)* found that participation in transcendental meditation classes produced significant increase in intelligence and increased social self-confidence. *Brown et al. (1993)* confirmed that students who meditated, or who meditated and exercised had significantly greater inner-directedness than did those who only exercised or who did neither. *Shah et al. (2001)* found that there is a positive and significant effect of *Saral* meditation on confidence. *Gaur et al. (2003)* revealed that who practiced the *preksha* Meditation for 25 days increased their ego strength and confidence self assurance.

There was significant effect of gender on self confidence when pre self confidence was taken as covariate. Further, the mean score of males on self confidence is less than that of females (Table-2). It reflects that male student teachers were more self confident than female counterparts. *Ziegler et al. (2000)* also reported that girls expressed significantly lower levels of self-confidence regarding chemistry than boys. Similarly *Kalaian et al. (1994)* reported gender differences among secondary teacher candidates across three categories of criterion measures i.e. self-confidence in teaching, anticipated sources of professional knowledge, and educational orientations and beliefs. *Einarson et al. (1996)* found gender and ethnic differences in academic self-confidence and academic self-efficacy. *Wilson (2000)* found that the perceived importance of various sources of sport-confidence differed between and within gender. *Sleeper et al. (1987)* revealed that overall, sex-of-subject differences in self-confidence are less powerful than the effects wielded by the sex of others in achievement settings. Whereas *Velazquez-Zamora (2001)* indicated that the variable

gender was independent with regard to computer anxiety and computer confidence among the secondary teachers. But, *Hall (1990)* found that self-confidence of females is not lower than that of males. *Huang et al. (2001)* reported that perceived respect from professors as the strongest determinant of female academic self-confidence whereas the perceived quality of teaching is the strongest predictor among male students.

There was no significant effect of religion on self confidence when pre self confidence was taken as covariate. It means that both Hindu and Sikhs student- teachers have equal level of self-confidence. No study was found which examined the relationship of religion and self confidence.

There was no significant effect of interaction between meditation and gender; and meditation and religion on self confidence when pre self confidence was taken as covariate. It means that male and female (gender); and both Hindu and Sikhs (religion) student- teachers have equally benefited from meditation. Same results regarding interaction between meditation and gender; and meditation and religion on self confidence were found, when pre- self confidence and pre general intelligence were taken as covariates. It means that male and female (gender); and both Hindu and Sikhs (religion) student- teachers have equally benefited from meditation when pre- self confidence and general intelligence were controlled. *Purwar (2002)* reported that self confidence was found to be positively correlated with intelligence at under uncontrolled conditions only, but under controlled conditions the correlation coefficient was not significant. *Singh et al. (2007)* revealed that both male and female (sex); and above, below and average (intelligent) students were found to be equally benefited from *Shaktipat* meditation. In general the results of the present study are in agreement with *Kritzell (2000)* who also showed that meditation did significantly improve the participants' overall psychological functioning.

Educational Implications

Present study revealed that *Shaktipat* Meditation was an effective practice to improve self-confidence of student- teachers. Self confidence is essential trait for successes and achievements in teaching learning field. Therefore practice of meditation should be given due place in the educational institutes. Morning assembly may be replaced by the meditation practice. Results of the study compel the investigator to suggest that meditation practice should be included in curriculum of teacher education. As all student- teachers (both male and female and both Hindu and Sikhs) were equally benefited from meditation, its application is beyond the limits of religion and gender.

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Body Mass Index, Blood Pressure and Haemoglobin in Jat Sikh Children Ranging in Age from 10 to 16 Years

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Abstract

In the present investigation body mass index, blood pressure and haemoglobin have been studied among Jat-Sikh children of Patiala district. The sample consists of 251 boys and 306 girls ranging in age from 10 to 16 years. All the variables have shown a general tendency towards increase with age. The boys are significantly heavier and taller than girls at most of the age levels from 12 to 16 years. The value of BMI is also slightly more in boys in all age groups except at 11 and 15 years and significantly more in boys at 14 years of age. Blood pressure has also been found to be more in boys at all age levels except at 12 and 13 years. The differences reach a level of significance at 16 years in systolic blood pressure and at 11 and 14 years in diastolic blood pressure. The haemoglobin level has been found to be significantly more in boys in all age groups. After 12 years the level of haemoglobin has increased more markedly in boys.

Key Words: Body Mass Index, Blood Pressure, Haemoglobin

Introduction

Body Mass Index (BMI) is a reliable indicator of health and nutritional status of human beings *(Garrow and Webster, 1985; Rookus et al., 1987; Must et al., 1991; Naidu et al., 1991; Cole et al., 1995; Pishdad, 1996 and Yanai, 1997).* Body Mass Index also known as the "Quetlet's Index" expresses the relationship between the two most widely used parameters to monitor linear and ponderal growth, viz., height and weight. BMI does not measure fat directly, but research has shown that BMI correlates to direct measures of body fat, such as by under water weighing and dual energy X-ray absorptiometry *(Mei et al., 2002).*

There are preliminary evidences that hypertensive processes begin in the childhood *(DeSweit et al., 1992)*, with numerous studies finding co-relations between blood pressure levels from early to late childhood *(Lauer and Clark, 1989)* and from childhood to adulthood *(Nelson et al., 1992).* These reports suggest the importance of tracking blood pressure in children to detect the early stages of hypertension.

As association between age, height, weight, body mass index and blood pressure has been studied by various investigators *(Siervogel et al., 1982; Kaas, 1985; Dyer and Elliott, 1989; Lauer and Clark, 1989; Sandin et al., 1990; Stamler, 1991; Roche and Siervogel, 1991; Chen et al., 1995; Rona et al., 1996; Kaufman et al., 1997; Luke et al., 1997; Vijayalakshmi et al., 1997; Steyn et al., 2000; Venkataramana et al., 2001; Mufunda et al., 2006 and Mzayek et al., 2007).*

Haemoglobin concentration is an important diagnostic indicator for the well being of an individual. In prepubertal period no major differences have been reported between the sexes in haemoglobin concentration. It is only

after the onset of menstruation that the differences emerge *(Velberg et al., 1976).* The total amount of haemoglobin in the body increases more in boys than in girls at puberty *(Sjostrand, 1953).* Menstruation is the principle cause of iron loss in women *(Hallberg et al., 1966; Simon et al., 1981 and Frassinelli et al., 1985).* Evaluation of the haemoglobin concentration of women from India, Canada, Central America, China and the United States shows that this situation is wide spread (*Cook et al., 1986; Ji et al., 1987 and Looker et al., 1997).* Women worldwide are at risk of being in a negative iron balance and by current criteria if their haemoglobin concentration is less than 11.5g/ml they are deemed to be anaemic, whereas in men the cut off point is 13g/100ml *(Hoffbrand and Pettit, 1993).*

In the present investigation an attempt has been made to study body mass index, blood pressure and haemoglobin levels in Jat Sikh children ranging in age from 10 to 16 years.

Material and Method

The present cross-sectional study has been conducted on 557 Jat Sikh children (251 boys and 306 girls) ranging in age from 10 to 16 years. The decimal age of the subjects has been calculated up to three decimal places *(Weiner and Lourie, 1969).* The data have been grouped in yearly age groups i.e. 9.500-10.499, 10.500-11.499 and so on. The measurements taken on subjects are weight, height, blood pressure and haemoglobin. The equipment used for taking the various measurements are weighing machine, anthropometer rod, sphygmomanometer, stethoscope and Sahil's haemometer. The statistical tests viz., mean, standard deviation, standard error of mean and test of significance 't' have been applied.

Results:

Weight, Height and Body Mass Index

Table 1: Mean and standard deviation of weight, stature and body mass index of Jat Sikh children from 10 to 16 years of age.

Age	N	Weight (Kg)		Stature (Cm)		BMI (Kg/M^2)	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
Boys							
10	24	31.28	9.61	141.57	9.41	15.37	3.39
11	30	30.21	6.71	141.50	9.78	14.95	1.88
12	34	36.07	5.80	145.35	6.07	17.02	2.26
13	33	41.10	7.50	151.60	10.50	17.81	2.61
14	42	44.15	4.59	155.58	7.14	18.27	1.94
15	48	46.84	7.57	161.08	10.84	17.96	1.92
16	40	53.55	8.71	164.95	10.31	19.69	2.76
Girls							
10	30	28.56	4.59	137.53	7.15	15.04	1.83
11	40	28.68	5.80	138.00	8.56	14.97	2.33
12	39	32.83	5.16	141.96	7.90	16.33	2.51
13	52	37.00	5.85	147.87	7.51	16.89	2.19
14	58	39.86	5.24	152.69	5.64	16.98	1.89
15	49	42.43	4.44	152.54	5.66	18.22	1.60
16	37	47.60	4.78	154.00	5.82	19.37	1.54

Table 1 represents the mean and standard deviation values of weight, height and body mass index of boys and girls ranging in age from 10 to 16 years. A continuous increase in weight has been reported in both boys and girls except at 11 years in case of boys. Boys have been found to possess more weight at all age levels as compared to girls with statistically significant differences from 12 to 16 years of age. Height has also shown a continuous increase in both boys and girls at almost all age levels. Boys have been found to be taller than girls at all age levels with significant differences at 12 and 14 to 16 year of age.

The mean value of body mass index has increased from 15.37 kg/m^2 at 10 years to 19.69 kg/m^2 at 16 years in boys and from 15.04 to 19.37 kg/m^2 in girls, thus making a total gain of 4.32 kg/m^2 in boys and 4.33 kg/m^2 in girls

from 10 to 16 years. The maximum gain in BMI has occurred at the same age group in both boys and girls i.e. between 11-12 years, 2.07 kg/m^2 in boys and 1.36 kg/m^2 in girls. The values for body mass index has been slightly more in boys in all age groups except 11 and 15 years and significantly more in boys at 14 years of age only.

Blood Pressure

Table 2: Mean and standard deviation of Systolic and Diastolic blood pressure and Haemoglobin in Jat Sikh children ranging in age from 10 to 16 years.

Age	N	SBP (mm/Hg)		DBP (mm/Hg)		Haemoglobin (Gm/dl of Blood)	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
Boys							
10	24	120.62	4.18	80.45	4.31	11.37	1.48
11	30	119.70	3.58	80.00	3.21	11.13	1.75
12	34	122.10	3.47	79.14	3.24	12.05	1.38
13	33	121.78	3.76	79.21	3.32	12.45	1.76
14	42	121.80	4.50	80.23	2.45	12.21	1.63
15	48	122.47	5.02	81.20	3.81	13.55	1.40
16	40	122.87	4.51	82.75	6.31	13.74	1.54
Girls							
10	30	119.00	2.66	78.86	1.66	10.34	1.66
11	40	119.07	4.29	77.45	4.32	10.05	1.82
12	39	121.30	3.39	80.00	3.42	10.42	1.64
13	52	122.21	3.61	80.13	3.88	10.18	1.77
14	58	120.72	2.38	78.86	3.98	10.32	1.92
15	49	121.87	4.40	79.63	4.20	10.52	1.50
16	37	120.70	4.41	80.49	3.57	11.30	1.54

Table 2 represents the values for the mean and standard deviation of systolic and diastolic blood pressure and haemoglobin in Jat Sikh children ranging in age from 10 to 16 years. It has been found that systolic blood pressure increases with age in both boys and girls, with intermittent fluctuations, from a value of 120.62 mm of Hg to 122.87 mm of Hg in boys from 10 to 16 years and from 119 mm of Hg to 121.87 mm of Hg in girls from 10 to 15 years of age. Sex differences have been found statistically significant at 16 years of age only, where value has been found more in boys.

Diastolic blood pressure has shown fluctuations with age in both boys and girls, the values have been found to increase from 80.45 mm of Hg to 82.75 mm of Hg in boys and from 78.86 mm of Hg to 80.49 mm of Hg in girls from 10 to 16 years of age as evident from Table 2. Diastolic blood pressure has been observed to be slightly higher in boys than girls in all age groups except 12 and 13 years. Significant sex differences have been observed at 11 and 14 years of age.

Haemoglobin

It has been found that boys are ahead in having more haemoglobin content than girls at all age levels with significant differences (Table 2 to 3). In case of boys the maximum increase in haemoglobin has taken place from 14 to 15 years i.e. 1.34 g/100 ml of blood, while in girls increase has taken place from 15 to 16 years i.e. 0.78 gm/100 ml of blood.

Table 3: Sex Differences (t-test) in various measures of the body in Jat-Sikh children ranging in age from 10 to 16 years.

AGE	WT	HT	BMI	SBP	DBP	HB
10	1.27	1.74	0.44	1.65	1.71	2.43*
11	1.00	1.56	-0.04	0.67	2.85*	2.54*
12	2.52*	2.08*	1.25	1.00	-1.11	2.46*
13	2.67*	1.78	1.70	-0.52	-1.17	6.04*
14	4.52*	2.18*	3.36*	1.43	2.14*	5.23
15	3.50*	4.85*	-0.75	0.63	1.87	10.45*
16	3.77*	5.74	0.55	2.15*	1.96	7.04*

* indicates statistically significant at 5% level
- sign indicate more value in girls

Discussion:

In the present study an attempt has been made to study the age related changes in terms of morphological and physiological variables in Jat Sikh boys and girls ranging in age from 10 to 16 years. Weight and height have shown a trend of continuous increase in both boys and girls and boys are significantly heavier and taller than girls at most of the age levels from 12 to 16 years. The body mass index has also shown a trend of increase from 10 to 16 years in both boys and girls. A trend of increase in BMI has also been reported by *Steyn et al., 2000;*

Bose et al., 2005 and Kaur, 2006. In the present investigation boys possess slightly more BMI than girls except at 11 and 15 years with significant differences at 14 years, whereas Dowda *et al*., 2001 reported higher values in girls than boys ranging in age from 6-18 years. *Kaur (2006)* has also reported slightly more values of BMI in girls with non significant sex differences at all age levels from 5 to 16 years.

The total increase in BMI is more or less same i.e. 4.32 kg/m^2 and 4.33 kg/m^2 in boys and girls respectively. *Maynard et al. (2001) and Kaur (2006)* have reported more increase of BMI in girls than boys.

Blood pressure i.e. systolic and diastolic has been found to increase with age in both boys and girls with intermittent fluctuations. *Lauer and Clark, 1989; Rosner et al., 1993; Sinaiko, 1996; Hashimoto et al., 1997; Kafali et al., 1997 and Steyn et al., 2000* have also reported a trend of increase in blood pressure with age.

The blood pressure is slightly higher in boys than girls at all age levels except at 12 and 13 years. The differences reach a level of significance at 16 years in systolic and at 11 and 14 years in diastolic blood pressure. *Ann et al. (1998)* reported that from age 13 years onwards mean systolic blood pressure become higher in boys than girls.

The concentration of haemoglobin increases with advancement of age in both boys and girls as also reported by *Bhatnagar et al. (2003)*. The increase in the amount of haemoglobin is more in boys as compared to girls from 10 to 16 years and is found to be significantly more in boys as compared to girls at all age levels. *Bhatnagar et al. (2003)* also reported more values in males as compared to females. The sex differences in haemoglobin have become more marked after the onset of menstruation in girls. *Sjostrand (1953), Verberg et al. (1976) and Adalbert et al. (1976)* have also reported larger increase in haemoglobin in boys than girls at puberty.

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A Pilot Study Examining Injuries in Relation to Field Position of Competitive Football Players

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Abstract

The objectives of this study were to quantify the football injuries in relation to field position in competitive football players and to determine the nature, location, causes, outcome of injuries and the possible risk factors involved. Information on injuries were collected through a questionnaire from eight Indian football teams which were participating in All India Mayor Trophy football tournament held in Aurangabad, Maharashtra in September-2006. The age range was 16 to 30 years, 68% (87) of players were in the range of 20 to 25 years. The football players were asked to recall injuries over the preceding one year period. A total of 98 out of 128 football players sustained injuries in relation to field position. One hundred and eight injuries were recorded of which 27% were recurring injuries. Lower limb injuries predominated; the ankle and knee being the most commonly injured anatomical site. A significant proportion of injuries occurred in the upper limb region. A high number of injuries occurred in the Goalkeepers, and were mainly related to the thumb. Most injuries were of soft tissue in nature and relate to muscle, ligament, and tendon. Most common situations giving rise to injuries were collision (27.77%), twist/turn (22.22%) and stumble (17.59%). Those football players directly involved in attack or defense are more likely to be injured. Lower limb injuries were found to be predominated, muscle injuries being the most common type, collision is common causes of injuries. The results of the research provide a useful insight into the injuries in relation to field position, nature and sites of injury in competitive football players.

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Key Words: Treatment, Sustained, Anatomical Site, incidence, Soft tissue, Limbs

Introduction

Football has been demonstrated to be among the most hazardous of organized team sports and injury is a frequent event in football *(Winter Griffith, 1989; Sinku, 2006).*

Football requires a variety of physical attributes and specific playing skills therefore participants need to train and prepare to meet at least a minimum set of physical, physiological and psychological requirements to cope with the demands of the game and to reduce the risk of injury. It is an enjoyable and social sport that can be played from childhood to old age, either at a recreational level or as a competitive sport.

Football playing largely involves starting, running, slopping, twisting, jumping, kicking and turning movements' that place the players to greater risk of injury *(Waston, 1993).*

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

the sphere of sports medicine. Football is a high risk sport, dominated by overuse injuries while recovery time from injuries is relatively long, but only a few working days are lost by the players to return back to play, thus leading to abuse of the injured sites. In football only a few serious studies have been made in the literature regarding incidents of injury and pattern, possible risk factors and injury prevention *(Winter Griffith, 1989; Waston, 1993; Junge, 2004).* In football overuse injuries are the most frequent occurrences of injury. In football, injuries are traditionally divided into contact and non contact mechanism in which case contact refers to player contact. Some of the forces involved in a non contact injury are transmitted from the playing surface to the injured body part.

Keeping in view the paucity of information about sports injuries in general and football playing in particular, an attempt has been made in this area to investigate the nature, location, causes, outcome of injuries and the possible risk factors involved in footballers.

Materials & Methods

Information on injuries was collected from eight Indian Football teams, which were participating in All India Mayor Trophy football tournament held in September-2006 in the city of Aurangabad, Maharashtra. A questionnaire prepared by *Cromwell and Gromely (2000)* for elite Gaelic football players and modified by the investigator was given to the subjects' for completion. The study was conducted on 128 football players. Mean Scores, standard deviation and percentages were calculated and utilized to identify the nature, location and cause of injury in football players.

The investigator personally established contact with the team managers and coaches of the eight teams and the purpose of the study was explained to them. Further instructions were given by the investigator to the players for the completion of the questionnaire. A total of 144 questionnaires were administered and 128 were returned by the players after completion thus giving an over all response rate of 88.88%.

Results & Discussion

Mean age, weight and height of the footballers was 19.33 (SD ± 1.44) years, 61.25 (SD ± 8.33) kg and 168.54 (SD ± 8.33) cm. respectively. Average training duration was 1.98 (SD ± 0.42) yrs.

A total of 98 out of 128 football players reported of having sustained injuries in relation to their field position. A total of one hundred and eight injuries were reported by the players.

The results of football players with respect to their injury details are presented in Figures 1-4.

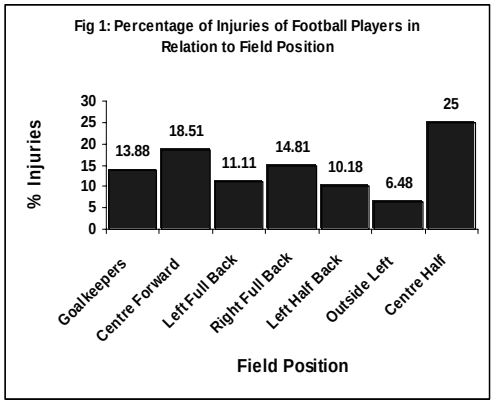

Figure 1 illustrates the percentage of injuries sustained with respect to the playing field position of footballers.

Highest percentage of injuries was recorded in case of footballers playing at center half position (25%) followed by center forward (18.51%), right full back (14.81%), goalkeeper (13.88%), left full back (11.11%), left half back (10.18%), out side left (6.48%) in decreasing order.

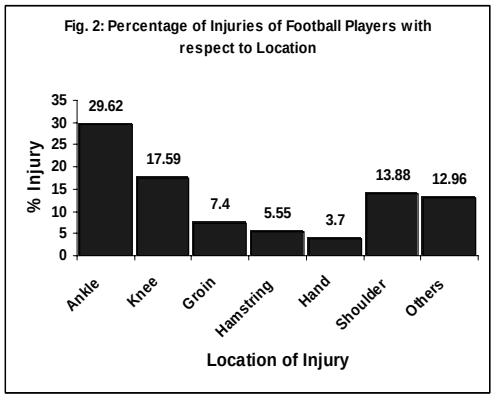

Figure 2 illustrates the most commonly injured anatomical site in footballers. Maximum injured site in footballers was found to be the region of ankle (29.62%) followed by knee (17.59%), shoulder (13.88%), groin (7.40%), hamstring (5.55%), Hand (3.70%), and others (12.96%). Figure shows that the ankle, knee and shoulder were the most involved sites of injury in footballers.

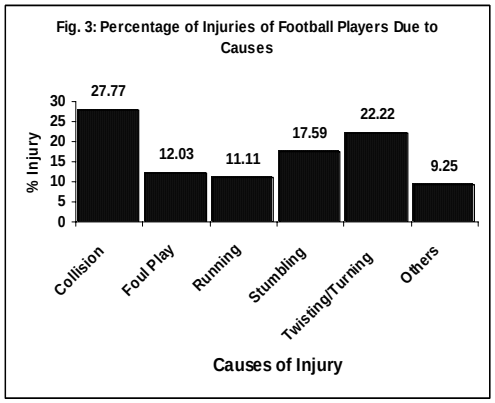

Fig 3 depicts the common causes of injury in football players. It can be observed that the most common cause was collision (27.77%) followed by twist/turn (22.22%), stumble (17.59%), foul play (12.03%), running (11.11%), and others (9.25%).

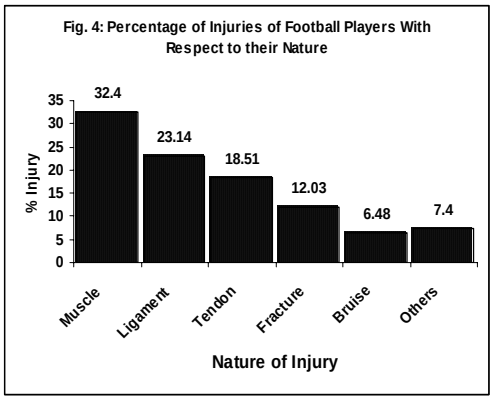

Figure 4 demonstrate the nature of injuries incurred by footballers. Maximum incidence of injuries reported by the footballers relate to the muscles (32.40%), followed by ligaments (23.14%), tendon (18.51), fractures (12.03%), bruises (6.48%) and others (7.40%) in decreasing order. Muscle and Ligament injuries were the most frequently occurring injuries in football players.

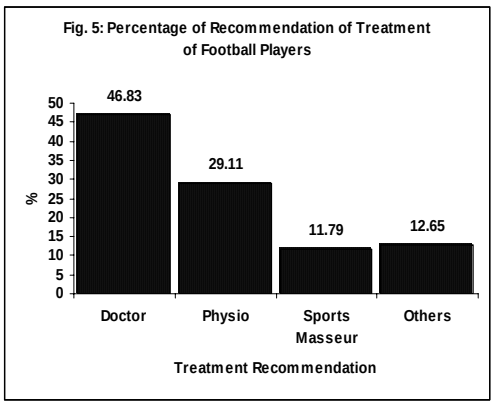

Figure 5 compares the method of treatment obtained by the footballers for the injuries incurred by them. It is observed that 46.83% of footballers got their injuries treated by a doctor followed by 29.11%, 11.79% of footballers who went to physiotherapists & sports masseur for treatment. It is observed that doctor treated maximum football players than physiotherapist and sports masseur.

This study reveals that 57.40% of injuries occurred during training while 42.59% were occurred during competition. The relatively high incidence of injuries during training was probably due to bad technique, low fitness and large amount of over training by the football players. The players who are directly involved in attack or defence are most likely to be injured. This is evident from the fact that most injuries were sustained by the footballers playing at Center Half and Center Forward positions.

In this study, most injuries were acquired in the lower limb (68.49%) of which 29.62% related to ankle and 17.59% to knees. *Waston (1993)* also found that lower limb injuries were most common in contact sports. A significant proportion of injuries occurred in the upper limb region (31.51%), of which shoulder injuries predominated (13.88%), *Cromwell & Gromely (2000)* found that relatively high incidence of shoulder injuries is due to fact that the shoulder charge is permitted while tackling in football playing.

Muscle and ligament injuries were the most common types of injuries to the football players. It may be due to bad technique, and low fitness level of football players. The least common injuries were of the most serious types and included fractures (12.03%). About 73.41% of the injuries required treatment of which doctor treated 46.82% of the injuries. Finally it is concluded that injuries are a very serious problem for competitive football players.

Conclusions

Most of injuries of football player are sustained in lower limb; ankle and knee injuries are the most commonly occurring injuries among football players. Study also concluded that:

1. Upper limb injuries occurred in the shoulder and finger regions.
2. Regarding the nature of injuries; muscle and ligament injuries are the most commonly reported ones in football players.
3. Maximum injuries occur during training.
4. Regarding treatment of injuries, Doctor is the most common attention provider of football players.
5. Most injuries were sustained to the Center Half and Center Forward.

This research provides a platform for further research in the field of sports, Physical Education and Sports Medicine.

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Comparison of Cardiovascular Responses to Exercise and Recovery Pattern in Players

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Abstract

The study was conducted on 149 Punjabi University players preparing for inter university competition during their training camps held at Punjabi University, Patiala. The subjects were administered progressive workloads starting from 50W at 60 rpm on an electrically controlled bicycle ergometer and increased in steps of 25W every minute until the exhaustion of the subject. Blood pressure & minute heart rate were recorded during exercise and recovery at intervals of one minute during the course of exercise and 15 minutes of recovery. On the basis of the study it is concluded that significant differences are demonstrated by different category of players and physical education students in their blood pressure and heart rate responses to varying intensities of exercise and at different points of recovery.

Key Words: Maximal exercise, Recovery, Blood pressure, Heart rate

Introduction

After exercise, bodily processes do not immediately return to resting level. The variation in recovery from light, moderate and strenuous exercise is determined by specific metabolic and physiological processes resulting from each level of effort *(Hultman et al, 1967, Di parampero et el, 1983, Gaesser and Brooks, 1984,)*. During the initial minutes of recovery, even though the muscle is no longer actively working, oxygen demands do not immediately decrease; instead oxygen consumption remains elevated, temporarily. This is due to restoration of metabolic processes to its pre-exercise levels. This consumption, which exceeds the usually required when at rest, has traditionally been referred to as the oxygen debt. A more common term today is excess post exercise oxygen consumption (EPOC) *(Gaesser and Brooks, 1984)*. The EPOC curve has two distinct components: an initial fast component (alactacid debt) and a secondary slow component (lactacid debt) both components of the curve reflect the anaerobic activity that had occurred during exercise. The first phase of recovery is marked by rapidly declining VO_2 and heart rate. It is during this period that tissue stores of the ATP and Phosphocreatine (PCr) depleted in the muscle are restored within 30 seconds and 100% restored within 3 to 5 minutes (*Hultman et al, 1967*).

The ability to maintain muscle performance during high intensity exercise depends on the recovery performance in many individual and team sports. According to *Zafeiridis (2005)* a higher rate of PCr re-synthesis, a greater ability to tolerate buffer and remove H^+ and restore muscle pH and a greater oxidative enzyme activity may accelerate the recovery process.

Many sports such as football, boxing, hockey, wrestling, etc., have intense period of work alternating with short to moderate periods of rest (or reduced

activity), depending upon the specific demands of the sport. Not only is the creatine phosphate, which is the most immediate reserve in the skeletal muscle or for the re-synthesis of ATP, taxed to the maximum during short term high intensity maximum exercise, the fact that muscle and blood lactate concentrations are also significantly elevated after 6 seconds (*Boobis et al, 1983*), and 10 seconds (*Jacob et al, 1983*), following maximum intensity work, exemplifies that glycolysis also present an important source of ATP re-synthesis in short duration exercise. The resulting drop in muscle pH may have a detrimental effect on subsequent performance (*Curtin and Edman, 1989*). The return of exercising muscle towards resting pH and normal CP levels will consequently be an important component of recovery. The high correlation between recovery during intermittent exercise and creatine phosphate re-synthesis are consistent with this theory (*Bogdanis et al, 1996*). A number of studies have concluded that recovery will be facilitated by an enhanced oxygen uptake capacity (*Petersen and Cooke, 1994*). The ability to recover quickly is therefore important in many team sports like football, hockey and in combat sports like boxing and wrestling.

Individual differences exist among sports person to metabolize lactate for example improvement of aerobic fitness plays a great role in recovery. Some studies have supported an association between aerobic fitness and lactate removal (*Tomlin and Wenger, 2001*) following high intensity exercise, whereas some others have failed to confirm an association (*Evans and Cureton, 1983*; *Oothuyse & Carter, 1999*).

The present study has been conducted with an aim to compare the exercise and recovery patterns on common cardiovascular variables like heart rate and blood pressure following maximal exercise among different category of players and physical education students.

Material & Method

The study was conducted on 149 Punjabi University players preparing for inter university competition during their training camps held at Punjabi University, Patiala. The age range of the subjects was 18-25 years.

Mean characteristics of age, height & weight of the three groups are presented in table 1.

Table1: Comparison of mean values age, height & weight among different categories of players and PES

	N	Age, Yrs		Height, Cms		Weight, Kg	
		Mean	SD	Mean	SD	Mean	SD
Netball	29	20.52	0.78	1.78	0.08	35.86	5.01
Hand Ball	11	20.00	1.00	1.75	0.09	30.91	3.02
Boxers	25	22.24	2.03	1.69	0.06	31.20	3.62
Cyclists	21	20.33	1.98	1.75	0.05	32.14	4.05
Football	52	19.17	1.44	1.73	0.06	30.67	2.63
PES	11	22.36	2.25	1.76	0.08	40.91	5.39

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 Auscultatory method using mercury 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 one minute for a total period of 15 minutes following maximal exercise. Keeping in view the room available in the journal for a research paper, it is not possible to depict the results of the study for all the workloads administered to the players; therefore the results have been compiled for selected workloads and described under the following sub headings:

- Heart rate & Blood pressure (BP) at rest
- Heart rate & BP response at 50W, 100W & 150W work loads
- Heart rate & BP response at 3rd, 9th and 15th minute of recovery following maximal exercise.

Results & Discussion:

1. Heart rate & Blood pressure (BP) at rest

Average resting heart rate ranged between 65.72 to 81.28 beats /minute among different categories of players' (table 2). Lowest average resting heart rate values have been observed, in case of boxers'. Statistically speaking there is a significant difference in resting heart rate values among different categories of players and physical education students as is indicated in tables 3-4.

Table 2: Comparison of mean Minute heart rate (MHR), systolic Blood Pressure (SBP) & diastolic Blood Pressure (DBP) at rest between different categories of players and Physical Education Students

		MHR, beats/min		SBP, mm Hg		DBP, mm Hg	
	N	Mean	SD	Mean	SD	Mean	SD
Netball	29	81.28	5.55	113.10	4.71	73.10	4.71
Hand Ball	11	74.18	5.10	115.36	5.55	73.64	5.05
Boxers	25	65.72	5.86	111.20	3.32	71.20	3.32
Cyclists	21	76.71	7.12	118.10	6.80	76.67	4.83
Football	52	70.73	6.97	113.37	4.92	73.27	4.74
PES	11	75.27	4.17	115.45	5.22	75.45	5.22

Table 3: ANOVA: Statistical comparison of resting MHR, SBP and DBP among different categories of players and PES

		Sum of Squares	df	Mean Square	F	Sig
MHR	Between Groups	3919.76	5	783.96	19.98	0
	Within Groups	5611.17	143	39.24		
	Total	9530.95	148			
SBP	Between Groups	635.20	5	127.04	5.01	0
	Within Groups	3625.83	143	25.36		
	Total	4261.03	148			
DBP	Between Groups	391.90	5	78.38	3.71	0.003
	Within Groups	3022.86	143	21.14		
	Total	3414.76	148			

Table 4: Scheffe Post hoc comparison for mean differences in resting MHR values among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	7.09	15.56*	4.56	10.55*	6.00
Handball		8.46*	-2.53	3.45	-1.09
Boxers			-10.99*	-5.01	-9.55*
Cyclists				5.98*	1.44
Football					-4.54

Mean value of resting systolic and diastolic pressure among different categories of players and physical education students also reveal significant differences as evaluated by analysis of variance test (tables 3, 5 & 6). Cyclists are observed to posses' significantly higher resting systolic blood pressure in comparison to net ball players, boxers and football players. As far as the DBP is concerned, boxers are observed to possess lower value as compared to the cyclists.

Table 5: Scheffe Post hoc comparison for mean differences in resting SBP among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	-2.26	1.90	-4.99*	-0.26	-2.35
Handball		4.16	-2.73	2.00	-0.09
Boxers			-6.90*	-2.17	-4.25
Cyclists				4.73*	2.64
Football					-2.09

Table 6: Scheffe Post hoc comparison for mean differences in resting DBP among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	-0.53	1.90	-3.56	-0.17	-2.35
Handball		2.44	-3.03	0.37	-1.82
Boxers			-5.47*	-2.07	-4.25
Cyclists				3.40	1.21
Football					-2.19

2. MHR & BP response to exercise:

Administration of graded exercise is observed to reveal differential exercise heart rate & BP responses among the different categories of players. Boxers demonstrate significantly lower heart rate & SBP response than all the rest of categories of players at 50W workload. Among all other categories of players heart rate responses to 50W of workload is not found to be statistically different (Tables 7-9). Mean SBP response at this workload has been observed to be significantly lower in boxers than the cyclists while no statistical difference in SBP response is observed among other category of players. PES group also demonstrate significantly lower response in this variable as compared to the cyclists. Diastolic component of BP on an average recorded a decrease at 50W workload as compared to the average resting value recorded in the various categories. In statistical terms the DBP values are observed to be comparable among the different categories (Table 7, 8, & 11)

Table7: Comparison of MHR, SBP & DBP at 50W workload among different categories of players and PES

		MHR, beats/min		SBP, mm Hg		DBP, mm Hg	
	N	Mean	SD	Mean	SD	Mean	SD
Netball	29	147.69	7.78	149.31	7.99	59.93	3.87
Hand Ball	11	146.27	8.76	150.91	7.01	60.36	1.96
Boxers	25	135.08	7.34	146.00	6.46	58.96	2.80
Cyclists	21	144.33	4.65	155.24	9.81	59.48	4.31
Football	52	145.13	9.09	150.00	7.92	58.56	3.21
PES	11	146.27	4.43	143.64	5.05	60.55	3.70

Table 8: ANOVA: Statistical comparison of MHR, SBP and DBP at 50W workload among different categories of players and PES

		Sum of Squares	df	Mean Square	F	Sig
MHR	Between Groups	2566.86	5	513.37	8.54	0
	Within Groups	8595.14	143	60.11		
	Total	11162	148			
SBP	Between Groups	1411.64	5	282.33	4.66	0.00
	Within Groups	8655.47	143	60.53		
	Total	10067.11	148			
DBP	Between Groups	73.25	5	14.65	1.25	0.29
	Within Groups	1682.16	143	11.76		
	Total	1755.41	148			

Table 9: Scheffe Post hoc comparison for mean differences in MHR at 50W workload among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	1.42	12.61*	3.36	2.56	1.42
Handball		11.19*	1.94	1.14	0.00
Boxers			-9.25*	-10.05*	-11.19*
Cyclists				-0.80	-1.94
Football					-1.14

Table 10: Scheffe Post hoc comparison for mean differences in SBP at 50W workload among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	-1.60	3.31	-5.93	-0.69	5.67
Handball		4.91	-4.33	0.91	7.27
Boxers			-9.24*	-4.00	2.36
Cyclists				5.24	11.60*
Football					6.36

Cardiovascular reaction to further increase in exercise intensity to 100W reveals a similar response of heart rate as was observed at the starting workload of 50W. Boxers demonstrated a significantly lower value than the other groups (Table 11-13).

SBP responded significantly less vigorously in case of boxers than the other groups while DBP response to 100W workload was comparable in all the groups except for cyclists where it was found to be significantly lower (Tables 14 & 15).

Table 11: Comparison of MHR, systolic & diastolic BP at 100W among different categories of players and PES

		MHR, beats/min		SBP, mm Hg		DBP, mm Hg	
	N	Mean	SD	Mean	SD	Mean	SD
Netball	29	170.72	7.74	174.86	8.01	59.86	4.40
Hand Ball	11	171.09	8.30	179.64	4.57	60.36	5.12
Boxers	25	156.72	9.49	175.60	6.01	59.72	4.12
Cyclists	21	166.33	5.03	183.81	12.03	51.48	7.87
Football	52	168.25	8.66	178.37	6.40	54.79	4.41
PES	11	170.45	6.09	164.91	5.49	59.27	2.72

Table 12: ANOVA: Statistical comparison of MHR, 100W among different categories of players and PES

		Sum of Squares	df	Mean Square	F	Sig
MHR	Between Groups	3448.6	5	689.72	10.68	0
	Within Groups	9232.89	143	64.57		
	Total	12681.49	148			
SBP	Between Groups	2935.67	5	587.13	10.30	0
	Within Groups	8154.20	143	57.02		
	Total	11089.87	148			
DBP	Between Groups	1496.70	5	299.34	12.17	0
	Within Groups	3517.13	143	24.56		
	Total	5013.83	148			

Table 13: Scheffe Post hoc comparison for mean differences in MHR at 100W workload among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	-0.37	14.00*	4.39	2.47	0.27
Handball		14.37*	4.76	2.84	0.64
Boxers			-9.61*	-11.53*	-13.73*
Cyclists				-1.92	-4.12
Football					-2.20

Table 14: Scheffe Post hoc comparison for mean differences in SBP at 100W workload among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	-4.77	-0.74	-8.95*	-3.50	9.95*
Handball		4.04	-4.17	1.27	14.73*
Boxers			-8.21*	-2.77	10.69*
Cyclists				5.44	18.90*
Football					13.46*

Table 15: Scheffe categories Post hoc comparison for mean differences in DBP at 100W workload among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	-0.50	0.14	8.39*	5.58*	1.09
Handball		0.64	8.89*	5.58*	1.09
Boxers			8.24*	4.93*	0.45
Cyclists				-3.31	-7.79*
Football					-4.48

Comparison of minute heart rate response to 150W workload between different groups divulged significantly lower response in case of boxers than the other groups. Physical education students' group recorded the highest mean minute heart rate value that is significantly more than the mean MHR of boxers, cyclists and footballers (Tables 17-19).

Systolic blood pressure response to 150W workload brought out maximal reaction from cyclists followed by handball, football, boxers, netball & PES in decreasing order. In statistical terms, significant differences have been recorded in systolic blood pressure response among the different categories (Table 19).

Table 16: Comparison of minute heart rate, SBP & DBP at 150W workload among different categories of players and PES

		MHR, beats/min		SBP, mm Hg		DBP, mm Hg	
	N	Mean	SD	Mean	SD	Mean	SD
Netball	29	186.17	6.23	196.79	5.61	60.55	3.89
Hand Ball	11	184.09	6.06	201.45	5.15	60.18	2.09
Boxers	25	170.28	12.43	198.80	4.15	58.84	3.48
Cyclists	21	183.10	6.07	209.81	16.60	46.19	11.08
Football	52	181.29	9.41	200.98	4.72	54.00	5.36
PES	11	193.18	6.15	186.55	7.63	59.81	4.04

Table 17: ANOVA: Statistical comparison of MHR, SBP & DBP at 150W workload among different categories of players and PES

		Sum of Squares	df	Mean Square	F	Sig
MHR	Between Groups	5403.06	5	1080.61	14.32	0
	Within Groups	10792.21	143	75.47		
	Total	16195.26	148			
SBP	Between Groups	4419.54	5	883.91	14.38	0
	Within Groups	8788.43	143	61.46		
	Total	13207.97	148			
DBP	Between Groups	3381.53	5	676.31	19.98	0
	Within Groups	4841.04	143	33.85		
	Total	8222.58	148			

Table 18: Scheffe Post hoc comparison for mean differences in MHR at 150W workload among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	2.08	15.89*	3.08	4.88	-7.01
Handball		13.81*	1.00	2.80	-9.09
Boxers			-12.82*	-11.01*	-22.90*
Cyclists				1.81	-10.09
Football					-11.89*

Table 19: Scheffe Post hoc comparison for mean differences in SBP at 150W workload among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	-4.66	-2.01	-13.02*	-4.19	10.25*
Handball		2.65	-8.36	0.47	14.91*
Boxers			-11.01*	-2.18	12.25*
Cyclists				8.83	23.26*
Football					14.44*

In a similar way DBP also has been observed to respond to varying degrees among the various groups. Cyclists, boxers & footballers exhibit significantly lower DBP values as compared to the other groups (Table 20).

Table 20: Schaeffe Post hoc comparison for mean differences in DBP at 150W workload among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	0.37	1.71	14.36*	6.55*	0.73
Handball		1.34	13.99*	6.18	0.36
Boxers			12.65*	4.84*	-0.98
Cyclists				-7.81*	-13.63*
Football					-5.82

3. Heart rate & Blood pressure (BP) recovery following maximal exercise:

Comparison of initial recuperation in heart rate following exhaustive exercise as measured at the third minute of recovery among the various groups demonstrate lowest mean MHR value of 101.81 beats/min in case of cyclists followed by boxers (103.44), handball (105.73), football (106.08), netball (112.21) and PES (118.55) in increasing order. In other words cyclists, boxers & football group of players are observed to recover relatively more quickly as compared to the other groups (Tables 21-23). Statistically speaking significant differences are observed in the 3rd minute of recovery period in the minute heart rate values among the various groups.

Table 21: Comparison of 3rd minute recovery MHR values among different categories of players and PES

		MHR, beats/min		SBP, mm Hg		DBP, mm Hg	
	N	Mean	SD	Mean	SD	Mean	SD
Netball	29	112.21	6.37	131.21	6.77	60.48	3.88
Hand Ball	11	105.73	2.53	122.73	4.67	60.36	4.37
Boxers	25	103.44	8.43	125.20	8.95	62.72	5.22
Cyclists	21	101.81	8.37	126.43	7.93	63.24	5.64
Football	52	106.08	5.97	126.63	7.19	61.69	5.39
PES	11	118.55	7.17	136.82	7.17	59.36	3.17

Table 22: ANOVA: Statistical comparison of MHR, SBP & DBP at 3rd minute of recovery among different categories of players and PES

		Sum of Squares	df	Mean Square	F	Sig
MHR	Between Groups	3195.07	5	639.01	13.769	0
	Within Groups	6636.76	143	46.41		
	Total	9831.83	148			
SBP	Between Groups	1792.38	5	358.48	6.545	0
	Within Groups	7831.78	143	54.77		
	Total	9624.16	148			
DBP	Between Groups	196.10	5	39.22	3.249	0.16
	Within Groups	3484.26	143	24.37		
	Total	3680.36	148			

Table 23: Scheffe Post hoc comparison for mean differences in 3rd minute recovery heart rate among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	**6.48**	**8.77***	**10.40***	**6.13***	**-6.34**
Handball		**2.29**	**3.92**	**-0.35**	**-12.82***
Boxers			**1.63**	**-2.64**	**-15.11***
Cyclists				**-4.27**	**-16.74***
Football					**-12.47***

SBP at 3rd minute of recovery following maximal exercise reveal higher values in case of netball group and PES as compared to the other groups. In statistical terms the cyclists, boxers, football & handball players record significantly lower SBP values than the netball & PES groups (Table 24). Systolic pressure in other words exhibit a tendency to return to the resting state faster in case of cyclists, boxers, football & handball players than the netball & PES groups.

Table 24: Scheffe Post hoc comparison for mean differences in 3rd minute recovery SBP among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	**8.48**	**6.01**	**4.78**	**4.57**	**-5.61**
Handball		**-2.47**	**-3.70**	**-3.91**	**-14.09***
Boxers			**-1.23**	**-1.43**	**-11.62***
Cyclists				**-0.21**	**-10.39***
Football					**-10.18***

DBP recovery after three minutes of cessation of maximal exercise reveals almost comparable values (Table 21). Statistically speaking no significant differences have been observed (Table 22).

Progression of recovery period to nine minutes following maximal exercise reveals a further decline in the average values of MHR recorded in the various groups (Table 25). Cyclists, boxers & football players exhibit the same trend of quicker recovery than their other counterparts as was observed at 3rd minute of recuperation. Analysis of variance reveal existence of significant differences in MHR recorded at 9th minute of recovery (Table 26). Scheffe post hoc comparison further reveals that cyclists, boxers & football players recover significantly quickly than PES group (Table 27).

Table 25: Comparison of 9th minute recovery MHR, SBP & DBP values among different categories of players and PES

		MHR, beats/min		SBP, mm Hg		DBP, mm Hg	
	N	Mean	SD	Mean	SD	Mean	SD
Netball	**29**	**100.97**	**4.90**	**116.21**	**4.75**	**73.79**	**4.94**
Hand Ball	**11**	**97.27**	**2.10**	**113.64**	**5.05**	**72.73**	**4.67**
Boxers	**25**	**94.52**	**5.45**	**114.40**	**5.07**	**72.00**	**5.00**
Cyclists	**21**	**92.76**	**6.25**	**117.86**	**6.04**	**76.67**	**4.83**
Football	**52**	**95.98**	**4.79**	**114.04**	**6.03**	**73.08**	**5.44**
PES	**11**	**106.27**	**6.33**	**124.36**	**5.43**	**70.91**	**3.02**

Table 26: ANOVA: Statistical comparison of MHR, SBP & DBP at 9th minute of recovery among different categories of players and PES

		Sum of Squares	df	Mean Square	F	Sig
MHR	**Between Groups**	**1985.92**	**5**	**397.18**	**15.02**	**0**
	Within Groups	**3780.36**	**143**	**26.44**		
	Total	**5766.28**	**148**			
SBP	**Between Groups**	**1162.21**	**5**	**232.44**	**7.59**	**0**
	Within Groups	**4378.34**	**143**	**30.62**		
	Total	**5540.55**	**148**			
DBP	**Between Groups**	**355.94**	**5**	**71.19**	**2.85**	**0.02**
	Within Groups	**3566.21**	**143**	**24.94**		
	Total	**3922.15**	**148**			

Table 27: Scheffe Post hoc comparison for mean differences in 9th minute recovery MHR among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	**3.69**	**6.45***	**8.20***	**4.98***	**-5.31**
Handball		**2.75**	**4.51**	**1.29**	**-9.00***
Boxers			**1.76**	**-1.46**	**-11.75***
Cyclists				**-3.22**	**-13.51***
Football					**-10.29***

SBP tends to attain almost similar average values at 9th minute of recovery in the various groups except in the case of

PES group where relatively higher mean value of 124.36 mm Hg is observed. In statistical terms, it is found to be significantly greater than all the other groups (Tables 25, 26 & 28).

Table 28: Scheffe Post hoc comparison for mean differences in 9th minute recovery SBP among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	2.57	1.81	-1.65	2.17	-8.16*
Handball		-0.76	-4.22	-0.40	-10.73*
Boxers			-3.46	0.36	-9.96*
Cyclists				3.82	-6.51
Football					-10.33*

DBP recovery at 9th minute of cessation of maximal exercise reveals almost comparable values (Table 25). Statistically speaking no significant differences have been observed among the different groups (Table 26).

Cardiovascular restoration to further advancement in recovery to 15th minute demonstrates a continuous decrease in minute heart rate though at a slower rate. The picture is similar to that observed at 3rd & 9th minute of recovery phases. PES group is observed to recover slowest of the all other groups (Table 29 - 31).

Table 29: Comparison of 15th minute recovery MHR, SBP & DBP values among different categories of players and PES

		MHR, beats/min		SBP, mm Hg		DBP, mm Hg	
	N	Mean	SD	Mean	SD	Mean	SD
Netball	29	93.93	3.91	109.31	5.30	73.45	4.84
Hand Ball	11	92.55	1.75	104.55	5.22	73.64	5.05
Boxers	25	87.44	4.90	103.60	4.68	72.40	4.36
Cyclists	21	88.10	4.57	108.81	6.31	76.67	4.83
Football	52	91.52	3.98	104.13	4.82	73.46	4.80
PES	11	100.91	6.20	114.55	5.22	73.64	5.04

Table 30: ANOVA: Statistical comparison of MHR, SBP & DBP at 15th minute of recovery among different categories of players and PES

		Sum of Squares	df	Mean Square	F	Sig
MHR	**Between Groups**	1811.58	5	362.32	19.58	0
	Within Groups	2646.45	143	18.51		
	Total	4458.03	148			
SBP	**Between Groups**	1596.28	5	319.26	11.89	0
	Within Groups	3838.96	143	26.85		
	Total	5435.24	148			
DBP	**Between Groups**	231.45	5	46.29	2.03	0.08
	Within Groups	3263.85	143	22.82		
	Total	3495.30	148			

Table 31: Scheffe Post hoc comparison for mean differences in 15th minute recovery MHR among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	1.39	6.49*	5.84*	2.41	-6.98*
Handball		5.11	4.45	1.03	-8.36*
Boxers			-0.66	-4.08*	-13.47*
Cyclists				-3.42	-12.81*
Football					-9.39*

Systolic component of blood pressure continues to drop in all the groups and is observed to even fall below the resting levels. Inter group differences are however observed in the SBP and have statistical significance also. PES group demonstrate significantly greater mean value of SBP than the other groups (Table 32). DBP on the other hand show similar values and are statistically not different from each other.

Table 32: Scheffe Post hoc comparison for mean differences in 15th minute recovery SBP among different categories of players and PES

	Handball	Boxers	Cyclists	Football	PES
Netball	4.76*	5.71*	0.50	5.18*	-5.24
Handball		0.95	-4.26	0.41	-10.00*
Boxers			-5.21*	-0.53	-10.95*
Cyclists				4.67	-5.74*
Football					-10.41*

In present investigation systolic BP response in relationship to HR during exercise and recovery has also been

studied, it is observed from the figures that blood pressure increases with increase in MHR during graded exercise in all categories of players.

It is interesting to observe that BP response to exercise in relation to HR is mild up to acceleration of HR to the order of 150 beat/minute, where after BP increases more vigorously. In other words slope of BP-HR response during exercise leading to increase in HR upto 150 beat/minute is observed to be less steep as compared to BP response beyond 150 beat/minute.

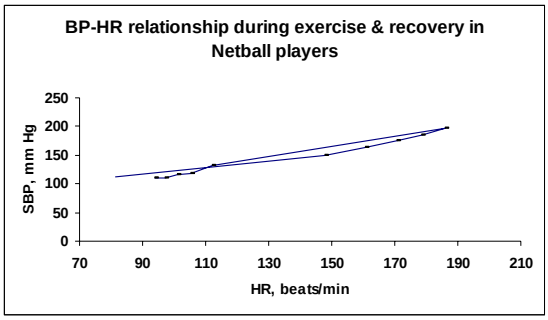

Figure 1

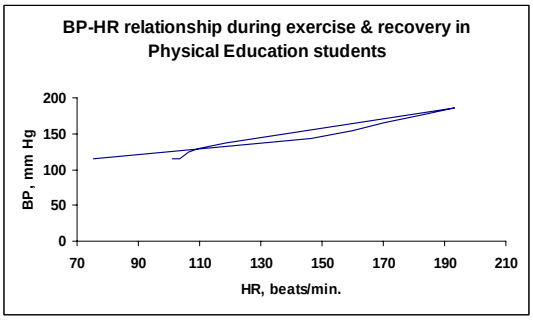

Figure 2

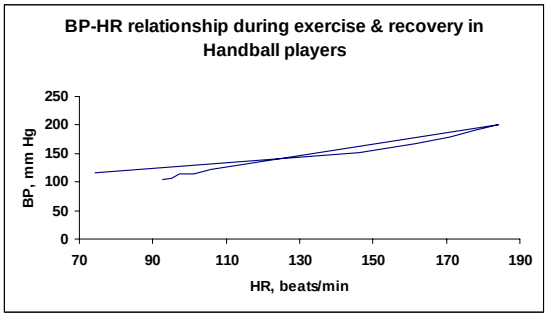

Figure 3

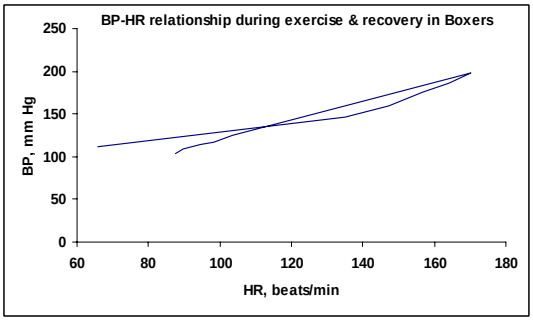

Figure 4

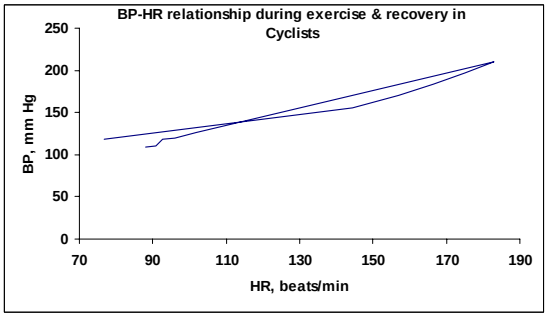

Figure 5

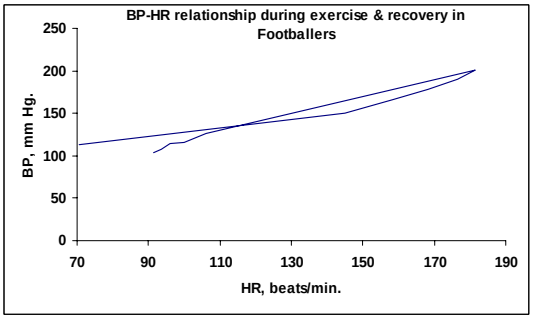

Figure 6

Boxers, cyclists and football players exhibit steeper BP-HR response after achieving 150 beat/minute of HR as compared to other categories. The observation suggests more intensive sympathetic stimulation attained by

boxers, cyclists and footballers beyond 150 beats/min of exercise. This stimulation helps them to achieve higher cardiac output and thus increases their ability to do exercise. Cardiac output increases in a rectilinear fashion and plateaus at maximal exercise. The initial increase in cardiac output reflects an increase in stroke volume and heart rate; however, at work load greater than 40-50% VO_2max, the increase in cardiac output is achieved solely by increases in the heart rate. In normally active individuals stroke volume increases initially and then plateaus at approximately 40-50% of VO_2max (*Astrand et al, 1964 and Higginbotham et al, 1986*). Stroke volume may actually decrease slightly near the end of maximal exercise in untrained and moderately trained individual (*Gledhill and Jamnik, 1994*). 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 (*Poliner et al, 1980*).

Heart rate increases in rectilinear fashion and plateaus at maximal exercise. Systolic blood pressure increases during maximal exercise, often reaching values in exercise of 200 mmHg in very fit individuals. The increase in systolic blood pressure is caused by the increased cardiac output which out weighs the decrease in resistance. Systolic blood pressure and heart rate are two variables that are routinely monitored during an exercise test to ensure the safety of participants. If either of these variables fails to rise with an increasing workload, cardiovascular insufficiency and an inability to adequately profuse tissue is possibility.

Another interesting observation indicates that BP-HR relationship line does not tow the BP-HR relationship line observed during exercise. The BP-HR relationship line during recovery is observed to lie above the BP-HR relationship line of exercise during the first minute of recovery indicating that BP remained elevated in spite of the fact that HR recorded a tremendous drop during the first minute of recovery, after this the BP-HR relationship line during recovery is observed to lie below the exercise BP-HR line. The abrupt drop in heart rate during first minute of recovery can be explained on the findings of many researchers who have reported withdrawal of intensive sympathetic stimulation achieved during exercise *(Gaesser and Brooks, 1984 and. Zafeiridis et al, 2005).*

Conclusion

On the basis of the study it is concluded that significant differences are demonstrated by different category of players and physical education students in their blood pressure and heart rate responses to varying intensities of exercise and at different points of recovery.

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Effect of Aerobic Exercises on Patients with early Coronary Artery Disease

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Abstract

The purpose of the study was to examine the effects of aerobic exercises on patients of early coronary artery disease. The study was conducted on thirty male adult patients of stable angina, ranging in age from 40 to 60 years (mean 53.2 years). Six weeks cardiac rehabilitation program (CRP) consisting of light aerobic exercises was administered to the subjects' with intermittent monitoring of their cardiovascular fitness. Intensity of exercise programme (CRP) was increased every two weeks. The results revealed that there was a gradual increase in cardiovascular fitness but the exercise tolerance had decreased during this period.

Key word: Coronary artery disease, Cardiac Rehabilitation, Exercise tolerance, Cardiovascular fitness

Introduction

Cardiac rehabilitation is a medically supervised programme to help heart patients recover quickly and improve their overall physical and mental functioning. *Wenger (1991)* states that coronary patients should not exercise at a level higher than that documented to produce an appropriate cardiovascular response during testing. He states further that aerobic exercises should be preferred, as isometric exercises increases heart rate, cardiac output and systolic blood pressure that can provoke angina.

In cardiac rehabilitation, a wider choice of intensities is left to the patient for aerobic exercise without giving up the potential to reduce cardiac risk factors *(Mertesdorf and Schmitz, 2005)*. *Smith et al, (2004)* quoted that low risk patients whose cardiac rehabilitation is initiated in the home environment may be more likely to sustain positive physical & psychological changes overtime than the patient whose programme is initially institution based. The goal of Cardiac rehabilitation is to reduce the risk of another cardiac event or to keep an already present heart condition from getting worse. Evidences suggest that improving the plasma lipid and lipoprotein profile with diet, exercise and drug therapy benefits patients. An attempt was given in this study to start the cardiac rehabilitation programme to the patients with chief complaint of stable angina from the first day onwards for six weeks.

Materials and Methods

Thirty male patients of coronary artery disease of age between 40-60 years were studied. All the patients were recruited from the Northern India. Those subjects were included in the study who had stable angina and were diagnosed by the physicians of Adesh Hospital Muktsar, Punjab. All the subjects had at least one common associated disease which was diabetes mellitus and were on the medication of beta-blockers which had blunted their heart rates. Only those subjects were taken into account who sincerely continued the CRP for six weeks period.

Following CRP was administered for a period of six weeks to the subjects' and their cardiovascular fitness was evaluated after every two weeks.

A set of exercises which consisted of lower limb and trunk exercises alongwith stretching exercises were taught to the patients on the very first day. The resting heart rate was measured by the sports tester and a target heart rate calculated as per Karvonen's formula was set for each subject for exercise. For the first two weeks the intensity of up to 10% increase in the heart rate was recommended to be achieved for CRP by the patients. Thereafter the target heart rate was incremented by further 5% every two weeks to 15% and 20%.

Crompton's Test was administered to the subjects' to assess their cardiovascular fitness. For this test the patient was made to lie down supine for at least three minutes. Then the pulse rate of the right radial artery was measured. Later on the patient was asked to stand up and the pulse rate was measured again immediately. The difference between the two pulse rates gave the value for cardio vascular fitness. Crompton's Test was repeated after every two weeks till the end of sixth week.

The rate of perceived exertion was asked verbally to the patients according to the tolerance of the exercises and was rated in accordance with the Borg's Scale on the first day. This was repeated after every two weeks till the end of six weeks.

Data was analyzed with the help of Macmed Software Win 98. Mean, standard deviation and standard error were calculated to interpret the results statistically. Paired t-test was utilized to evaluate the impact of CRP on cardiovascular fitness and exercise tolerance.

Results and Discussion:

Table 1: Mean Scores

CRP Phase	RHR	THR	CT	BS
First Day	63.2	73.2	9.9	12.3
End of 2nd week	66.1	81.0	8.2	13.7
End of 4th week	67.8	87.2	7.5	14.2
End of 6th week	67.5	Not Adv	5.7	12.6

RHR-Resting heart rate in beats/min., THR-Target heart rate in beats/min.
CT-Crompton test score, BS-Borg Score

Table -1 compares the mean scores of resting heart rate (RHR), target heart rate (THR), Crompton's test Score (CT) and Borg's Scale Score (BT) in patients' with early coronary artery disease at different stages of CRP. Results show that despite the fact that patients' are on regular intake of beta blockers which are known to blunt the heart rate, the resting heart rate increases after the second week till the end of the fourth week but at the end of the sixth week exhibit a tendency to stabilize. The results of the Crompton's test showed that in comparison from the first day the cardiovascular fitness increased as the values of the Crompton's test decreased at the end of sixth week steadily. The results of the RPE initially had risen from the first day to the end of the second week, also to the end of fourth week, but dipped down at the end of sixth week.

Tables 2 and 3 show the mean, standard deviation, standard error and paired t-test for CT & BS. Significant differences were found between the scores of Crompton's test before and after the cardiac rehabilitation which refer to increase in the cardiovascular fitness of the patients' after CRP. A similar comparison of RPE as assessed through Borg's Scale before and after the cardiac rehabilitation was made in the patients'. Results reveal non-significant differences between the scores of Borg's Scale before

and after the cardiac rehabilitation programme.

Table 2: Computation of analysis of 't' ratio of before and after cardiac rehabilitation on Crompton's test:

Period	Mean	SD	SEM	t-ratio
Before CRP	9.93	2.98	0.54	11.79*
After CRP	5.66	2.21	0.44	

* t value significant at p <0.001

Table 3: Computation of analysis of 't' ratio of before and after cardiac rehabilitation on Borg's Scale:

Period	Mean	SD	SEM	t-ratio
Before CRP	12.3	1.39	0.25	1.20
After CRP	12.6	1.71	0.31	

* t value significant at p <0.001

The study support the findings of many investigators who have reported positive effects of CRP comprising of aerobic exercises on the common pathway of coagulation reducing thrombosis formation and hypercoagulability at rest which suggest a reduced risk of atherosclerotic disease progression (*Gopinathannair & Lockhard, 2005*), LDL-Cholesterol (*Konig et al, 2005).* According to *American Heart Association (1965)* a balance of low level activity and rest is essential to the healing myocardium, especially during phase I rehabilitation.

The American Heart Association and American College of Sports Medicine proposes physical activity using dynamic exercises for the prevention of cardiovascular diseases as the secondary prevention. *Shiutt et al (2005)* states that exercise induces improvement of the cardiovascular risk factors e.g. dyslipidaemia, insulin resistance and inflammation, normalization of endothelial function and retardation of atherosclerosis.

In the present investigation the improvement in cardiovascular fitness with six weeks' of CRP provide evidence of benefit of light aerobic exercises in cardiovascular rehabilitation. Based on the observations of the present study and indicative findings of many investigators of positive impact of aerobic exercises in early cardiac rehabilitation, it is suggested that this should be included in the complex therapy in cardiac patients.

Conclusion:

The study provides an indication for starting cardiac rehabilitation from the first day. Though the resting heart rate during the initial phase of CRP increase in the patients' but with continuous endurance training to the heart muscle for six weeks it tends to stabilize with further progression of CRP. The Cardiovascular fitness increases steadily with the training programme.

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