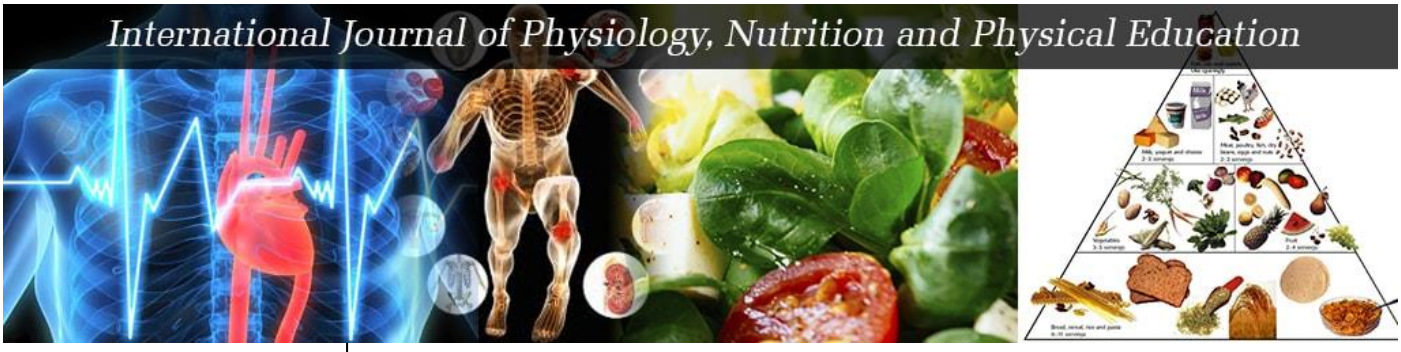

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Nusrat Gull
Department of Physical Education, Mewar University, Chittorgarh, Rajasthan, India

Correspondence
Nusrat Gull
Department Of Physical Education, Mewar University, Chittorgarh, Rajasthan, India

Relationship between anthropometric with cardiovascular endurance of inter university Kabbadi players

Nusrat Gull

Abstract
The purpose of this study was to find out the relationship between anthropometric with cardiovascular endurance of inter-university Kabaddi players. Present study was conducted to evaluate the effect of regular unstructured physical training and athletic level training on anthropometric measures, body composition, blood pressure and cardio respiratory fitness in adolescents. Inter University Kabbadi players in the age group of 20–24 years were classified into athletes (group 1) and physically active non-athletes (group 2). Parameters measured and calculated were weight, height, body mass index, waist and hip circumference, body fat percentage (BF%), fat free mass (FFM), Systolic (SBP) & Diastolic blood pressure (DBP), Mean arterial pressure (MAP), Rate pressure product (RPP) and Predicted VO_2 max.

Keywords: Physical activity, body composition, fat free mass, cardio respiratory fitness

Introduction
As we are moving into 21st century, alarming global health trends are emerging in developing countries like India, as indicated by a rapid increase in obesity, hypertension and decreased level of physical fitness among youth. Studies done on Indian school children reported a high prevalence of overweight and obesity and the prevalence of hypertension and prehypertension was found to be 2.8% and 2% respectively even in rural Indian children. Physical activity and improved dietary patterns are accepted strategies to overcome poor body composition, hypertension and reduced cardio respiratory fitness (CRF) in adolescents which are considered as independent risk factors for the development of future cardiovascular complications in adulthood. Global School based Student Health Survey (GSHS) states that in India, only 37.5% of students had met the WHO physical activity recommendations. Every student typically spends 8-10 hours in school from his/her early childhood to adolescence. The positive health behavior imparted in childhood continues even in adulthood. This necessitates the reconsideration of the role of the schools in addressing these problems. Hence, schools can become central element in ensuring the students' participation in adequate physical activity to develop healthy lifestyles. International guidelines recommend that children and adolescents should participate in physical activity for a minimum of 60 minutes a day which is developmentally appropriate, enjoyable, and involves a variety of activities. One hour physical activity can be spread throughout the day in school during physical education classes (PE), recess period, during intramural sports and in before-school and after-school programs. Participation in competitive sport such as interscholastic sport events and/or vigorous recreational exercise is gaining popularity due to the documented health benefits. This is a welcome trend as students who participate in one or more sports events report multiple positive health behaviors and lesser negative health behaviors than students who do not participate in sports.

Data Collection
Anthropometric Measures: All the anthropometric and skin fold thickness measurements were made by anthropometrist certified by International Society for the Advancement of Kinanthropometry (ISAK). Students weight was measured using a digital weighing scale to the

nearest 0.1 kg and height was recorded on vertical stadiometer to the nearest 0.1 cm. Body Mass Index (BMI) was calculated by using Quetelet formula i.e. body weight in kilograms/ height in meter square. Waist circumference (WC) was measured at the midpoint between lower rib margin and iliac crest at the end of expiration and hip circumference (HC) was measured at the maximal circumference over the buttocks using anthropometric tape (CESCROF Sports Equipment Limited, Porto Alegre - Rio Grande do Sul, Brazil).

Body composition measures: Body density was determined based on Durnin and Rahaman equation for Kabbadi players. Skin fold thickness was measured using Clinical plicometer innovare (CESCROF Sports Equipment Limited, Porto Alegre - Rio Grande do Sul, Brazil). Measurements were taken in triplicate to the nearest 0.1mm by the same investigator and the average measurement was used in data analysis. Then the BF% was calculated using Siri equation (BF% = (495/body density) – 450). Total body fat (kg) was obtained by multiplying BF% by weight and dividing by 100. Fat free mass (FFM) was calculated by subtracting body fat (kg) from body weight (kg).

Blood pressure: After giving 5 minutes of rest in sitting posture to the players, brachial systolic (SBP) and DBP and Heart rate (HR) were recorded on semi-automatic non-invasive BP monitor (CITIZEN CH432B, Japan). Pulse Pressure (PP) = SBP − DBP, Mean arterial pressure (MAP = DBP + PP/3), and Rate pressure product (RPP = [HR × SBP]/ 100) were calculated for each recording. Three BP and HR recordings at 2 minutes intervals were taken and the lowest of these values was included for the present study.

Cardio respiratory fitness: Players were asked to refrain from any vigorous intensity physical activity 24 hours prior to the day of RWFT and report to the 400 meters track two hours after taking light breakfast. They were instructed to walk as fast as possible for one mile on the track. Time for completion was noted using stopwatch. Followed by recording of number of pulse beat for 15 seconds from brachial artery and multiplied by four to obtain one minute recovery HR (beats/min). Body weight adjusted VO_2max (mL/ kg of body weight/ min) score was calculated using the following equation (18;19):

Female players: VO_2max = 139.168 – (0.88 X age in years) – (0.077 X weight in lb.) – (3.265 X walk time in minutes) – (0.156 X heart rate).

Male players: Add 6.318 to the equation for females above. Absolute VO_2max is calculated by multiplying the VO_2max adjusted for body weight by the corresponding body weight of the individual. VO_2max adjusted for FFM is calculated by dividing the absolute VO_2max by the corresponding FFM.

Statical Analysis

Mean difference between the groups was analyzed using unpaired Student's t– test. All statistical analysis was carried out for two-tailed significance at the 5 % level using SPSS version 19 (SPSSInc, USA)

Results

[Table-1] show that there was no significant difference in height, weight, BMI, waist and hip circumference between group 1 and group 2 students of both gender. Also, there was no significant intragroup gender difference in both group 1 and group 2 students in these parameters. As expected, BF% was significantly higher in female players as compared to males in both group 1 and group 2 students. In [Table-2]. Intragroup comparison shows that FFM was significantly higher in males as compared to females in both the groups. Intergroup comparison shows that FFM was higher in group 1 females as compared to group 2 females. However, the FFM values were comparable between group 1 and group 2 male players. Intergroup comparison shows that VO_2max body weight was higher in group 1 students as compared to group 2 persons of both the gender and intragroup comparison showed that VO_2max body weight was higher in the male players as compared to females in both the groups. Absolute VO_2max values were significantly higher in male players than in females in both the groups and intergroup comparison shows that absolute VO_2max values were higher in group 1 females as compared to group 2 females with no difference being observed between group 1 and group 2 males. VO_2max values adjusted for FFM showed no difference between the groups and between males and females.

Table 1: Comparison of anthropometric measures between group 1 and group 2 players

Parameters			Height (m)	Weight (kg)	BMI	Waist (cm)	Hip (cm)
Group 1	Female (FG1)	(n=34)	1.53±0.08	46.59±6.72	19.81±2.17	58.86±4.65	76.79±15.27
	Male (MG1)	(n=45)	1.56±0.10	47.21±9.39	19.23±2.10	59.80±8.21	74.50±9.49
Group 2	Female (FG2)	(n=68)	1.52±0.09	45.29±8.24	19.50±2.27	57.82±9.82	76.86±11.24
	Male (MG2)	(n=90)	1.58±0.13	49.07±10.63	19.47±2.17	59.54±8.04	74.64±10.13
p values	FG1 vs FG2		0.464	0.430	0.512	0.598	0.980
	MG1 vs MG2		0.403	0.338	0.552	0.860	0.940
	FG2 vs MG2		0.001	0.017	0.925	0.239	0.204
	FG1 vs MG1		0.207	0.745	0.241	0.582	0.448

Group 1 – players who underwent athlete level training;
Group 2 - players who underwent regular unstructured physical training. WHR – Waist to Hip ratio. Analysis between groups was done by unpaired Student t– test. $p< 0.05$ is considered statistically significant

Table 2: Comparison of body composition and cardiorespiratory finess between group 1 and group 2 adolescents

Parameters			BF %	FFM (kg)	VO_2max (BW)	VO_2max (abs)	VO_2max FFM
Group 1	Female (FG1)	(n=34)	30.19±3.95	33.19±4.39	54.40±5.00	2522.40±357.70	67.82±22.08
	Male (MG1)	(n=45)	16.38±5.59	39.45±8.07	60.76±4.49	2851.67±515.68	67.88±16.66
Group 2	Female (FG2)	(n=68)	29.64±3.84	31.19±4.79	48.70±3.21	2204.48±416.62	65.50±13.96
	Male (MG2)	(n=90)	17.25±5.13	40.60±9.15	55.48±3.55	2722.64±618.53	67.28±5.78
p values	FG1 vs FG2		0.533	0.046	< 0.001	< 0.001	0.520

	MG1 vs MG2	0.384	0.505	< 0.001	0.242	0.759
	FG2 vs MG2	< 0.001	< 0.001	< 0.001	< 0.001	0.277
	FG1 vs MG1	< 0.001	< 0.001	< 0.001	0.002	0.988

Group 1 – players who underwent athlete level training;
Group 2 - players who underwent regular unstructured physical training. FFM- Fat Free Mass, VO_2max (BW)– VO_2max adjusted for body weight, VO_2max (abs) - VO_2max absolute, VO_2max FFM – VO_2max adjusted for fat free mass, Analysis between groups was done by unpaired Student t –test. $p < 0.05$ is considered statistically significant

Table 3: shows that DBP, MAP and RPP were significantly lower in group 1 students of both genders when compared to group 2 students. There was no significant difference in other cardiovascular parameters between the groups.

Table 3: Comparison of Cardiovascular parameters between group 1 and group 2 adolescents

Parameters			SBP (mmHg)	DBP (mmHg)	MAP (mmHg)	PP	HR (beats/min)	RPP
Group 1	Female (FG1)	(n=34)	109.06±8.16	63.88±6.87	78.94±6.64	45.18±6.55	76.38±10.01	8330.44±1291.36
	Male (MG1)	(n=45)	106.67±7.01	64.40±7.51	78.49±6.21	42.27±8.32	79.20±7.68	8434.22±876.80
Group 2	Female (FG2)	(n=68)	111.84±9.15	67.97±4.50	82.59±4.85	43.87±8.97	80.44±10.80	8993.06±1414.82
	Male (MG2)	(n=90)	110.86±11.57	67.86±10.32	82.22±9.71	43.00±10.11	80.70±11.34	8944.22±1554.40
p values	FG1 vs FG2		0.137	<0.001	0.002	0.452	0.070	0.024
	MG1 vs MG2		0.027	0.048	0.020	0.675	0.425	0.043
	FG2 vs MG2		0.565	0.932	0.576	0.776	0.885	0.840
	FG1 vs MG1		0.166	0.754	0.097	0.757	0.161	0.672

Group 1 - Players who underwent athlete level training.
Group 2 - players who underwent structured physical training. SBP – systolic blood pressure, DBP - diastolic blood pressure, PP – Pulse pressure, HR – Heart rate. Analysis between groups was done by unpaired Student t–test. $p < 0.05$ is considered statistically significant

Discussion

We observed that the anthropometric measures of males and females in both the groups (group 1 and group 2) were within the normal limits according to available national studies. However, there is no national reference data available for the hip circumference of adolescents. BMI values and BF% values of males and females in both the groups were within the 5^{th} and 95^{th} percentile of the available national reference data. Hence, students from both the groups can neither be considered underweight nor overweight based on BMI and BF% values. Further, the VO_2max body weight values of both the group students were in superior category in both the genders according to Heywood classification. None of the students in our study was either hypertensive or prehypertensive [SBP, DBP or both more than 95^{th} percentile for age, sex and height was considered hypertension and between 90^{th} and 95^{th} percentile was considered as pre hypertension [27]. These findings suggest that students of both the groups have optimal body composition measures, BP and CRF. This observation can be attributed to the regular physical activity practiced by both group 1 and group 2 students of both genders and the availability of balanced diet to all. Our findings also substantiate the international recommendations that one hour of physical activity daily is sufficient for the optimum development of adolescents and reducing their cardiovascular risk later in the life

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