



EVALUATION OF AEROBIC AND TRUNK MUSCLE ENDURANCE AMONG UNDERGRADUATE PHYSIOTHERAPY STUDENTS –AN OBSERVATIONAL STUDY

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Abstract

Background: Physiotherapists were desired to have a good level of physical fitness to meet their job demands. As educators of Physical Therapy profession, it was important to expose students to their professional physical fitness demanded that they would face in employment setting. The professional demands of physiotherapy profession required the therapist to engage in activities which demanded good amount of strength, endurance.

Methods: An observational study was conducted on 156 male and female Physiotherapy students , Cooper 12 min walk test for aerobic endurance, Sorensen test for trunk extensor endurance, Plank test for trunk flexor endurance were performed on students, BMI was calculated and subjects were divided on basis of BMI that overweight and normal was done.

Results: The aerobic endurance of physiotherapy students between the age of 22-23 was lowest (i.e. 32.60 ml.kg-1min⁻¹). trunk extensor and flexor endurance of the student lowest between the age 18-19 was 01:12 sec. 47:48 respectively. The Comparison between the overweight and normal BMI students for the trunk extensor and trunk flexors endurance showed the significant difference that is $p=0.02$, $p=0.06$. The comparison between the overweight and normal BMI students for the aerobic endurance showed no significant difference that is $p=0.088$ difference that is $p=0.021$, $p=0.061$.

Conclusion: It was found that Physiotherapy students have low to moderate level of aerobic endurance and trunk muscle endurance .The aerobic endurance didn't show statically significant between normal BMI and overweight Physiotherapy students .The trunk muscle endurance statically significant between normal BMI and overweight Physiotherapy students.

Key words: Aerobic endurance , BMI , Physical activity , trunk muscle endurance

INTRODUCTION

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure.

The term “physical activity” could not be interchanged with “exercise”. Exercise, is a subgroup of physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective. Physical activity comprised of exercise as well as other activities which involved bodily movement and were done as a part of playing, working, active transportation, house chores and recreational activities.

Regular physical activity (PA) and health-related physical fitness were key indicators of health outcomes. Physiotherapy professional bodies had been recognizing that physical activity and exercise were integral to professional practice and were core contributors to health along with reducing the risk of developing diabetes, hypertension, and cardiovascular diseases. PA also improved emotion and stress control.^[1]

Physiotherapists were desired to have a good level of physical fitness to meet their job demands. As educators of Physical Therapy profession, it was important to expose students to their professional physical fitness demanded that they would face in employment

setting. The professional demands of physiotherapy profession required the therapist to engage in activities which demanded good amount of strength, endurance. The Physiotherapists were widely involved with and flexibility.^[2]

A reasonably high level of physical fitness was required to carry out the routine job activities of a physiotherapist. However, in the curriculum and academic experience no attention was given to the physical fitness of physiotherapy students. Therefore, as students of Physiotherapy, it was all the more relevant that they understand the demands of the profession and their actual physical fitness.^[2]

The functions performed by physical therapists in health care delivery system were diverse. The therapist worked in hospitals with all varieties of patients.^[2]

Physiotherapist is required to be engaged in various activities. The therapist work in hospitals and in rehabilitation centers with varieties of patients. Their work involves giving various exercises to patients, transferring of patients for that they need good amount of strength, endurance and flexibility. Therefore they need to maintain good physical fitness level to meet their demands.^[3]

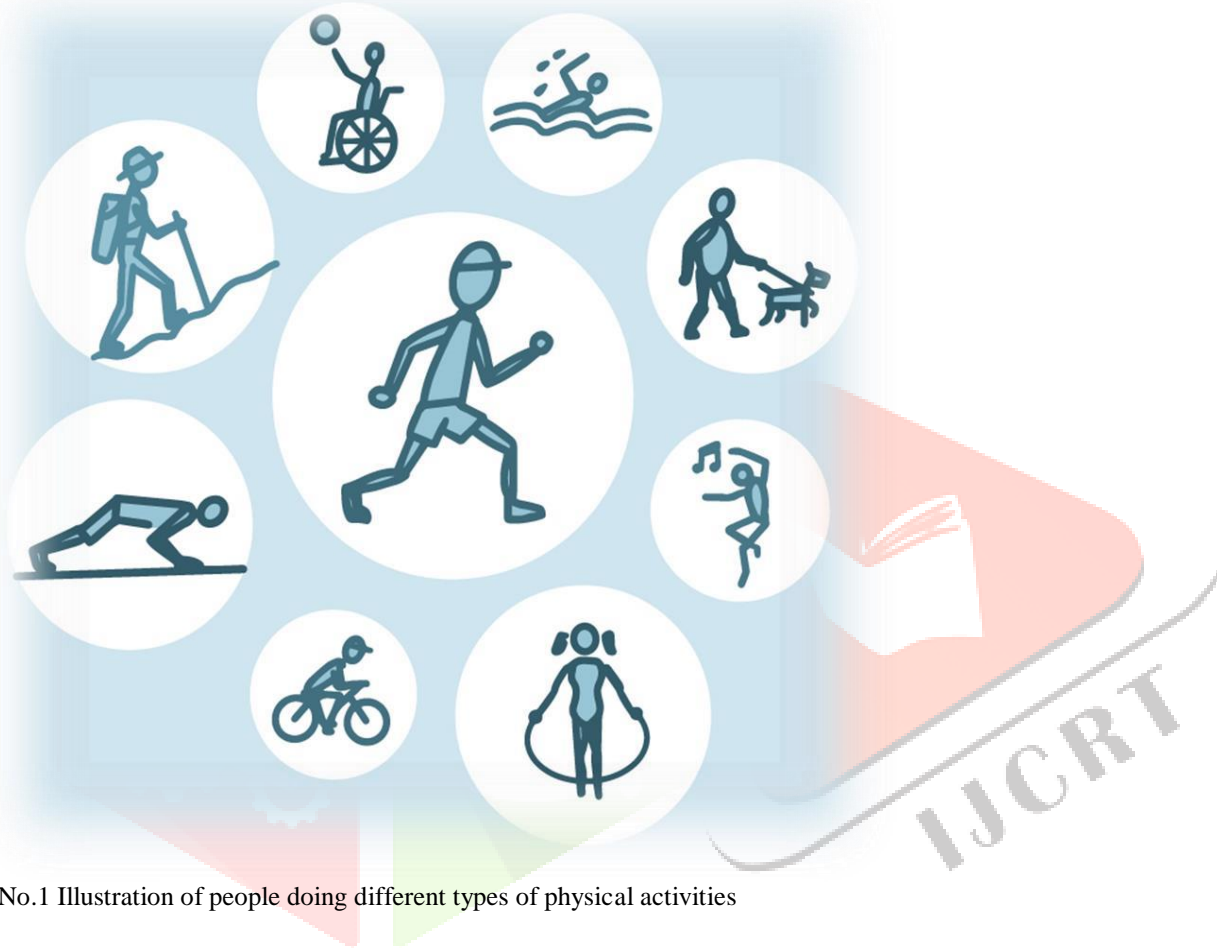


Fig No.1 Illustration of people doing different types of physical activities

MATERIALS AND METHODOLOGY

1. Type of Study – Observational Study.
2. Method of Sampling – Cluster Sampling.
3. Study setting – Dr. Ulhas Patil College Of Physiotherapy, Jalgaon.
4. Study Population – Physiotherapy students of age between 18-23 yrs.
5. Sample Size – 156 physiotherapy students
6. Study Duration – 6 Months.
7. Study place – Dr. Ulhas Patil College of Physiotherapy, Jalgaon.
8. Materials required –
 - i. Informed consent form
 - ii. Pen
 - iii. Paper
 - iv. Measuring tape
 - v. Plinth
 - vi. Weighing machine
 - vii. Inch tape

9. Outcome Measure –

- i. Cooper 12 min walk test
- ii. Sorensens test
- iii. Plank test

10. Statistical Tool –

- i. Unpaired test

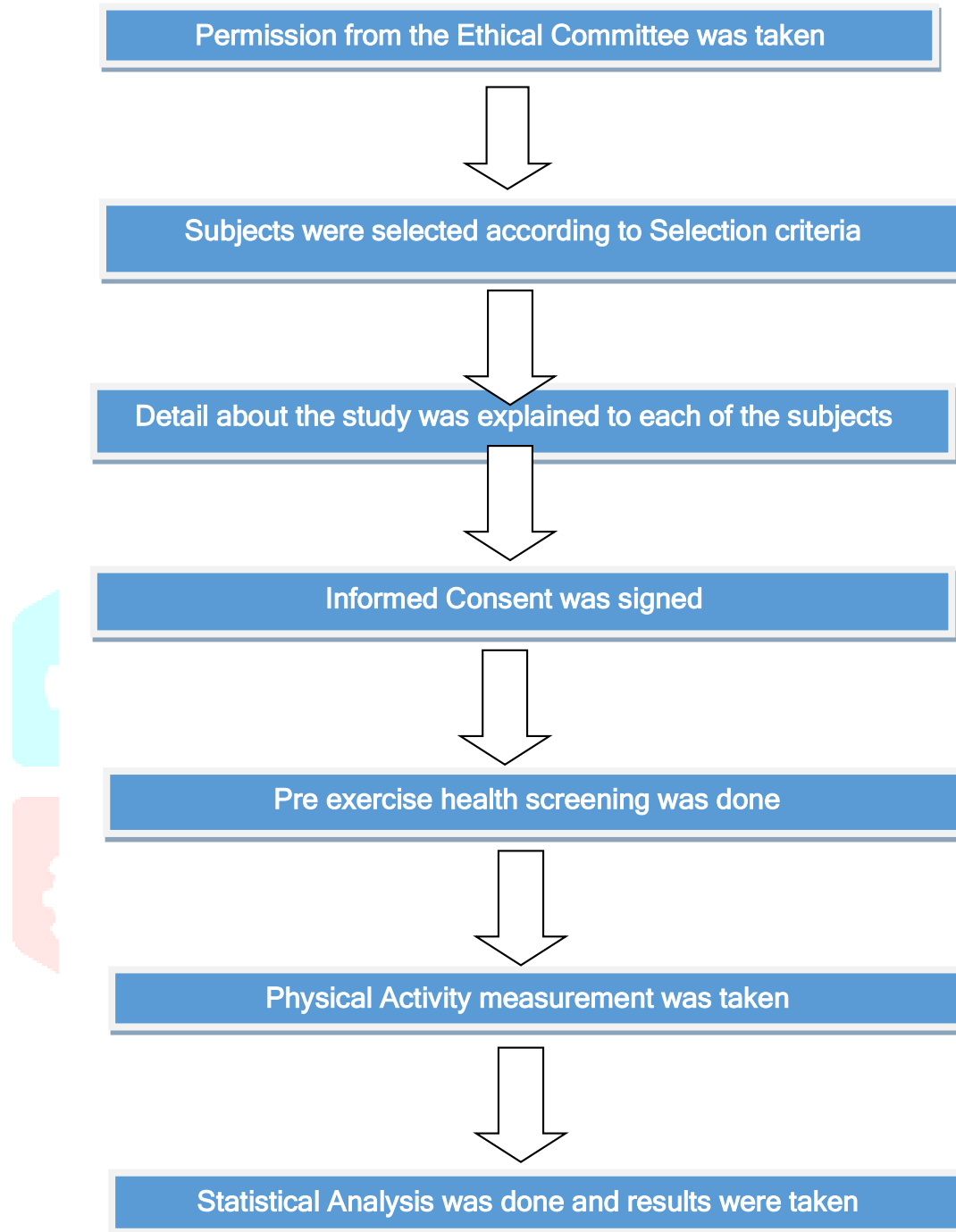
SELECTION CRITERIA**• Inclusion criteria :-**

1. Subjects with informed consent.
2. Subjects of Age Group of 18-23 years were included
3. Both the genders.

• Exclusion criteria:-

1. Any recent abnormal cardiovascular and pulmonary condition.
2. Any gait abnormality
3. Any musculoskeletal abnormality of UE ,LE, Spine
4. Post covid subjects
5. Individuals involved in sports and gym activities
6. Any recent surgery



PROCEDURE**Outcome Measures****Physical Activity Measurement**

A) COOPER 12 min Walk test

- $VO_{2max} = \text{distance in meters} + 504.9 / 44.73$

Subject was asked to cover the maximum distance as they can cover in 12 minutes.

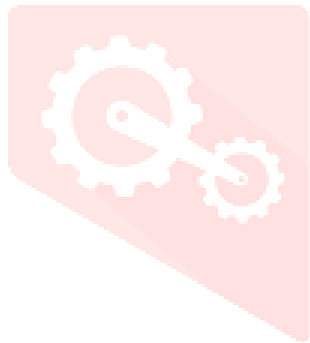
Place markers at set interval around the track to aid measuring the completed distance ,participants run for 12 min and the total distance covered was recorded. Walking is allowed ,though the participants must be encouraged to push themselves as hard as they can to maximize the distance covered.

B) To Measure Endurance of Trunk Extensors Muscles (TE)

• Sorenson's Test: - Subject was asked to lie prone on the examination table with the upper edge of the iliac crests within alignment with the edge of the table. The lower body was fixed to the table by three straps around the pelvis, knee and ankle, with the arms folded across the chest; the patient isometric ally maintained the upper body in horizontal position while time was recorded. (Fig No.2)



Fig No.2



C) To measure Endurance of trunk flexor muscles (TF)

• Plank Test: - Subject in prone position with forearm placed on the ground with the elbows aligned below the shoulders and arms parallel to the badh at about shoulder width distance and time was recorded. (Fig No.3)

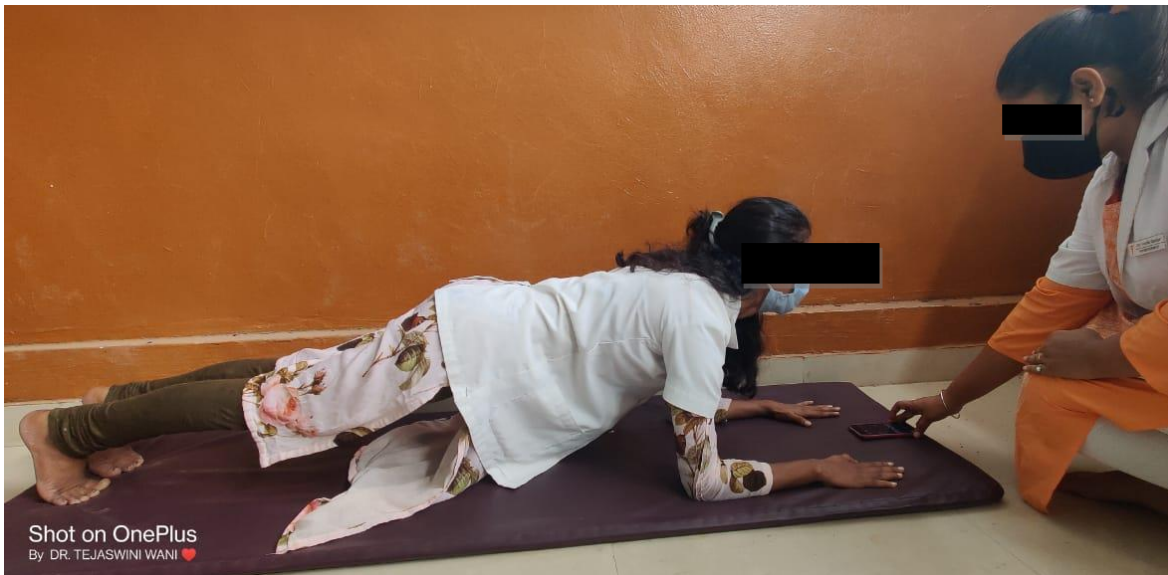
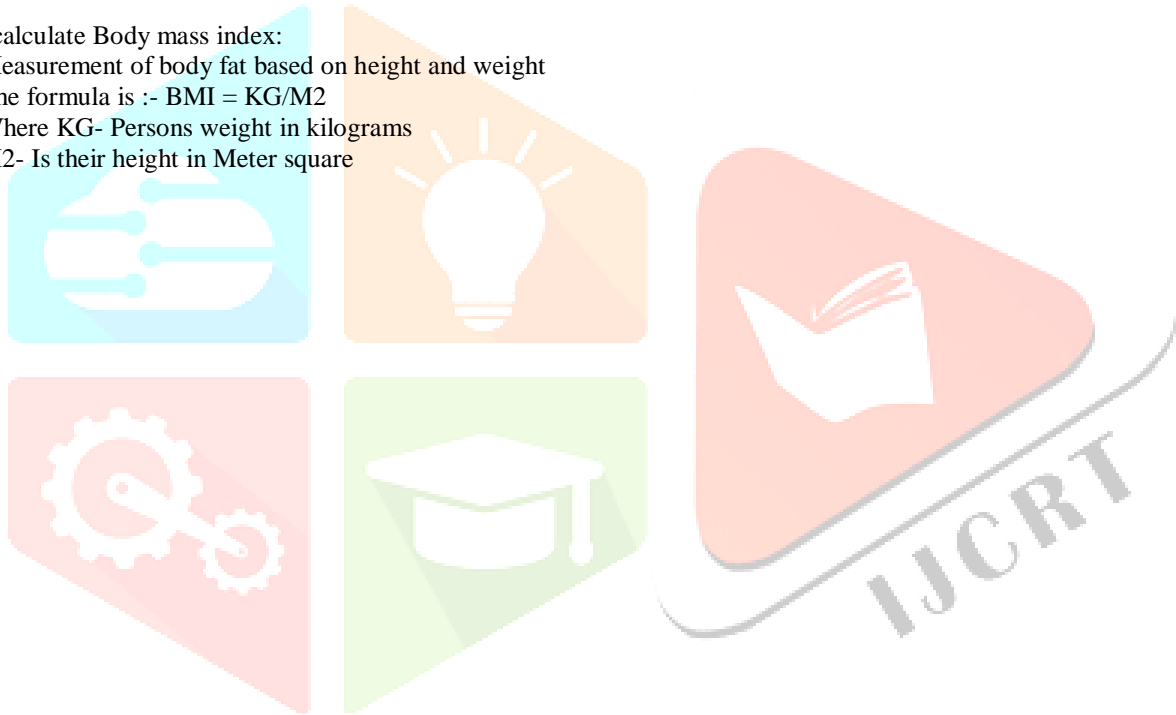


Fig No.3

- D) To calculate Body mass index:
Measurement of body fat based on height and weight
The formula is :- $BMI = KG/M^2$
Where KG- Persons weight in kilograms
M²- Is their height in Meter square

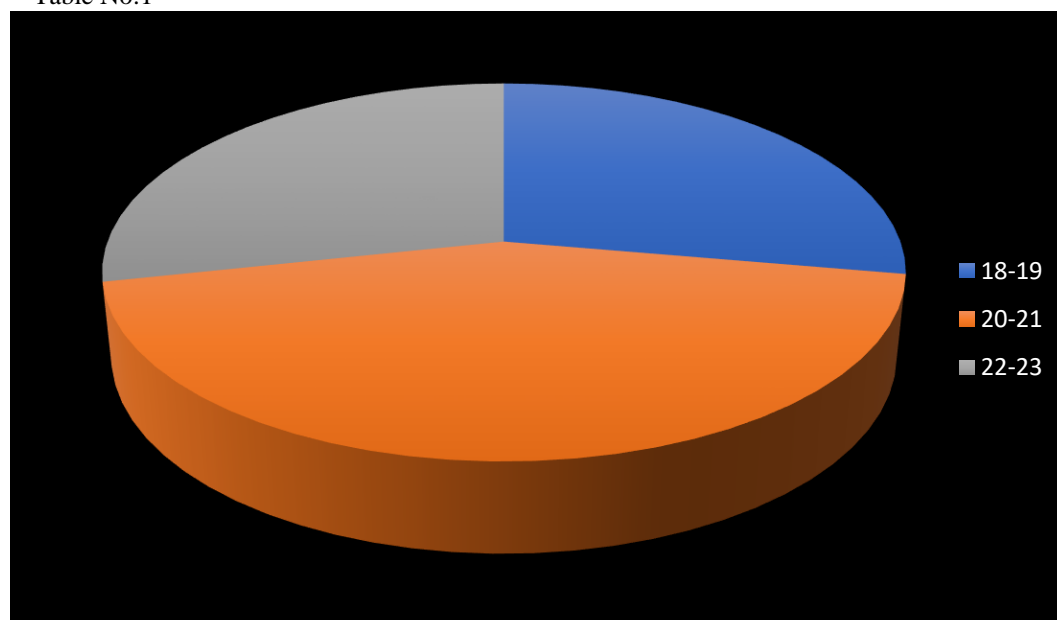


DATA ANALYSIS

Table No. 1: Age distribution

AGE	No. of students
18-19	43
20-21	68
22-23	44

Table No.1

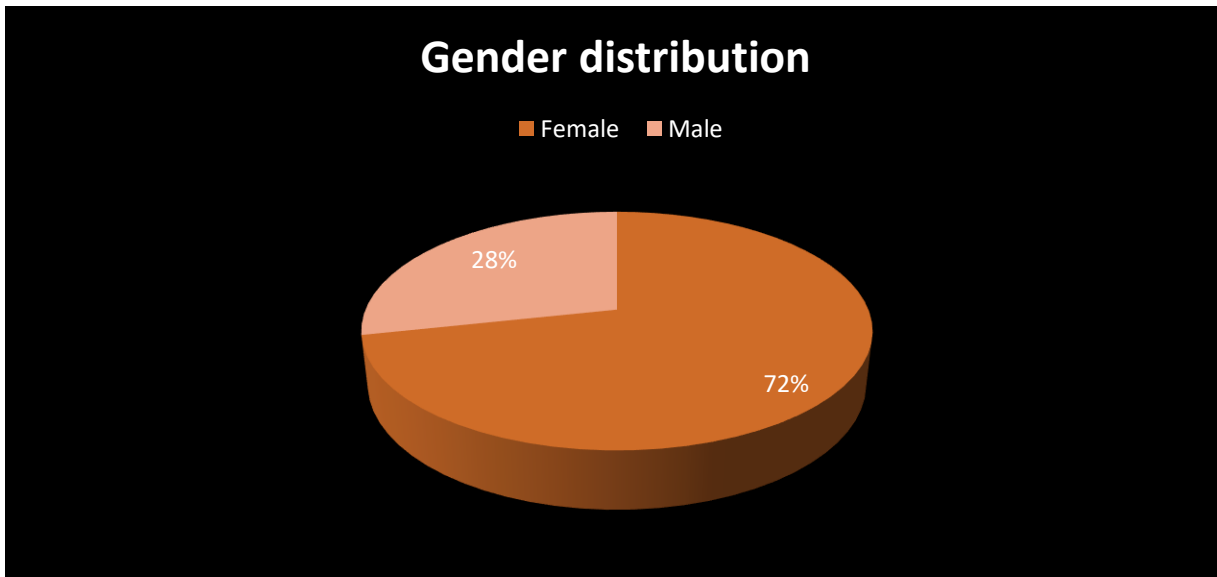


Graph No.1

Table no.1 and graph no. 2 suggest that here the total no of students where divided according to the age group they where divided into 3 age group like wise age group between 18-19 there where total 43 students ,in age group 20-21 total no of students where 68 , in age group 22-23 there where 44 students .

Table No. 2: Gender distribution

GENDER	No.Of Students
Female	112
Male	44



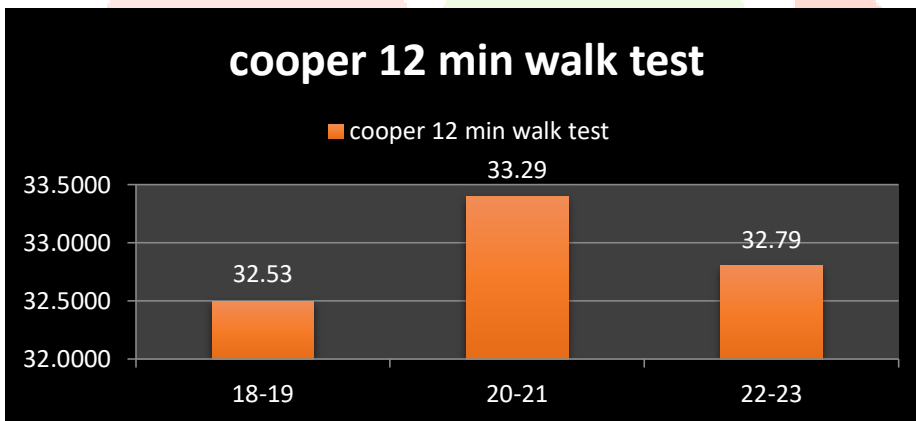
Graph No.2

Table no. 2 and graph no.2 suggest that there were total 156 students among them 112 students were female and 44 were male .

COOPER TEST

Table No.3

Cooper Test		
Age	Mean	Std. Deviation
18-19	32.5300	3.58040
20-21	33.2996	3.29511
22-23	30.7953	2.65381



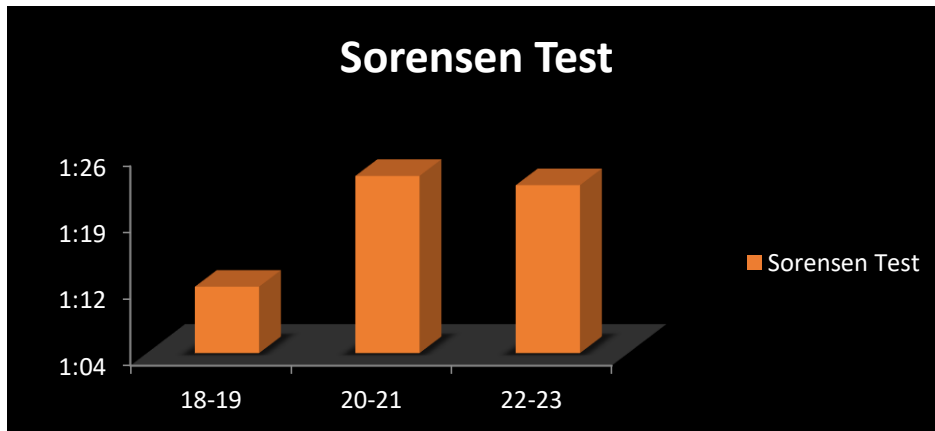
Graph No.3

Table no. 3 and graph no. 3 shows the mean and the standard deviation of the cooper 12min walk test of 3 different age group . The age group 18-19 the mean 32.53 ± 3.58 , the age group 20-21 mean 33.29 ± 3.29 , and in age group 22-23 mean 30.79 ± 2.65 .

SORENSEN TEST

Table No.4

Sorensen Test		
Age	Mean	Std. Deviation
18-19	01:12	00:24
20-21	01:24	00:36
22-23	01:23	00:37



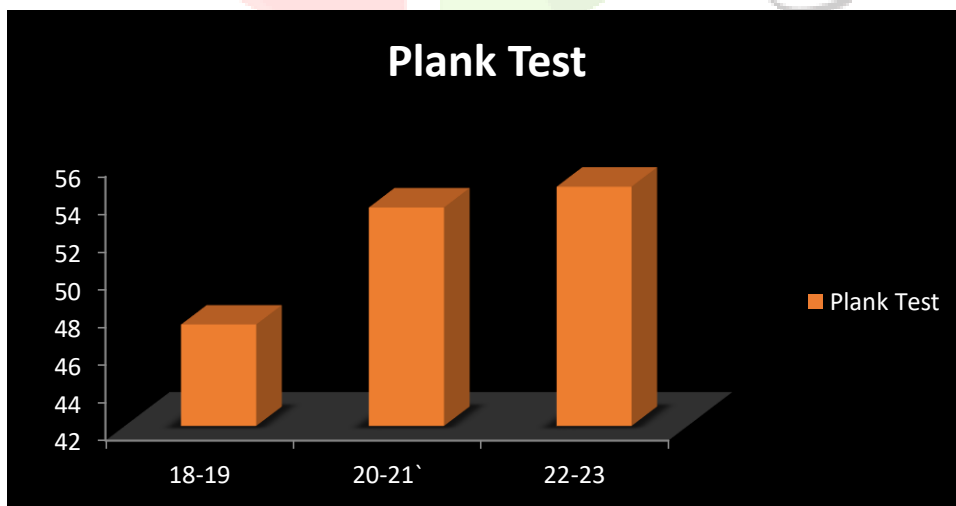
Graph No.4

Table no. 4 and graph no. 4 shows that the mean and the standard deviation of Sorensen test of 3 different age group .The age group between 18-19 the mean $01:12 \pm 00:24$, for age group 20-21 the mean $01:24 \pm 00:36$, and for age group 22-23 the mean $01:23 \pm 00:33$

PLANK TEST

Table No.5

Plank Test		
Age	Mean(sec)	Std. Deviation
18-19	47.4884	20.56508
20-21	53.6912	25.99211
22-23	54.7045	28.12975



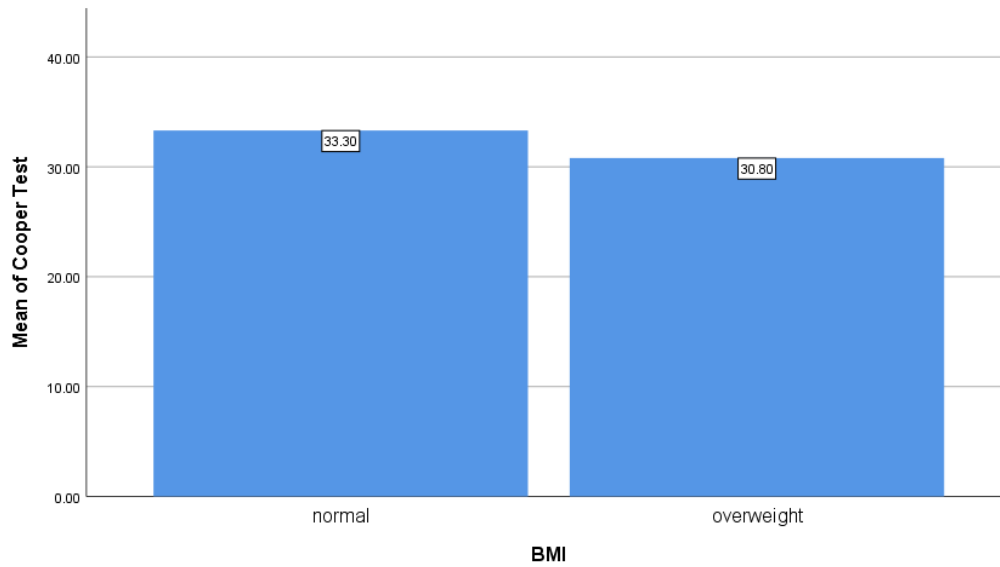
Graph No.5

Table no.5 and graph no. 5 shows the mean and the standard deviation of Plank test of 3 different age group .The age group between 18-19 the mean 47.48 ± 20.56 , for age group 20-21 mean 53.69 ± 25.99 and for the age group 22-23 the mean 54.70 ± 28.12 .

COMPARISION OF AEROBIC ENDURANCE AMONG NORMAL BMI AND OVERWEIGHT STUDENTS

Coopertest	
BMI	Mean
normal	33.2996
overweight	30.7953

Table No.6



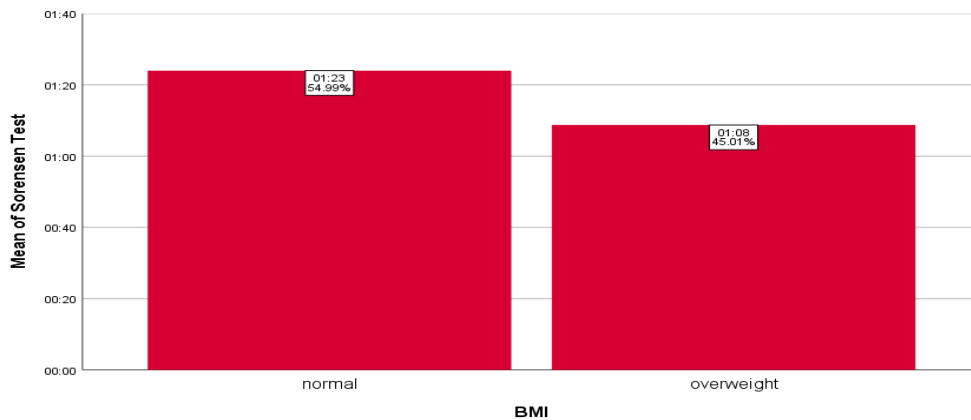
Graph No.6

Table no. 6 and graph no. 6 shows the mean of the cooper test when compared between the normal BMI students (33.2)and the overweight BMI students (30.7)

COMPARISION OF TRUNK EXTENSOR MUSCLE ENDURANCE BETWEEN NORMAL BMI AND OVERWEIGHT STUDENTS

Sorensen Test	
BMI	Mean
normal	01:23
overweight	01:08

Table No.7



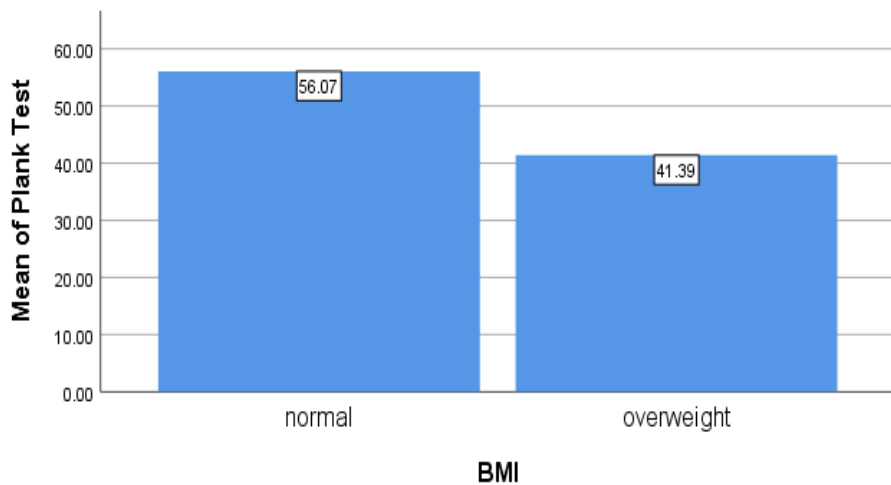
Graph No.7

Table no. 7 and graph no. 7 the mean of the Sorensen test when compared between the normal BMI students (01:23) and overweight BMI students (01:08)

COMPARISON OF TRUNK FLEXOR MUSCLE ENNDURANCE BETWEEN NORMAL BMI AND OVERWEIGHT STUDENTS

Plank Test	
BMI	Mean(sec)
normal	56.07
overweight	41.39

Table No. 8



Graph No.8

Table no. 8 and graph no. 8 shows the mean of plank test when compared between the normal BMI students (56.07) and overweight BMI students (41.39)

Table No.9

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Plank Test	Equal variances assumed	3.580	0.061	3.009	131	0.003	14.683	4.881	5.028	24.338
	Equal variances not assumed			3.692	#####	0.000	14.683	3.977	6.794	22.573

Table no.9 shows significant difference (0.061) when we compared the normal BMI students and the overweight M=BMI students for plank test

Table No.10

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Sorensen Test	Equal variances assumed	5.434	0.021	2.307	131	0.023	00:15	00:06	00:02	00:28
	Equal variances not assumed			3.049	#####	0.003	00:15	00:04	00:05	00:25

Table no.10 shows significant difference (0.021) when we compared the normal BMI students and the overweight BMI students for Sorensen test

Table No.11

Independent Samples Test										
Levene's Test for Equality of Variances			t-test for Equality of Means							
				t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
CT	Equal variances assumed	2.952	0.088	4.091	131	0.000	2.50431	0.61214	1.29335	3.71527
	Equal variances not assumed			4.516	77.286	0.000	2.50431	0.55459	1.40005	3.60857

Table no. 11 shows no significant difference (0.088) when we compared the normal BMI students and the overweight BMI students for Cooper test

RESULT

Data of 156 students was analysed there were 112 females and 44 males, students between the age group 18-19 were 43, between 20-21 were 68 and between 22-23 were 44

We found that the aerobic endurance of physiotherapy students between the age of 18-19 years was 33.53 ml.kg⁻¹.min⁻¹ between the age 20-21 years was 33.29 ml.kg⁻¹.min⁻¹ between age 22-23 was 32.60 ml.kg⁻¹.min⁻¹

The mean of trunk extensor endurance of the student between the age 18-19 was 01:12 sec, between the age 20-21 was 01:24sec, between the age 22-23 was 01:23sec. The mean of trunk flexor endurance of the students between the age 18-19 was 47:48 sec, between age 20-21 was 53:69 sec, between age 22-23 was 52:25 sec

As we compare BMI between the normal and the overweight, it was found that the aerobic endurance of normal BMI students was 33.2 ml.kg⁻¹.min⁻¹ and of overweight was 30.79 ml.kg⁻¹.min⁻¹

For the trunk extensor endurance of normal BMI students was 01:23sec and of overweight students was 01:8 sec

For the trunk flexor endurance of normal BMI students was 56.07sec and of overweight was 41.39sec

The comparison between the overweight and normal BMI students for the trunk extensor and trunk flexors endurance showed the significant difference that is p= 0.021, p=0.061

The comparison between the overweight and normal BMI students for the aerobic endurance showed no significant difference that is p=0.088

DISCUSSION

The aim of the study was to evaluate the physical activity level and physical fitness parameter in Dr. Ulhas Patil college of Physiotherapy students. Regular physical activity and health related physical fitness were key indicators of health outcomes. Cardiorespiratory endurance or general endurance is the ability of the cardiovascular and respiratory systems to supply oxygenated blood to active muscles during prolonged physical activity, VO_{2max} is defined as the maximum capacity of the body to utilize oxygen during maximum effort. VO_{2max} depends upon the oxygen transport, the oxygen binding capacity of the blood, and the body's ability to extract oxygen and the muscles oxidative capacity. Physiotherapy professional bodies have been recognized that physical activity and exercise were integral to professional practice and were core contributors to health along with reducing the risk of developing diabetes, hypertension, and cardiovascular diseases. As educators of Physiotherapy profession, it was important to expose students to their professional physical fitness demands that they would face in employment settings.

The students in this study were 112 female and 44 male [table no.1]. The age group was 18-23 among them they were divided into 3 groups majority of them were in between the age of 20-21 respectively [table no.2].

The result of the study shows that the aerobic endurance of the Physiotherapy students of between age group 18-19 years was 33.53 ml.kg⁻¹.min⁻¹, and between age group 20-21 was 33.29 ml.kg⁻¹.min⁻¹ and between age group 22-23 was 32.60 ml.kg⁻¹.min⁻¹. It

suggest that the highest VO_{2max} observed among the youngest age group (18-19 years) and was $33.53 \text{ ml.kg}^{-1}.\text{min}^{-1}$. [table no.3]. The results were similar to Henrik Loe study which showed that VO_{2max} was higher in the youngest age group. The Cooper's 12 min test was used to evaluate aerobic endurance. Validity of this test was given by Bandyopadhyay.

The mean of trunk extensor endurance of students between age group 20-21 was the highest and was 01:24sec and lowest in the age group between age 18-19 and was 01:12sec the minimal difference was seen in between all the 3 groups divided according to age. [table no.4] Chidozie E. Mbada, study results showed that there was no significant difference in the back muscles' endurance level of the adolescents and the young adults (20-29 yrs). Back muscles' endurance peaked between the 20 to 29 year age-category for mixed-sex groups. It suggested that the back muscle endurance decreases with increase in age. The result of this study showed that the mean endurance time was greater among men than women.

Elzbieta Szczygiel, et al. The study was done between the age group 18-23 years. It suggested that the deep muscle training could improve the trunk and respiratory control. The result confirmed that effect of deep muscle training on improved postural control. As Physiotherapist work basically correlate with postural control of him self to avoid the injuries. In this study the result showed that the mean of the trunk flexors endurance of students between age group 20-21 was the highest and was 53.69 sec and the lowest in the age group between age 18-19 and was 47.48 sec the minimal difference was seen in between all the 3 groups divided according to age. [table no.5]

The Xiaobin Chen et al. study suggested that overweight and obese students had poor performance in physical index than the normal weight students. As we compare BMI between the normal and the overweight, Obesity students might be less likely to take part in physical activity because of fear of poor, the abnormal weight status showed a bad performance of vital capacity weight index. It was found that the aerobic endurance of normal BMI students was comparatively higher that was $33.2 \text{ ml.kg}^{-1}.\text{min}^{-1}$ then the overweight BMI students and was $30.79 \text{ ml.kg}^{-1}.\text{min}^{-1}$. [table no.6]

Comparison for the trunk extensor endurance here we found that the trunk extensor endurance of normal BMI student was comparatively higher and was 01:23 sec than that of the overweight BMI students and was 01:8 sec. [table no.7] Comparison for the trunk flexor endurance here we found that the trunk flexor endurance of normal BMI students was comparatively higher that's 56.07 sec than that of the overweight BMI students that's 41.39 sec. [table no.8]

Here we did the unpaired t test The Comparison between the overweight and normal BMI students for the trunk extensor and trunk flexors endurance showed the significant difference that is $p=0.021$, $p=0.061$ [table no.9 and 10]

Kshitija Umesh Patkar et al, found no significant difference in obese and normal weight group indicating same cardiorespiratory performance in both the groups.

In fact Nevil et al, reported that the lighter person more likely to be placed in a low VO_{2max} category. In order to have a definite result, we aimed at finding a correlation between the fat percent, lean body mass with VO_{2max} . Our results indicate that there was a significant positive correlation with lean body mass. Fat percent had a negative correlation but was not statistically significant.

Goran et al, examined the influence of body weight and body composition (FM vs FFM) on aerobic fitness. The result of this study indicated that the maximal oxygen consumption of fat free tissue is independent of body fat mass. FM does not have any effect on VO_{2max} . These findings suggest that obese individuals do not have lower maximal aerobic capacity of their FFM compared with lean individuals or impaired cardiorespiratory and pulmonary responses to exercise. Thus inferring, VO_{2max} may be normal even in individuals with higher BMI. Also in the obese individuals there is increase in type II muscle fibers and decrease in type I muscle fibers which may have important effect on reduced oxygen uptake.

The comparison between the overweight and normal BMI students for the aerobic endurance showed no significant difference that is $p=0.088$ [table no.11]

The decrease in VO_{2max} in overweight and obese might be due to the following reasons: The mitochondrial oxidative enzyme activity is very less in obese people as the number of mitochondria and their function is limited in the skeletal muscles of overweight and obese individuals. Whereas the Glycolytic enzymes that is the Phospho fructokinase and a-glycerol phosphate activity is more in obesity and type II diabetes.

The Type I muscle fibers also called the slow twitch oxidative fibers are more in number than type II fibers in obese individuals. As the name implies the type I fibers are rich in mitochondria and glutamines enhancing the glucose metabolism regulated by insulin. Some other studies have also implied the same.

Increasing adiposity is associated with lower skeletal muscle oxidative capacity and capillarization. Skeletal muscle capillaries are a fundamental component in diffusion of various substance including oxygen, glucose, insulin, and fatty acids from the circulation of skeletal muscle.

The increase in body fat in obese individuals should have an increase in capillarization in order to provide adequate oxygen and nutrient diffusion but the results have shown that there is low adipose tissue capillary density, decrease in vascular endothelial growth factor (VEGF) suggesting that obese Adipose tissue is deprived of oxygen.

CONCLUSION

It was found that Physiotherapy students have low to moderate level of aerobic endurance and trunk muscle endurance .The aerobic endurance did not statically significant between normal BMI and overweight Physiotherapy students .The trunk muscle endurance statically significant between normal BMI abd overweight Physiotherapy students.

LIMITATIONS

1. Study is limetd under Dr. Ulhas Ptil College of Physiotherapy
2. And here we just evaluated the aerobic endurance and the trunk muscle endurance

SUGGESTION / FUTURE SCOPE

Future study can be done to evaluate the Flexibility and Strength among the Physiotherapy students , As the flexibility and strength are the basic demand for the Physical Therapist to deal with there job demand

Funding: Self Funding

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