

Study of VO₂ Max and MET Values of the B. P. Ed. and M. P. Ed. Students
Prof. A. S. Giri, Asst. Professor, MSM's College of Physical Education, Aurangabad, M. S.

Introduction:

Training:

The word 'Training' has been a part of human language since ancient times. It denotes the process of preparation for some task. This process invariably extends to a number of days and even months and years. The term 'training' is widely used in sports. The regular and systematic use of physical exercise, however, does not guarantee maximum improvement in performance. The effect of these exercises is increased or decreased by a multitude of factors. Some of these factors, if ignored, lead to a drastic reduction in the efficacy of physical exercise. The complex nature of sports training involving physical exercise along with other means becomes obvious when one looks at the training of advanced sports persons. The training of advanced sports persons is significantly supported by means and measures from several sports science disciplines e.g., sports medicine, sports physiology, nutrition, physiotherapy, sports psychology, sports biomechanics and so on. The training for specific sports is based on motor abilities viz. strength, speed, endurance, flexibility and coordinative abilities. Few sports are dominated by specific motor ability along with all other in supportive action. In this study the scholar is specified to only endurance ability, which is dominated in basketball sport.

Endurance:

Endurance training is the deliberate act of exercising to increase stamina and endurance. An Exercise for endurance tends to be aerobic in nature versus anaerobic movements. Aerobic exercise develops slow twitch muscles. Performing these exercises strengthens and elongates the muscles for preparation of extended periods of use.

Athletes train for endurance to compete in 5k and 10k races, half marathons, marathons, ultra marathons, triathlons, Ironman competitions, Century bike rides, mountain biking and so on. Non-athletes can train similarly with an aerobic workout to burn calories and fat. It is known that long distance training (LDT) for endurance over long periods of time can be harmful to joints and ligaments.

Long-term endurance training induces many physiological adaptations both centrally and peripherally mediated. Central cardiovascular adaptations include decreased heart rate, increased red blood cell count, increased blood plasma which reduces blood viscosity and increased cardiac output as well as total mitochondrial volume in the muscle fibers used in the training (i.e., the thigh muscles in runners will have more mitochondria than swimmers). Adaptations of the peripheral include capillarization that is an increase in the surface area that both the venous and arterial capillaries supply. This also allows for increased heat dissipation during strenuous exercise. The muscles heighten their glycogen and fat storing capabilities in endurance athletes in order to increase the length in time in which they can perform work. Catabolism also improves increasing the athlete's capacity to use fat and glycogen stores as an energy source. These metabolic processes are known as glycogenolysis, glycolysis and lipolysis.

Aerobic Endurance Training:

There are several different types of aerobic endurance training - each with a different, specific outcome and suitable for different events and sports.

The duration, frequency and intensity of sessions vary with each form of training leading to different physiological adaptations within the body. The table below summarizes the main types of aerobic endurance training and suggested parameters:

Types Of Aerobic Endurance Training			
Type	Frequency (Per Week)	Duration (Per Session)	Intensity
Long, Slow Distance	1-2	Race distance or longer or (30 – 120 min)	~ 70% VO ₂ max
Pace / Tempo	1-2	20-30 min	At lactate threshold or slightly above race pace.
Interval	1-2	3-5 min interval (work:rest ratio 1:1)	Near VO ₂ max.
Repetition	1	30-90 sec interval (work:rest ratio 1:5)	Greater VO ₂ max.
Fartlek	1	20-60 min	Variable: ~ 70% VO ₂ max with bouts at or above lactate threshold

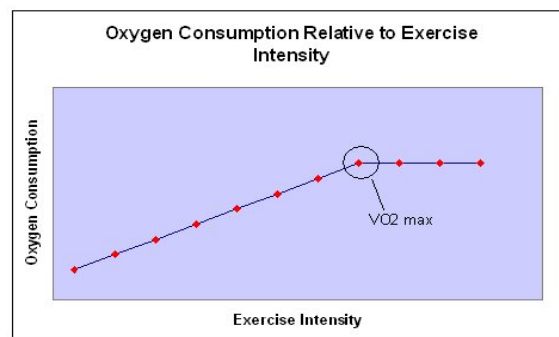
Adopted from Essentials of Strength Training and Conditioning (2000)

VO₂ Max, Aerobic Power& Maximal Oxygen Uptake:

VO₂ max has been defined as:

"The highest rate of oxygen consumption attainable during maximal or exhaustive exercise".

As exercise intensity increases so does oxygen consumption. However, a point is reached where exercise intensity can continue to increase **without** the associated rise in oxygen consumption. To understand this in more practical terms, take a look at the diagram below:



The point at which oxygen consumption plateaus defines the VO₂ max or an individual's maximal aerobic capacity. It is generally considered the best indicator of cardio-

respiratory endurance and aerobic fitness. However, it is more useful as an indicator of a person's aerobic **potential** or upper limit than as a predictor of success in endurance events.

Aerobic power, aerobic capacity and maximal oxygen uptake are all terms used interchangeably with $\dot{V}O_2$ max. $\dot{V}O_2$ max is usually expressed relative to body weight because oxygen and energy needs differ relative to size. It can also be expressed relative to body **surface area** and this may be a more accurate when comparing children and oxygen uptake between sexes.

One study followed a group of 12-year-old boys through to the age of 20 - half of which were trained, the other half untrained but active. Relative to bodyweight no differences in $\dot{V}O_2$ max were found between the groups suggesting that training had no influence on maximal oxygen uptake. However, when $\dot{V}O_2$ max was expressed relative to body surface area, there was a significant difference between groups and maximal oxygen uptake did indeed increase in proportion to training.

The correct way to write $\dot{V}O_2$ max is:

$\dot{V}O_2$ max

It is usually measured in millilitres of oxygen per kilogram of bodyweight per minute:

$ml \cdot kg^{-1} \cdot min^{-1}$

However, on this website you will see it written as $\dot{V}O_2$ max in ml/kg/min. This simply prevents the subscripted ₂ from altering the alignment of the text on web pages. The dot above the \dot{V} denotes that it is the **rate** of ventilation being measured.

Genetics plays a major role in a person's $\dot{V}O_2$ max and heredity can account for up to 25-50% of the variance seen between individuals. The highest ever recorded $\dot{V}O_2$ max is 94 ml/kg/min in men and 77 ml/kg/min in women. Both were cross-country skiers.

Untrained girls and women typically have a maximal oxygen uptake 20-25% lower than untrained men. However, when comparing elite athletes, the gap tends to close to about 10%. Taking it step further, if $\dot{V}O_2$ max is adjusted to account for fat free mass in elite male and female athletes, the differences disappear in some studies. Cureton and Collins suggest that sex-specific essential fat stores account for the majority of metabolic differences in running between men and women.

Training and $\dot{V}O_2$ Max:

In previously sedentary people, training at 75% of aerobic power, for 30 minutes, 3 times a week over 6 months increases $\dot{V}O_2$ max an average of 15-20%¹⁸. However, this is an average and there are large individual variations with increases as wide ranging as 4% to 93% reported.

Amongst groups of people following the same training protocol there will be **responders** - those who make large gains, and **non-responders** - those who make little or no gains. This was originally put down to a simple issue of compliance but more recent research suggests that genetics plays a role in how well any one individual responds to an endurance training program. The extent by which VO_2 max can change with training also depends on the starting point. The fitter an individual is to begin with, the less potential there is for an increase and most elite athletes hit this peak early in their career. There also seems to be a genetic upper limit beyond which, further increases in either intensity or volume have no effect on aerobic power²³. This upper limit is thought to be reached within 8 to 18 months.

Crucially, once a plateau in VO_2 max has been reached further improvements in performance are still seen with training. This is because the athlete is able to perform at a higher percentage of their VO_2 max for prolonged periods.

Two major reasons for this are improvements in anaerobic threshold and running economy.

Resistance training and intense 'burst-type' anaerobic training have little effect on VO_2 max. Any improvements that do occur are usually small and in subjects who had a low level of fitness to begin with. Resistance training alone does not increase VO_2 max even when short rest intervals are used between sets and exercises.

Considerable training is required to reach the upper limit for VO_2 max. However, much less is required to maintain it. In fact peak aerobic power can be maintained even when training is decreased by two thirds. Runners and swimmers have reduced training volume by 60% for a period of 15-21 days prior to competition (a technique known as tapering) with no loss in VO_2 max.

VO_2 Max as a Predictor of Performance

In elite athletes, VO_2 max is not a good predictor of performance. The winner of a marathon race for example, cannot be predicted from maximal oxygen uptake.

Perhaps more significant than VO_2 max is the speed at which an athlete can run, bike or swim at VO_2 max. Two athletes may have the same level of aerobic power but one may reach their VO_2 max at a running speed of 20 km/hr and the other at 22 km/hr.

While a high VO_2 max may be a prerequisite for performance in endurance events at the highest level, other markers such as lactate threshold are more predictive of performance³⁶. Again, the speed at lactate threshold is more significant than the actual value itself.

Think of VO_2 max as an athlete's aerobic potential and the lactate threshold as the marker for how much of that potential they are tapping.

Factors Affecting VO_2 Max:

There are many physiological factors that combine to determine VO_2 max but which of these are most important? Two theories have been proposed:

Utilization Theory:

This theory maintains that aerobic capacity is limited by lack of sufficient oxidative enzymes within the cell's mitochondria. It is the body's ability to utilize the available oxygen that determines aerobic capacity. Proponents of this theory point to numerous studies that show oxidative enzymes and the number and size of mitochondria increase with training. This is coupled with increased differences between arterial and venous blood oxygen concentrations (a-VO₂ difference) accounting for improved oxygen utilization and hence improved VO₂max.

Presentation Theory:

Presentation theory suggests that aerobic capacity is limited not predominantly by utilization, but by the ability of the cardiovascular system to deliver oxygen to active tissues. Proponents of this theory maintain that an increase in blood volume, maximal cardiac output (due to increased stroke volume) and better perfusion of blood into the muscles account for the changes in VO₂max with training.

So what plays the greater role in determining an athlete's VO₂ max - their body's ability to **utilize** oxygen or **supply** oxygen to the active tissues?

In a review of the literature, Saltin and Rowell concluded that it is oxygen **supply** that is the major limiter to endurance performance. Studies have shown only a weak relationship between an increase in oxidative enzymes and an increase in VO₂ max. One of these studies measured the effects of a 6-month swim training program on aerobic function. While oxidative enzymes continued to increase until the end, there was no change in VO₂ max in the final 6 weeks of the program.

Determining VO₂ Max:

VO₂ max can be determined through a number of physical evaluations. These tests can be **direct** or **indirect**. Direct testing requires sophisticated equipment to measure the volume and gas concentrations of inspired and expired air. There are many protocols used on treadmills, cycle ergometer and other exercise equipment to measure VO₂ max directly.

One of the most common is the Bruce protocol often used for testing VO₂ max in athletes or for signs of coronary heart disease in high risk individuals.

Indirect testing is much more widely used by coaches as it requires little or no expensive equipment. There are many indirect tests used to **estimate** VO₂ max. Some are more reliable and accurate than others but none are as accurate as direct testing. Examples include the multistage shuttle run (**bleep test**), 12 minute walk test and 1.5 mile run. [Click here for some sample endurance tests used to estimate VO₂ max in the field.](#)

VO₂ Max at Altitude:

VO₂ max decreases as altitude increases above 1600m (5249ft) or about the altitude of Denver, Colorado. For every 1000m (3281ft) above that, maximal oxygen uptake decreases further by approximately 8-11%⁴³. Anyone with a VO₂ max lower than 50 ml/kg/min would struggle to survive at the summit of Everest without supplemental oxygen.

The decrease is mainly due to a decrease in maximal cardiac output. Recall that cardiac output is the product of heart rate and stroke volume. Stroke volume decreases due to the

immediate decrease in blood plasma volume. Maximal heart rate may also decrease and the net effect is that less oxygen is "pushed" from the blood into the muscles.

Objectives of the Study:

1. To find out the VO_2 max of the B. P. Ed. and M. P. Ed. enrolled students during the year 2015-16.
2. To find out the MET values of the B. P. Ed. and M. P. Ed. enrolled students during the year 2015-16.
3. To compare the evaluated results with the standard norms so as to estimate their present level of cardio-vascular endurance and MET values.

Hypothesis:

1. The research scholar hypothesize that VO_2 Max and MET Values of B. P. Ed. boys' Students are less than the values of M. P. Ed. Boys' Students
2. The research scholar further hypothesize that VO_2 Max and MET Values of B. P. Ed. girls' Students are less than the values of M. P. Ed. girls' Students

Delimitations of the Study:

1. The study is delimited to the male and female students
2. The study is further delimited to the Professional education students
3. The study is further delimited to the B. P. Ed. and M. P. Ed. Students
4. The study is delimited to the students from only one college
5. The study is delimited to the city of Aurangabad, Maharashtra State.

Limitations of the Study:

1. The sincere response to the test is the limitation of the study
2. The state of physiology of the students during administration of the test
3. Few limitations such as weather, rest, diet and personal conditions of the students were beyond the concern of the researcher

Methodology:

Population: The population selection was from the city of Aurangabad Physical Education colleges' students' viz. B. P. Ed. and M. P. Ed. for the year 2015-16.

Sample: The selection of the sample was all the students of B. P. Ed. and M. P. Ed. admitted into Marathwada Sanskritik Mandal's College of Physical Education, Aurangabad for the year 2015-16. Total of 8 girls of B. P. Ed. and 19 boys of B. P. Ed. whereas, 9 girls from M. P. Ed. and 18 boys from M. P. Ed. attempted the test successfully.

Variables:

Independent Variables: Beep Test / Canadian Fit Test / 20 meters shuttle run test

Dependent Variables: Performance of the Students in VO_2 max and MET Values

Collection of Data: All the students of B. P. Ed. and M. P. Ed. students for the year 2015-16 were made to participate in the beep test after optimal warming up during morning session and the data is collected in tabular form after providing them with specific codes.

Procedure: 20 Meters Shuttle Run (Canadian Fit Test) or Beep Test:

METHOD 1: This is a very simple test used and recognized internationally and introduced in India by the Sports Medicine Center. Just by means of a simple audio cassette and a tape recorder, one can determine the VO_2 max of an athlete and identify real talent with better VO_2 max capacity amongst many participants. Simplicity of this test facilitates many people to be tested in a very short time.

REQUIREMENTS: (i) A 20 meters area with markings as shown on the ground. (ii) A cassette player (iii) A 20 meters shuttle run audio cassette.

THE TEST – SALIENT FEATURES: (1) It is suitable for either sex, individuals between the age of 6 and 60 in a medically fit condition. (2) The test includes a period of warm up. (3) Maximal effort is required only at the end of the test. (4) The test as such involves jogging and running at progressively increasing pace, over a 20 meters course for as long as possible. The pace is given by the audio cassette. At every sound heard, you must have reached one of the 20 meters lines and upon hearing the sound, you should pivot and reverse your direction and run at the set pace to the opposite line in time for the next audio signal. This way you run till your maximum capacity is reached. If twice in a row you can't reach within 2 strides of the line, you have reached your max capacity and so remember the last number announced on the cassette player. This is your stage level and equates this with your score from the score sheet attached – to know your VO_2 max as per your age.

READING YOUR RUN SCORE FROM THE CHART GIVEN: (1) The chart/ score sheet has been worked out from age group of 7 onwards to 18 + (which includes adults of all ages) – which has been put on the horizontal axis of the chart. (2) The 1st column vertically downwards shows the number of stages/ minutes you have run. (3) The 2nd vertical column downwards shows your running speed in kilometers/ hour. (4) The columns thereafter are placed age groups wise and divided into two sub-sections vertically: (a) the first shows the METS – value (MET is the energy unit – and indicates the aerobic fitness level. At rest it is 1 MET and during exercise it should be able to reach between 10 to 20 METS i.e., 10 to 20 times your resting level). (b) The second sub-section shows the VO_2 in milliliter/ kilogram.

20 Meters Shuttle Run (Canadian Fit Test) Prediction Of Met And VO_2 Max With Fit Test

Stage	VEL KM/H	AGE											
		7		8		9		10		11		12	
		MET	VO_2	MET	VO_2	MET	VO_2	MET	VO_2	MET	VO_2	MET	VO_2
1	8.5	12.9	45.0	12.3	43.0	11.7	41.1	11.2	39.1	10.6	37.2	10.1	35.2
2	9.0	13.5	47.1	12.9	45.2	12.4	43.4	11.9	41.5	11.3	39.6	10.8	37.8
3	9.5	14.1	49.3	13.6	47.5	13.1	45.7	12.5	43.9	12.0	42.1	11.5	40.3
4	10.0	14.7	51.4	14.2	49.7	13.7	48.0	13.2	46.3	12.7	44.6	12.3	42.9
5	10.5	15.3	53.6	14.8	51.9	14.4	50.3	13.9	48.7	13.4	47.0	13.0	45.4
6	11.0	15.9	55.7	15.5	54.2	15.0	52.6	14.6	51.1	14.1	49.5	13.7	47.9
7	11.5	16.5	57.9	16.1	56.4	15.7	54.9	15.3	53.4	14.9	52.0	14.4	50.5
8	12.0	17.1	60.0	16.7	58.6	16.3	57.2	15.9	55.8	15.5	54.4	15.1	53.0
9	12.5	17.8	62.2	17.4	60.9	17.0	59.5	16.6	58.2	16.3	56.9	15.9	55.6

10	13.0	18.4	64.4	18.0	63.1	17.7	61.9	17.3	60.6	17.0	59.4	16.6	58.1
11	13.5	19.0	66.5	18.7	65.3	18.3	64.2	18.0	63.0	17.7	61.8	17.3	60.6
12	14.0	19.6	68.7	19.3	67.6	19.0	66.5	18.7	65.4	18.4	64.3	18.1	63.2
13	14.5	20.2	70.8	19.9	69.8	19.7	68.8	19.4	67.8	19.1	66.7	18.8	65.7
14	15.0	20.9	73.0	20.6	72.0	20.3	71.1	20.1	70.2	19.8	69.2	19.5	68.3
15	15.5	21.5	75.1	21.2	74.3	21.0	73.4	20.7	72.5	20.5	71.7	20.2	70.8
16	16.0	22.1	77.3	21.9	76.5	21.6	75.7	21.4	74.9	21.2	74.1	20.9	73.3
17	16.5	22.7	79.5	22.5	78.7	22.3	78.0	22.1	77.3	21.9	76.6	21.7	75.9
18	17.0	23.3	81.6	23.1	81.0	22.9	80.3	22.8	79.7	22.6	79.1	22.4	78.4
19	17.5	23.9	83.8	23.8	83.2	23.6	82.6	23.5	82.1	23.3	81.5	23.1	81.0
20	18.0	24.5	85.9	24.4	85.4	24.3	85.0	24.1	84.5	24.0	84.0	23.9	83.5

Reference: Table of prediction of MET, VO₂ max is in the Armed forces sports medicine center, Pune.

Stage	VEL KM/H	AGE											
		13		14		15		16		17		18+	
		MET	VO ₂	MET	VO ₂	MET	VO ₂	MET	VO ₂	MET	VO ₂	MET	VO ₂
1	8.5	9.5	33.3	9.0	31.4	8.4	29.4	7.9	27.5	7.3	25.5	6.7	23.6
2	9.0	10.3	35.9	9.7	34.0	9.2	32.2	8.7	30.3	8.1	28.5	7.6	26.6
3	9.5	11.0	38.5	10.5	36.7	10.0	35.0	9.5	33.2	9.0	31.4	8.5	29.6
4	10.0	11.7	41.1	11.3	39.4	10.8	37.7	10.3	36.0	9.8	34.3	9.3	32.6
5	10.5	12.5	43.8	12.0	42.1	11.6	40.5	11.1	38.9	10.6	37.2	10.2	35.6
6	11.0	13.3	46.4	12.8	44.8	12.4	43.3	11.9	41.7	11.5	40.2	11.0	38.6
7	11.5	14.0	49.0	13.6	47.5	13.1	46.0	12.7	44.6	12.3	43.1	11.9	41.6
8	12.0	14.7	51.6	14.3	50.2	13.9	48.8	13.5	47.4	13.1	46.0	12.7	44.6
9	12.5	15.5	54.2	15.1	52.9	14.7	51.6	14.4	50.3	14.0	48.9	13.6	47.6
10	13.0	16.3	56.9	15.9	55.6	15.5	54.4	15.2	53.1	14.8	51.8	14.5	50.6
11	13.5	17.0	59.5	16.7	58.3	16.3	57.1	16.0	55.9	15.7	54.8	15.3	53.6
12	14.0	17.7	62.1	17.4	61.0	17.1	59.9	16.8	58.8	16.5	57.7	16.2	56.6
13	14.5	18.5	64.7	18.2	63.7	17.9	62.7	17.6	61.6	17.3	60.6	17.0	59.6
14	15.0	19.2	67.3	19.0	66.4	18.7	65.4	18.4	64.5	18.1	63.5	17.9	62.6
15	15.5	20.0	69.9	19.7	69.1	19.5	68.2	19.2	67.5	19.0	66.5	18.7	65.6
16	16.0	20.7	72.6	20.5	71.8	20.3	71.0	20.1	70.2	19.8	69.4	19.6	68.6
17	16.5	21.5	75.2	21.3	74.5	21.1	73.7	20.9	73.0	20.7	72.3	20.5	71.6
18	17.0	22.2	77.8	22.1	77.2	21.9	76.5	21.7	75.9	21.5	75.2	21.3	74.6
19	17.5	23.0	80.4	22.8	79.9	22.7	79.3	22.5	78.7	22.3	78.2	22.2	77.6
20	18.0	23.7	83.0	23.6	82.5	23.5	82.1	23.3	81.6	23.2	81.1	23.0	80.6

Reference: Table of prediction of MET, VO₂ max is in the Armed forces sports medicine center, Pune.

Statistical Treatment: The data is organized and mean and standard deviation is calculated and the mean values are compared with the standard norms for the age group.

Table No. 1: Mean and standard deviation of the M. P. Ed. Girls of MSMCOPE

Code	Level	VO₂ max	MET level
MPEDG-1	5.3	35.6	10.2
MPEDG-2	3.8	29.6	8.5
MPEDG-3	6.1	38.6	11
MPEDG-4	5	35.6	10.2
MPEDG-5	7.8	41.6	11.9
MPEDG-6	3.8	29.6	8.5
MPEDG-7	7	41.6	11.9
MPEDG-8	5.1	35.6	10.2
MPEDG-9	6.2	38.6	11
Mean	5.566667	36.26667	10.37778
Standard Deviation	1.35	4.444097	1.252775

Table No. 2: Mean and standard deviation of the B. P. Ed. Girls of MSMCOPE

Code	Level	VO₂ max	MET level
BPEDG-1	4.1	32.6	9.3
BPEDG-2	4	32.6	9.3
BPEDG-3	5.2	35.6	10.2
BPEDG-4	6.2	38.6	11
BPEDG-5	2	26.6	7.6
BPEDG-6	3.7	32.6	9.3
BPEDG-7	4.1	32.6	9.3
Mean	4.185714	33.02857	9.428571
SD	1.300549	3.644957	1.038772

Table No. 3: Mean and standard deviation of the M. P. Ed. Boys of MSMCOPE

Code	Level	VO₂ max	MET level
MPEDB-1	7.8	41.6	11.9
MPEDB-2	10.2	50.6	14.5
MPEDB-3	6.1	38.6	11
MPEDB-4	6.11	38.6	11
MPEDB-5	8.8	44.6	12.7
MPEDB-6	7.4	41.6	11.9
MPEDB-7	8.2	44.6	12.7
MPEDB-8	4.11	32.6	9.3
MPEDB-9	9.3	47.6	13.6
MPEDB-10	10.1	50.6	14.5
MPEDB-11	10	50.6	14.5
MPEDB-12	10.5	50.6	14.5
MPEDB-13	8.11	44.6	12.7
MPEDB-14	10.7	50.6	14.5

MPEDB-15	6.5	38.6	11
MPEDB-16	7.9	41.6	11.9
MPEDB-17	8.5	44.6	12.7
MPEDB-18	6	38.6	11
Mean	8.129444	43.93333	12.55
Standard Deviation	1.848604	5.401525	1.565154

Table No. 4: Mean and standard deviation of the B. P. Ed. Girls of MSMCOPE

Code	Level	VO2 max	MET level
BPEDB-1	8.5	46	13
BPEDB-2	7.8	44.6	12.7
BPEDB-3	10	50.6	14.5
BPEDB-4	8.8	47.6	13.6
BPEDB-5	9.6	50.6	14.5
BPEDB-6	6.2	38.6	11
BPEDB-7	8.5	46	13
BPEDB-8	9.2	47.6	13.6
BPEDB-9	11.6	56.6	16.2
BPEDB-10	7	41.6	11.9
BPEDB-11	9.11	50.6	14.5
BPEDB-12	6.5	41.6	11.9
BPEDB-13	7.7	44.6	12.7
BPEDB-14	9.4	48	14
BPEDB-15	7.3	42	12
BPEDB-16	10.6	53.6	15.3
BPEDB-17	9.6	50.6	14.3
BPEDB-18	8.2	40.6	12.7
BPEDB-19	7.2	41.6	11.9
Mean	8.568947	46.47368	13.33158
SD	1.41915	4.839289	1.343731

Results and Findings:

1. The mean of the Stage level of B. P. Ed. Girls is 4.18 and the standard deviation is 1.3
2. The mean of the VO₂ max of B. P. Ed. Girls is 33.02 and the standard deviation is 3.6
3. The mean of the MET values of B. P. Ed. Girls is 9.42 and the standard deviation is 1.03
4. The mean of the Stage level of M. P. Ed. Girls is 5.6 and the standard deviation is 1.35
5. The mean of the VO₂ max of M. P. Ed. Girls is 36.26 and the standard deviation is 4.4
6. The mean of the MET values of M. P. Ed. Girls is 10.3 and the standard deviation is 1.3
7. The mean of the Stage level of B. P. Ed. Boys 8.56 and the standard deviation is 1.41
8. The mean of the VO₂ max of B. P. Ed. Boys is 46.47 and the standard deviation is 4.83
9. The mean of the MET values of B. P. Ed. Boys is 13.33 and the standard deviation is 1.34
10. The mean of the Stage level of M. P. Ed. Boys 8.12 and the standard deviation is 1.84

11. The mean of the VO_2 max of M. P. Ed. Boys is 43.93 and the standard deviation is 5.40
12. The mean of the MET values of M. P. Ed. Boys is 12.55 and the standard deviation is 1.56

Conclusions:

1. From the above results it is concluded that the first hypothesis made by the research scholar is rejected as the value of VO_2 max and MET of B.P. Ed. Boys' found higher than that of M. P. Ed. Boys'.
2. From the above results it is also concluded that the second hypothesis made by the research scholar is accepted as the value of VO_2 max and MET of B.P. Ed. girls' found less than that of M. P. Ed. girls'.

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12. Table of prediction of MET, VO_2 max is in the Armed forces sports medicine center, Pune.