

## Role of Exercise and Nutrition on Cardiopulmonary Fitness

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### Abstract

Physical fitness is the prime criterion for survival, to achieve any goal and to lead a healthy life. Effect of exercise to have a good physical fitness is well known since ancient Vedas. Our aim is to find out the effect of exercise and nutrition on growing children with scientific records. So, we have selected Residential and Non-residential school children with age between 12 and 16 years. Obviously, Residential school children will get recommended nutritious food and they are undergoing regular physical exercise training. Subjects were divided into two groups. Group I is residential and group II is non-residential, each of having 100 students and they were subjected for cardiopulmonary fitness tests.

Physical fitness can be assessed by suitable cardiopulmonary fitness parameters like Physical Fitness Index (PFI in %) and maximal oxygen consumption that is  $VO_2\text{max}$  (ml/kg/min) by using Harvard step test. Results were compared and subjected to statistical analysis for Z test.  $VO_2\text{max}$  (Mean  $\pm$  SD) in residential was  $66.03 \pm 7.06$  and in non-residential school children was  $55.24 \pm 7.53$ . PFI (Mean  $\pm$  SD) in residential was  $54.96 \pm 8.38$  and in non-residential school children was  $44.75 \pm 5.05$ . So,  $VO_2\text{max}$  ( $p=0.000$ ) and PFI ( $p=0.000$ ) were significantly higher in residential as compared to that of non-residential school children.

So, from above data analysis it is observed that regular

exercise and nutritious food increase the cardiopulmonary fitness values in residential school children.

### Keywords

*residential school children, non-residential school children,  $VO_2\text{max}$ , PFI*

### Introduction

Physical fitness is defined as an ability to carry out daily tasks with vigor and alertness without undue fatigue with ample energy to enjoy leisure time pursuits, to meet unusual situations and unforeseen emergencies<sup>1</sup>.

For a common man, the physical fitness is ability to withstand stress and pressure under different circumstances where an unfit person would be ineffective or would quit<sup>1</sup>.

Regular physical exercise is known to have beneficial effects on health. As diseases are related to lack of fitness, Americans realized that there is a need to counteract a sedentary lifestyle with planned physical activity through sports and formal exercise. This brought government's attention to the lack of fitness of its citizenry. This led to the establishment of minimum fitness standards in the country's public schools<sup>2</sup>.

In our country, we are getting acquainted with the modern amenities at a very fast rate. So, we are neglecting the natural physical activities. The present attractive education system has helped to improve the education

standards. But, the non active sedentary stressful life has made the youth physically unfit. Now, the time has come to consider about the physical fitness and exercise in the adolescent age group. Realizing this fact, educationalists have recommended minimal physical exercise in the curriculum<sup>3</sup>.

The physical growth in boys and girls more or less is equal up to adolescence. So, we have selected boys only.

The age between 12 and 16 years, the physique is changing. During this period of growth, height, weight and maximum aerobic capacity will reach their peak. So, to achieve good fitness in children sports programme should be arranged<sup>4</sup>.

The exercise will help to attain maximum physical fitness due to development of muscle and cardiorespiratory strength as well as endurance of the children<sup>4</sup>.

The advantages of physical fitness are many, like increase in the level of intelligence, tolerance, activity and social behaviour.

Physically fit children are easily adaptable for stress. Their neuromuscular tension is less. They do not suffer from easy fatiguability. Nutrition through diet provides necessary energy substrates including vitamins and minerals which in turn provide enzymes that catalyze energy production.

Cardiopulmonary fitness can be assessed by suitable tests like VO<sub>2</sub> max and PFI.

The present study was undertaken to show the effects of exercise and nutrition on growing children by comparing the cardiopulmonary test performance of residential and non-residential school children.

### Materials and Methods

Our study included 200 students in the age range of 12 to 16 years from residential (Sainik) and non-residential (Banjara) schools of Bijapur city, North Karnataka.

*Method of collection of data*<sup>5</sup>: For comparison, we divided the students into two groups.

**Group I:** It consisted of 100 male students from residential (Sainik) school of Bijapur city, North Karnataka.

**Group II:** It consisted of 100 male students from non-residential (Banjara) school of Bijapur city, North Karnataka.

The subjects represented almost all socio-economic sections and religions.

Written consent was taken from Principals of both the schools as students were minor.

The ethical clearance for the study was obtained from the ethical committee of BLDE University.

The procedures were explained to children. Through thorough history and detailed clinical examination, students were selected.

Subjects were taken into confidence and data was collected at the school campus during working hours between 12 noon to 2pm during resting period.

**Inclusion criteria:** 1) Apparently healthy 2) Age: 12-16 yrs

**Exclusion criteria:** 1) Suffering from cardiopulmonary disorders 2) Any chronic diseases 3) Any endocrine disorders 4) H/O obesity or anemia.

**Cardiopulmonary fitness parameters:**

By using Modified Harvard Step Test (HST): The test was done on Modified Harvard Steps of 33 cms height. PFI and VO<sub>2</sub> max were calculated by using following formulae.

- 1) Physical fitness Index (%) (PFI %) <sup>6</sup>

$$PFI = \frac{\text{Duration of exercise in secs} \times 100}{2 (\text{pulse } 1+2+3)}$$

- 2) Maximal aerobic power VO<sub>2</sub> Max (ml/kg/min) by Margaria's equation<sup>7</sup>.

It was obtained by using the formula.  
VO<sub>2</sub> Max = 111.33 – (0.42 × Pmax)

### Results

**Group I:** Residential (Sainik) school children = 100 students.

**Group II:** Non-Residential (Banjara) school children = 100 students.

Recording of cardiopulmonary fitness test parameters were shown below in table form and in graphical form.

**Table 1**  
Shows cardiopulmonary fitness parameters

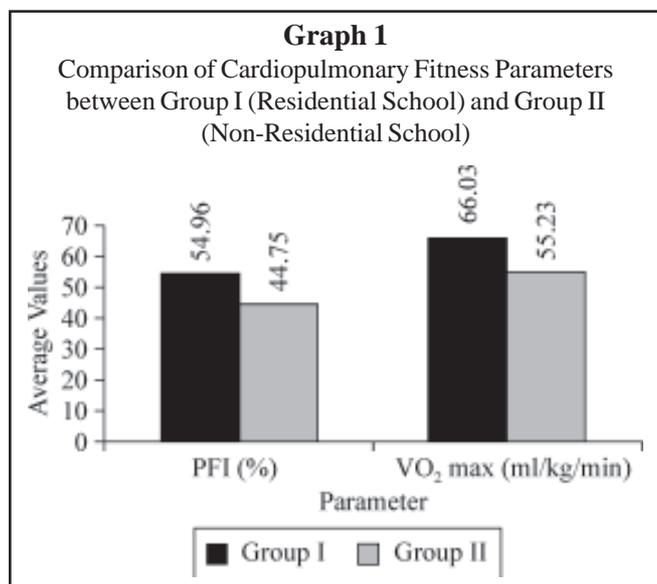
Parameters	Group I (Sample size-100)		Group II (Sample size-100)		Z Values	p values
	Mean $\pm$ SD	SE	Mean $\pm$ SD	SE		
PFI(%)	54.96 $\pm$ 8.38	0.838	44.75 $\pm$ 5.05	0.505	10.44	0.00001***
VO <sub>2</sub> Max(ml/kg/min)	66.03 $\pm$ 7.06	0.706	55.23 $\pm$ 7.53	0.753	10.44	0.00001***

\*p: <0.05: Significant, \*\* p: <0.01: Highly significant, \*\*\* p: <0.001: Very highly significant, NS: Non Significant

The mean PFI (%) for Group I (Residential) was 54.96 $\pm$ 8.38, which was significantly higher than that of group II (Non-Residential) which was 44 $\pm$ 5.05 (p = 0.000) (Table 1).

The mean VO<sub>2</sub> max (ml/kg/min) for Group I (Residential) was 66.03 $\pm$ 7.06, which was significantly higher than that of Group II (Non-Residential) which was 55.24 $\pm$ 7.53 (p = 0.000) (Table 1).

It was observed from Graph 1 that mean PFI (%) and mean VO<sub>2</sub> max (ml/kg/min) were significantly higher in Group I (Residential) as compared to those of Group II (Non-Residential).



#### Statistical Analysis

All the values were presented as mean, standard deviation and standard error. Comparison of mean values of parameters were done between Group I and Group II using Z test<sup>8</sup>.

#### Discussion

Several studies have established that physical fitness is necessary to carry out daily task. The effect of regular exercise is known to have beneficial effect on health. Gymnastic activity in school curriculum was introduced by John Bernard<sup>2</sup>.

In our country, there are residential and non-residential schools. Residential schools like Sainik school, Navodaya school and many others have implemented regular exercise training by qualified trained persons for their students. Nutritious food is also provided under the guidance of qualified dieticians and doctors in such schools. In non-residential schools, education is being provided but regular exercises are not monitored regularly and no dieticians are there to guide for the nutrition for the students.

Physical fitness is assessed by cardiopulmonary efficiency tests. Cardiopulmonary fitness parameters included PFI and VO<sub>2</sub> max. They are very highly statistically significant in Group I as compared to those of Group II (p=0.000).

The mean PFI (%) obtained for Group I and Group II were 54.96  $\pm$  8.38 and 44.75  $\pm$  5.05 respectively, indicating that students of residential (trained) school had higher values than that of students of non-residential (untrained) school due to regular physical activity and training may be one of the contributing factors in attainment of such growth<sup>9</sup>. These values correlated with observations made by Chatterjee *et al* (2001)<sup>10</sup>. Their study also showed higher PFI score in trained (athletics) than those of untrained (non-athletics) but comprising of female subjects only.

Sunil KR. Das *et al* also studied PFI with modified Harvard test in young men and women. Their study restricted to untrained subjects only<sup>11</sup>.

We found very highly significant increase in  $VO_2$  max of the subjects from Group I compared to Group II. The obtained values were  $66.03 \pm 7.06$  and  $55.23 \pm 7.53$  respectively.

Similar observations were reported regarding cardiopulmonary efficiency by different authors all over the world at different age groups.

### Conclusion

Our study clearly indicates that regular exercise and balanced nutrition supplementation will improve physical fitness as indicated in Group I (Residential school) children.

### Suggestion for Further Research

Longitudinal study may be conducted on Non-Residential school children. They may be subjected to regular exercise training and providing nutritious food as per the dieticians advice. The effect may be observed for different duration between the same age groups.

### Acknowledgement

I am thankful to staff members of Dept of Physiology, BLDE University, Principals and school children of Sainik School (Residential) and Banjara School (Non-Residential).

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