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ROLE OF EXERCISE AND NUTRITION ON CARDIOPULMONARY FITNESS AND PULMONARY FUNCTIONS ON RESIDENTIAL AND NON-RESIDENTIAL SCHOOL CHILDREN

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Abstract : Physical fitness is the prime criterion for survival and to lead a healthy life. Our aim is to find out effect of exercise and nutrition on physical fitness on growing children with scientific records. The present study was designed on healthy school children of a Residential-Sainik (100) and Non-Residential (100) school children (12-16 yrs) of Bijapur. To evaluate cardiopulmonary fitness parameters included are VO_2 Max (ml/kg/min) and Physical Fitness Index (PFI %). Harvard Step Test determined VO2 Max and PFI. Also recorded pulmonary function parameters like Forced Expiratory Volume in 1 sec (FEV1 in %) by recording spirometry. Peak Expiratory Flow Rate (PEFR in L/Min) by Peak flow meter and Maximal Expiratory Pressure (MEP in mmHg) by modified Black's apparatus. We found statistically significant higher values (p=0.000) of VO_2 Max, PFI, FEV1, PEFR and MEP in residential school children compared to non-residential school children higher. So, our study shows that regular exercise and nutritious food increase the cardiopulmonary fitness values and pulmonary functions in Residential school children.

Key words : residential school children non-residential school children VO_2max PFI FEV1 PEFR MEP

INTRODUCTION

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

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

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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 (2).

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 (3).

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 (4).

The exercise will help to attain maximum physical fitness due to development of muscle and cardio respiratory strength as well as endurance of the children (4).

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

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

Physical fitness not only assessed by cardiopulmonary fitness parameters like VO_2 max and PFI but also by pulmonary function tests like FEV1, PEFR and MEP.

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 (5): 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 socioeconomic 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 cm height. PFI and VO_2 max were calculated by using following formulae.

1) Physical fitness Index (%) (PFI %) (6)

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

2) Maximal aerobic power VO_2 Max (ml/kg/min) by Margaria's equation (7).

It was obtained by using the formula.
VO2 Max = 111.33 – (0.42×Pmax)

Recording of Pulmonary Parameters (8, 9)

1) FEV1% by using Benedict-Roth's recording spirometry.
2) PEFR by using peak flow meter.
3) MEP by using Modified Black's apparatus (10).

RESULTS

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

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

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

The mean age (yrs) for group I (Residential) was 14.42±0.55 and group II (Non-Residential) that was 14.21±0.81 (Table I).

The mean BMI (%) for group I (Residential) was 18.26±1.80 and group II

TABLE I : Shows mean values of age and BMI.

Parameters	*Group I (Sample size-100)*	*Group II (Sample size-100)*
Age (yrs)	14.42±0.55	14.21±0.81
BMI (kg/mt^2)	18.26±1.80	17.52±3.46

Data are presented as Mean±SD.

(Non-Residential) which was 17.52±3.46 (Table I).

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

The mean VO_2 max (ml/kg/min) for group I (Residential) was 66.03±7.06, which was significantly higher than that of group II (Non-Residential) which was 55.24±7.53 (p=0.000) (Table II).

FEV1 (Mean±SD) in residential was 91.21±7.53 & in non-residential school children was 87.79±9.79 (p=0.000). PEFR (Mean±SD) in residential was 499.05±95.39 & in non-residential school children was 389.25±96.98 (p = 0.000). MEP (Mean±SD) in residential was 90.1±17.05 & in non-residential school children was 73.83±25.50 (p=0.000) (Table III).

Statistical analysis

All the values were presented as mean, standard deviation and standard error. Comparison of mean values of parameters was done between Group I and Group II using Z test (11).

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 (2).

In our country, residential schools like Sainik school, Navodaya school and many

TABLE II : Shows cardiopulmonary fitness parameters.

Parameters	*Group I (Sample size-100)*		*GroupII (Sample size-100)*		*Z values*	*P values*
	Mean±SD	*SE*	*Mean±SD*	*SE*		
PFI (%)	54.96±8.38	0.838	44.75±5.05	0.505	10.44	0.00001***
VO_2 Max (ml/kg/min)	66.03±7.06	0.706	55.23±7.53	0.753	10.44	0.00001***

Data are presented as Mean±SD *P: <0.05: Significant, **P: <0.01: Highly significant, ***P: <0.001: Very highly significant, NS: Non Significant.

TABLE III : Shows pulmonary function parameters.

Parameters	*Group I*		*GroupII*		*Z values*	*P values*
	Mean±SD	*SE*	*Mean±SD*	*SE*		
FEV1 (%)	91.21±7.53	0.753	87.79±9.79	0.979	5.19	0.000***
PEFR (l/m)	499.05±95.39	9.539	389.25±96.98	9.698	8.07	0.000***
MEP mmHg	90.1±17.05	1.705	73.83±25.50	2.550	5.30	0.000***

*P: <0.05: Significant, **P: <0.01; Highly significant, ***P: <0.001: Very highly significant.

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_2 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±8.38 and 44.75±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 (12). These values correlated with observations made by Chatterjee et al (2001) (13). 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 (14).

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±7.06 and 55.23±7.53 respectively. Pulmonary function tests including FEV1%, PEFR and MEP. The values as shown in table II were significantly higher in Group I compared to Group II (p=0.000).

Similar observations were reported regarding lung function tests by different authors all over the world at different age groups.

The values of MEP obtained in Residential and Non-Residential school children by Choudari D et al 2002 (15) correlate with our present study.

Conclusion

Our study clearly indicates that regular exercise and balanced nutrition supplementation will improve physical fitness and pulmonary functions 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.

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