STATUS OF RESPIRATORY PERFORMANCE IN RESIDENTIAL SCHOOL CHILDREN COMPARED TO NON-RESIDENTIAL SCHOOL CHILDREN

Khodnapur Jyoti P[1], Mullur Lata M[2], Dhanakshirur Gopal B[3], Aithala Manjunatha[4]

ABSTRACT

Objective: To compare the effect of regular physical exercise on respiratory performance among Residential and Non-Residential school children.

Material & Methods : The present study was designed on healthy respiratory symptom free children of a Residential Sainik (100) and Non-Residential (100) school children (aged 12-16 yrs) of Bijapur, to evaluate pulmonary functions. Pulmonary functions (Vt, ERV, VC, FVC, FEV1) were recorded by spirometry, PEFR by Peak flow meter and MEP by Modified Black's Apparatus.

Results : We found statistically significant higher values (p=0.000) of Breath Holding Time (BHT in secs), 40mmHg Endurance test(ENDT in secs), Tidal Volume (Vt in ml), Expiratory Reserve Volume (ERV in ml), Vital Capacity (VC in ml), Forced Vital Capacity (FVC in ml), Forced expiratory Volume at 1 second (FEV 1%), Peak Expiratory Flow Rate (PEFR in L/min) and Maximal Expiratory Pressure (MEP in mmHg) in Residential Sainik school children compared to Non-Residential school children.

Conclusion: Our study shows that possibly, regular physical exercise increases the pulmonary functions in Residential school children compared to Non-Residential school children.

Key words : Pulmonary functions, Residential school children, Non-Residential school children, respiratory status.

List of abbreviations: BHT: Breath Holding Test, ENDT: 40mmHg Endurance Test, Vt: Tidal Volume, ERV: Expiratory Reserve Volume, VC: Vital Capacity, FVC: Forced Vital Capacity, FEV1: Forced Expiratory Volume at 1st second, PEFR: Peak Expiratory Flow Rate, MEP: Maximal Expiratory Pressure, sec: seconds, ml: milli litre, %: percentage, l/min: litre per minute, mmHg: millimeter of mercury.

INTRODUCTION

Strength of respiratory muscles is evaluated by determining pulmonary function tests. Hutchison, a London Surgeon in 1846 in his classic treatise "On the capacity of lungs and Respiratory Function" introduced the concept of Spirometry. Recently with the inventions and evolutions, more sensitive and technologically excellent equipments such as Spirometer, Mini Wright's peak flow meter, Medspiror etc, are being developed for recording of pulmonary functions. [1]

There are various factors that influence the pulmonary function tests. The most important factors are age, height, weight, sex, race and proper scientific training. Further more individual factors such as environmental factors, socio-economic status, habits and differences in life style can cause a change in values of pulmonary function tests.[2] So, we aimed to study and compare the effect of regular exercise on pulmonary functions among school children. So, we selected Residential and Non-Residential school children with age between 12 and 16 years. Obviously, Residential school children are undergoing regular physical exercise training.

Regular physical exercise is known to have beneficial effects on health so on respiratory performance. Respiratory performance is increased due to increased number of functioning alveoli and their dilatation. Capillary vascularisation and strength of respiratory muscles are also increased. As a result, there is an increase in both static and dynamic functions of the lungs and the diffusing capacity. The rate of respiration is reduced. [3]

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. [4]

In our country, we are getting acquainted with the modern amenities at a very fast rate. So, we are

[1&2]Assisstant Professor, [3]Professor, [4]Professor and Head,
Dept of Physiology, B.L.D.E.U's Sri B.M.Patil, MC, Bijapur.

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. [5]

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. [6]

The exercise will help to attain maximum physical fitness due to development of muscle and cardiorespiratory strength as well as endurance of the children. [6]

OBJECTIVES OF THE STUDY

To compare the effect of regular physical exercise on respiratory performance among Residential and Non-Residential school children.

MATERIAL 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 [7]: 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. Who were undergoing regular physical exercise like swimming, horse riding, playing volley ball, basket ball, running etc. Any one exercise every day for one hour under the guidance since 4 years.

Group II: It consisted of 100 male students from non-residential (Banjara) school of Bijapur city, North Karnataka. Who were undergoing physical exercise like playing volley ball, basket, running etc

The subjects represented almost all socioeconomic sections and religions.

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

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

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.

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 12 noon to 2pm as the students were free.

Recordings were taken in the sitting position.

Recording of Pulmonary Parameters [8], [9], [10]

1. **BHT (Breath Holding Test) in seconds:** A subject is asked to take deep inspiration and then to hold it till the tolerance. Time is noted in seconds with the help of stop watch.
2. **40 mmHg Endurance Test in seconds by using Flack's Air Force Manometer:** A subject is asked to take a deep inspiration, close the nostril with the help of fingers and then to blow into the mercury manometer to raise the Mercury column to 40 mmHg and then to maintain it at that level. Time in seconds is noted. The subject is instructed not to blow the checks. The method employed is as suggested by Burger.
3. **Lung volumes and capacities :** They are recorded by Recording Spirometer.
    - i. **V_T, (Tidal volume in ml) :**
    - ii. **IRV (Inspiratory Reserve Volume, ml)** :
    - iii. **ERV (Expiratory Reserve Volume, ml) :**
    - iv. **VC (Vital Capacity, ml):**
    - v. **FVC (Forced Vital Capacity, ml):**
    - vi. **Forced Expiratory Volume (Timed Vital Capacity**)
4. **PEFR (Peak Expiratory Flow Rate, lit/min):** It is the amount of air that can be blown out of fully inflated lungs as rapidly as possible. Peak Expiratory Flow Rate recorded with a Peak Flow Meter.

5. **MEP (Maximum Expiratory Pressure) in mmHg**:

   The strength of respiratory muscles is assessed by measuring Maximal Expiratory Pressure (MEP) by using a Modified Black's apparatus[11],[12],[13].

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.[14]

RESULTS

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

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

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

Table 1: shows pulmonary function tests in residential school children compared to non-residential school children.

Parameters	Group I			Group II			Z Values	P Values
	Mean	± SD	SE	Mean	± SD	SE		
BHT (sec)	37.38	7.63	0.763	31.23	10.14	1.014	4.84	0.0001***
ENDT (sec)	36.51	9.23	0.923	24.84	11.50	1.150	7.91	0.0001***
Vt (ml)	487.25	93.17	9.317	462.65	75.25	7.525	2.08	0.037*
ERV (ml)	834.5	276.22	27.622	524.5	191.15	19.115	9.22	0.0001***
VC (ml)	2084	415.35	41.535	1767.5	420.58	42.058	5.35	0.0001***
FVC (ml)	2192.5	424.78	42.478	1897	444.77	44.477	4.80	0.0001***
FEV1 (ml)	1991.35	424.78	42.478	1608	412.60	41.260	6.65	0.0001***
FEV1 (%)	91.21	7.53	0.753	87.79	9.79	0.979	5.19	0.0001***
PEFR (l/m)	499.05	95.39	9.539	389.25	96.98	9.698	8.07	0.0001***
MEP mmHg	90.1	17.05	1.705	73.83	25.50	2.550	5.30	0.0001***

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

Foot note: BHT: Breath Holding Test, ENDT: 40mmHg Endurance Test, Vt: Tidal Volume, ERV: Expiratory Reserve Volume, VC: Vital Capacity, FVC: Forced Vital Capacity, FEV1: Forced Expiratory Volume at 1st second, PEFR: Peak Expiratory Flow Rate, MEP: Maximal Expiratory Pressure, sec: seconds, ml: milli litre, %: percentage, l/min: litre per minute, mmHg: millimeter of mercury.

It was observed from Table I that mean BHT in secs (Group I Mean ± SD is 37.38± 7.63, Group II Mean ± SD is 31.23±10.14 and p=0.0001), mean ENDT in secs (Group I Mean ± SD is 36.51± 9.23, Group II Mean + SD is 24.84± 11.50 and p=0.0001), mean Vt in ml (Group I Mean ± SD is 487.25± 93.17 ml, Group II Mean ± SD is 462.65±75.25ml and p=0.03), mean VC in ml (Group I Mean ± SD is 2084± 415.35 ml, Group II Mean ± SD is 1767.5±420.58 and p=0.0001), mean FVC in ml (Group I Mean ± SD is 2192.5 ± 424.78, Group II Mean ± SD is 1897±444.77 and p=0.0001), mean FEV1 in ml (Group I Mean ± SD is 1991± 424.78, Group II Mean ± SD is 1608±412.60 and p=0.0001), mean ERV in ml (Group I Mean ± SD is 834.5± 276.22, Group II Mean ± SD is 524.5± 191.15 and p=0.0001), mean FEV1 in %(Group I Mean ± SD is 91.21± 7.53, Group II Mean ± SD is 87.79± 9.79 and p=0.0001), mean PEFR in L/min(Group I Mean ± SD is 499.05± 95.39, Group II Mean ± SD is 389.25± 96.98 and p=0.0001) and mean MEP in mmHg (Group I Mean ± SD is 90.1± 17.05, Group II Mean ± SD is 73.83± 25.50 and p=0.0001) were significantly higher in group I (Residential) as compared to those of group II (Non-Residential).

DISSCUSSION

Several studies have established that regular exercise improves respiratory performance. The effect of regular exercise is known to have beneficial effect on health.

Gymnastic activity in school curriculum was introduced by John Bernard.[4]

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.

Pulmonary function tests including BHT, 40mmHg endurance test, V_T, IRV, VC, FVC , FEV1%, PEFR and MEP. The values (table: 1) were significantly higher in Group I compared to Group II.

A study on Peak expiratory flow rate of residential and non-residential school children showed that, the children from Sainik school had the higher values of lung functions related by PEFR in comparison to non-residential school children.[15]

Lakhera et al (1994)[16]observed in their study that lung volumes, lung capacities and FEV1 (%) were consistently higher in athletes than those of non-athletes due to lower air way resistance. These observations were very much correlated with those of Group I subjects in our study. It could be concluded that training definitely improves the Lung Volumes and Capacities in growing children.

The values of MEP obtained in Residential and Non-Residential school children by Choudari D et al (2002)[17] correlate with our present study.

Shivesh Prakash et al conducted a study on 20 randomly selected subjects belonging to Athletes, Yogi's and sedentary groups using a COSMED /micro Quark spirometer based on ATS Recommendations and observed the following:[18]

1. The groups differed significantly in FEV1 (p=0.047) and PEFR (p=0.022).

2. The highest Mean FEV1 (96.25%) and PEFR (116.77%) were observed in athletes and Yogi's.

3. Lowest FEV1 and PEFR values were observed amongst the sedentary workers.

4. Comparison of Athletes with sedentary workers revealed significantly higher FEV1 (p=0.038, 95%, 14.6; 4.2) and FEV1/FVC (p=0.02, 95% C1; 7.5; 0.6) parameters amongst the Athletes.

Above studies showed only few parameters among pulmonary function tests, as our study showed almost all the parameters which reflects the respiratory status.

CONCLUSION

So, our study showed better respiratory status in Residential school children compared to Non-Residential school children. Possibly, regular exercise under guidance may be the reason.

Our study is a cross sectional study comparing the effect of exercise among two groups on pulmonary functions. Longitudinal study may be better to observe the effect of exercise on pulmonary functions.

REFERENCE

1. West JB. Mechanics of breathing. In: Best and Tailor's Physiological Basis of Medical Practice. 12th ed. USA: Williams and Wilkins; 1990: p.523.
2. Lindiquit CH, Reynolds KD, Goron ML. Socioeconomic determinants of physical activity among children. Prev Med 1999; 29(4):305-312.
3. Fox E. Physical Training Methods and Effects. J Ortho Clin N Am 1971;8(3):545.
4. http://exercise.lovetoknow.com/Physical_Fitness_history.
5. Sujit K, Choudari. Text book of Concise Medical Physiology. 3rd Ed. Calcutta: New central book agency Ltd; 2000: p.404.
6. Pansare MS. Physiology of Fitness. Medical J of Western India 1986;14;18-20.
7. Sidhu KS, Methodology of Research in Education. Sterling's Publishers Pvt Ltd, New Delhi, (1st Edition), 1984, 4th reprint 1990, Page 262-272.
8. Udwadia F E, Sunawala J D. Lung function studies in healthy Indian subjects. J Ass of Physicians of India 1987:36;7:491-496.
9. Omprakash et al : Spirometric norms. A study from Karnataka: Lung India. 8th ed 1990 ;1:23-27.
10. Mahajan K K, Mahajan A Mishra N. Pulmonary functions in healthy females of Haryana. Ind J Chest Dis All Sci 39.1997;p:163-71.
11. Jain A.K. Manual of Practical Physiology. 2nd Ed, Arya Publications, Avichal Publishing Company, Himachal Pradesh 2007:p:178-184, 223, 233, 148-151.
12. Evans S A, Watson L, Hawkins M, Cowly A ,J Johnston IDA, Kinnenar WJM. Respiratory muscle weakness in chronic heart failure. Thorax 1995;50:625-628.
13. Boum GL. Text book of pulmonary diseases Lippincott Philidelphia. 6th Ed 1998:393 & 724.
14. Dr Mahajan Methods in Biostatistics (5th Edition), Jaypee Brothers, Medical Publishers Ltd, New Delhi 1989; Page 102, 114-119, 125-39.
15. Kulkarni VA, Aithala M, Choudari D. A study on Peak expiratory flow rate of residential and non-residential school children. J of Association Physiologists and Pharmacologists of India 2000 Dec; A11.
16. Lakhera SC, Kain TC, Bandopadhayay P. Lung function in middle distance adolescent runner. Ind J Physiol Pharmacol 1994;38(2):117-20.
17. Choudari D, Aithala M, Kulkarni VA. Maximal expiratory pressure in Residential and Non-Residential school children. Indian Journal of Paed 2002; vol 69.

Prakash S, Meshram S, Ramlekkar U. Athletes, Yogis and individuals with sedentary life styles, Do their lung functions differ? Indian J Physiol Pharmacol 2007; 51(1): 76-80.