

# Assessment of the Yoga on the Status of the Physical Fitness among Children of the Residential School

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**Abstract:** In this article, we primarily study current health related physical fitness and health enhancing physical activity of residential school children of Birla Education Trust, Pilani, India. 276 school children, aged 8 to 14 are selected from three residential public schools of BET, Pilani. The present study is undertaken to show the effects of yoga and prayanam on growing children by comparing the PFI test performance of residential school children.

**Keywords:** Residential School, PFI, t-test, 8-14 years.

## I. INTRODUCTION

In developing nations, working parents prefer residential school for their children but decision to attend the boarding school is not easy. Despite quality of resources, activities and academics offered by residential school, physical fitness is important concern of parents and administration of school. Physical fitness is defined as 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 (Clarke, 1971). Physical fitness is the prime criterion for survival, to achieve any goal and to lead a healthy life. With fast acquaintance of modern amenities, we are neglecting the natural physical activities. Present education system, in residential schools, help to improve the standards of education, but non active, sedentary, stressful life has made the children physically unfit. The age between 8 and 14 years is important phase of physique and psycho development and of attaining the growth peak. It is evident from ancient Vedas that Yoga and other physical activities play key role to have good physical fitness. Realizing this fact, educationalists have recommended incorporating minimal physical exercise in curriculum (Choudari, 2000).

Yoga or physical exercise helps to achieve maximum physical fitness due to development of muscle and cardio-respiratory strength as well as endurance of the school children. Pansare (1986) had explained the advantages of physical fitness, like increase in the level of intelligence, tolerance, activity and social behavior. Pratt et al. (2003) suggested international accepted physical activity questionnaire to measure physical fitness for all age.

Kulinna (2003) especially studied for student physical activity pattern: grade, gender and activity influence.

Physical fitness index (PFI) is powerful indicator to assess fitness of one. PFI comprises of Anthropometrical parameters like height (in cms), weight (in kg), abdominal circumference size or body surface area (in  $m^2$ ), body mass index (in  $kg/m^2$ ), chest circumference (in cms) etc. Routine and systematic exercises increase PFI by increasing oxygen consumption. Harvard step test is known to measure PFI (Das, 1993). Wang and Pereira (2003) suggested leisure physical activity and health related physical fitness for public school children using statistical analysis with random selection. Choudhary (2002) examined respiratory pressure in residential and non-residential school children. Harvard step test was conducted to assess Physical Fitness Index (PFI) of residential sainik school children of age 12-14 years by Choudhary (2002). Caballero et al. (2003) conducted randomized controlled trial for the prevention of obesity in American Indian school children. The wrong impression is the thinking that BMI quantifies the amount of fats in the body. It does not directly measure Body Fat Percentage (BF %). Yet it can be done by some other formula using the BMI score (Deurenberg, Weststate & Seidell, 2007). BMI only indicates that one is thin, too thin, fat and too fat for one's body height relatively; and this has a predictive health information in which public health is interested, especially concerning body weight that are not normal on the International BMI classification chart. Studies that focus on child weight and their academic achievement also report conflicting findings. Some find that weight lowers test scores, though only for girls (Sabia, 2007), whilst others report no significant differences (Kaestner & Grossman, 2009). Khodnapur et al. (2012) assessed the status of physical fitness of Sainik residential school children. Khodanpur et al. (2012) found the effect of exercise and nutrition on physical fitness on growing children with scientific records. They found statistically significant higher values ( $p=0.000$ ) of  $VO_2$  Max, PFI, FEV1, PEFR and MEP in residential school children compared to nonresidential school children. Recently, Atare and Nkangude (2014) investigated the association of Body Mass Index (BMI) and Academic Performance of undergraduate PHE students at the University. Badami (2013) found that training improve cardio respiratory and

muscular adaptation to exercise by alteration in the balance between sympatho adrenal acceleratory activity and vagally mediated deceleration with increased cardiac output with better substrate utilization. Shashikala (2014) inferred that exercise training improves the aerobic capacity of an individual, primarily by increasing cardio respiratory efficiency.

Utility of yoga and problems of physical fitness in residential school motivate us to study statistical model in detail and to visualize the importance of yoga on children development more efficiently. The purpose of this study is threefold. The first is to suggest suitable yoga and pranam for school children. The second is to propose suitable test to measure development and third to perform statistical investigation of effect of yoga on school children. Thus the objectives of the present study are to show the effects of regular exercise on growing children by comparing the PFI and anthropometric parameters of residential school children involving a larger sample size. The rest of the paper is organized as follows: In section 2, we give the method of selection of sample for study of advantages of yoga in school curriculum. In next section 3, we present statistical analysis and testing of hypothesis to recommend to include yoga in school curriculum and discuss benefits of yoga for adolescence. In last, conclusion is remarked.

## II. RESEARCH METHODOLOGY AND MATERIALS

For the present study, we selected different schools governed by Birla Education trust, Pilani. The physical growth in boys and girls more or less is equal up to adolescence so we have selected random mix of both. We consider the unbiased sample of children of 8 to 14 years from three major residential single schools: Birla Public School (BPS), Birla Balika Vidya Peeth and Birla School Pilani (BSP). This sample is classified broadly as male/Female, hindu/non-hindu, urban/rural etc. This sample of size  $n = 276$  is categorized as controlled group (50%) and uncontrolled group (50%). The subjects represented almost all socio-economic sections and religions. The detailed classification is tabulated below as follows:

Table1: Frequency distribution of students:

| Variable                  | %    | N   |
|---------------------------|------|-----|
| <b>School name</b>        |      |     |
| BPS                       | 54.3 | 150 |
| BBVP                      | 20.3 | 56  |
| BSP                       | 25.4 | 70  |
| <b>Sex</b>                |      |     |
| Male                      | 79.7 | 220 |
| Female                    | 20.3 | 56  |
| <b>Religion</b>           |      |     |
| Hindu                     | 96.4 | 266 |
| Non-hindu                 | 3.6  | 10  |
| <b>Residential status</b> |      |     |
| Rural                     | 29.2 | 80  |
| Urban                     | 70.8 | 194 |

More than half of the students (54.3%) were selected from Birla Public School, based on the population. 20 % were female students from Birla Balika Vidyapeeth and more than one fourth were from the Birla School Pilani. About 80% were male students and rest was females. Since there were very few observations from Muslim, Jain, Sikh etc., so they were merged into non-Hindu category. Majority of the students belonged to urban category (70.8%) and about 30% were from rural areas. Controlled and uncontrolled group were tested for physical fitness by the PFT developed by Goyal (2012). The procedures were explained to children. The inclusion criteria for controlled group are apparently healthy and age 8-14 years.

After recording statistics of both controlled and uncontrolled group, controlled group underwent through different kind of yogas, exercise and pranayam etc which are listed below.

### *Breathing exercise:*

1. Sashank Shwasak (Sasankas breathing)
2. Vyaghra Shwasa (Tiger breathing)
3. Shwana (Dog breathing)

### *Shithilikarana Vyayama (Yogic Loosening)*

1. Ankle strearching
2. Padahastasana Ardha cakrasana chalana (forward backward bending)
3. Trikonasana Chalana (side bending)
4. Ardha Chakrasana (side bending)
5. Suryanamasakar (12 Steps, 3 Rounds )

### *Asana*

1. Ardhakati Chakrasana
2. Padhastasan
3. Tadasana
4. Bhujngasana
5. Shalabhasana
6. Dhanurasana
7. Sarvangasana
8. Halasana
9. Chakarasana
10. Paschimothanasan
11. Ardhmatsayandrasana
12. Ustrasana
13. Yogamudrasana

### *Pranayama*

1. Vibhagiya Pranayanama (Sectional breathing)
2. Anulomvilom (Balansig)
3. Sitali or sitkari (cooling breath)
4. Bhramari pranayam

### *Meditation*

Nadanusandhan (A-kara- 5 round, U-kara-5 round, M-kara-5 round, A – U – M – 5 round) chanting.

The controlled group' children were supervised with systematic and routine yogas and pranayam regularly 1 hour/day for 6 days/week along with other regular academic and non-academic activities and regular nutritional diet.

The students suffering from cardiopulmonary disorders, endocrine disorders, obesity, anemia and any chronic diseases were excluded in this study. Written consent was taken from parents and principals of both the schools as students were minor. The ethical clearance for the study was obtained from the ethical committee of BET society.

Table2: Descriptive statistics of subject with respect to yoga status (Combined):

| Group Statistics |             |     |        |                |                 |
|------------------|-------------|-----|--------|----------------|-----------------|
| Variable         | Yoga status | N   | Mean   | Std. Deviation | Std. Error Mean |
| Waist(Cms.)      | Before yoga | 138 | 66.72  | 8.797          | .749            |
|                  | After yoga  | 138 | 65.38  | 8.116          | .691            |
| Weight(Kg.)      | Before yoga | 138 | 43.45  | 10.039         | .855            |
|                  | After yoga  | 138 | 44.16  | 9.057          | .771            |
| Height(Cms.)     | Before yoga | 138 | 151.49 | 11.013         | .937            |
|                  | After yoga  | 138 | 151.79 | 10.961         | .933            |
| BMI              | Before yoga | 138 | 18.80  | 2.872          | .245            |
|                  | After yoga  | 138 | 19.00  | 2.290          | .195            |
| Chest(Cms.)      | Before yoga | 138 | 72.78  | 7.386          | .629            |
|                  | After yoga  | 138 | 72.09  | 6.867          | .585            |
| Hips(Cms.)       | Before yoga | 138 | 78.88  | 8.287          | .705            |
|                  | After yoga  | 138 | 76.83  | 7.732          | .658            |
| B.P.upper        | Before yoga | 138 | 117.83 | 9.350          | .796            |
|                  | After yoga  | 138 | 118.33 | 4.809          | .409            |
| B.P.lower        | Before yoga | 138 | 78.26  | 7.875          | .670            |
|                  | After yoga  | 138 | 78.45  | 4.244          | .361            |
| P.F.M.           | Before yoga | 138 | 245.71 | 56.364         | 4.798           |
|                  | After yoga  | 138 | 289.43 | 47.198         | 4.018           |
| P.L.(P/M)        | Before yoga | 138 | 94.02  | 16.524         | 1.407           |
|                  | After yoga  | 138 | 73.39  | 5.701          | .485            |
| B.H.C.           | Before yoga | 138 | 15.78  | 9.784          | .833            |
|                  | After yoga  | 138 | 18.60  | 4.930          | .420            |

Table 3: T-test for equality of means with respect to yoga status (Combined):

Independent Samples Test

| Variable     | t-test for Equality of Means |     |                 |                 |   |         |
|--------------|------------------------------|-----|-----------------|-----------------|---|---------|
|              | T                            | df  | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference |         |
|              |                              |     |                 |                 | Lower                                     | Upper   |
| Weight(Cms.) | -.617                        | 274 | .538            | -.710           | -2.976                                    | 1.556   |
| Height(Cms.) | -.230                        | 274 | .818            | -.304           | -2.908                                    | 2.300   |
| BMI          | -.635                        | 274 | .526            | -.199           | -.814                                     | .417    |
| Chest(Cms.)  | .802                         | 274 | .423            | .688            | -1.002                                    | 2.379   |
| Hips(Cms.)   | 2.126                        | 274 | .034            | 2.051           | .151                                      | 3.950   |
| B.P.upper    | -.568                        | 274 | .570            | -.509           | -2.271                                    | 1.253   |
| B.P.lower    | -.246                        | 274 | .806            | -.187           | -1.686                                    | 1.312   |
| P.F.M.       | -6.987                       | 274 | .000            | -43.722         | -56.042                                   | -31.402 |
| P.L. P/M     | 13.864                       | 274 | .000            | 20.630          | 17.701                                    | 23.560  |
| B.H.C.       | -3.024                       | 274 | .003            | -2.820          | -4.656                                    | -.984   |

Table 4: Descriptive statistics of subject with respect to yoga status for female:

| Group Statistics |             |    |        |                |                 |
|------------------|-------------|----|--------|----------------|-----------------|
| Variable         | Yoga status | N  | Mean   | Std. Deviation | Std. Error Mean |
| Waist(Cms.)      | Before yoga | 28 | 68.79  | 10.005         | 1.891           |
|                  | After yoga  | 28 | 68.00  | 8.060          | 1.523           |
| Weight(Kg.)      | Before yoga | 28 | 45.29  | 9.908          | 1.872           |
|                  | After yoga  | 28 | 45.77  | 8.971          | 1.695           |
| Height(Cms.)     | Before yoga | 28 | 151.29 | 8.405          | 1.588           |
|                  | After yoga  | 28 | 151.61 | 8.360          | 1.580           |
| B.M.I.           | Before yoga | 28 | 19.63  | 2.960          | .559            |
|                  | After yoga  | 28 | 19.76  | 2.443          | .462            |
| Chest(Cms.)      | Before yoga | 28 | 74.29  | 7.615          | 1.439           |
|                  | After yoga  | 28 | 74.00  | 6.492          | 1.227           |
| Hips(Cms.)       | Before yoga | 28 | 83.36  | 7.534          | 1.424           |
|                  | After yoga  | 28 | 80.07  | 6.700          | 1.266           |
| B.P.upper        | Before yoga | 28 | 116.05 | 13.934         | 2.633           |
|                  | After yoga  | 28 | 116.53 | 5.331          | 1.007           |
| B.P.lower        | Before yoga | 28 | 80.47  | 13.543         | 2.559           |
|                  | After yoga  | 28 | 78.07  | 5.013          | .947            |
| P.F.M.           | Before yoga | 28 | 237.57 | 47.804         | 9.034           |
|                  | After yoga  | 28 | 267.47 | 48.712         | 9.206           |
| P.L.(Per/Minute) | Before yoga | 28 | 92.68  | 18.207         | 3.441           |
|                  | After yoga  | 28 | 73.32  | 1.806          | .341            |
| B.H.C.           | Before yoga | 28 | 14.83  | 4.221          | .798            |
|                  | After yoga  | 28 | 17.27  | 4.048          | .765            |

Table 5: T-test for equality of means with respect to yoga status for female: Independent Samples Test

| Variable         | t-test for Equality of Means |                 |                 |   |        |
|------------------|------------------------------|-----------------|-----------------|---|--------|
|                  | t                            | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference |        |
|                  |                              |                 |                 | Lower                                     | Upper  |
| Weight(Kg.)      | -.191                        | .849            | -.482           | -5.546                                    | 4.582  |
| Height(Cms.)     | -.143                        | .886            | -.321           | -4.813                                    | 4.170  |
| B.M.I.           | -.185                        | .854            | -.134           | -1.588                                    | 1.320  |
| Chest(Cms.)      | .151                         | .880            | .286            | -3.506                                    | 4.077  |
| Hips(Cms.)       | 1.725                        | .090            | 3.286           | -.534                                     | 7.106  |
| B.P.upper        | -.168                        | .867            | -.475           | -6.128                                    | 5.178  |
| B.P.lower        | .880                         | .383            | 2.402           | -3.069                                    | 7.874  |
| P.F.M.           | -                            | .024            | -29.900         | -55.759                                   | -4.041 |
| P.L.(Per/Minute) | 5.598                        | .000            | 19.357          | 12.425                                    | 26.289 |
| B.H.C.           | -                            | .031            | -2.446          | -4.662                                    | -.231  |

Table 6: Descriptive statistics of subject with respect to yoga status for male Group Statistics

| Variable         | Yoga status | N   | Mean   | Std. Deviation | Std. Error Mean |
|------------------|-------------|-----|--------|----------------|-----------------|
| Waist(Cms.)      | Before yoga | 110 | 66.19  | 8.432          | .804            |
|                  | After yoga  | 110 | 64.72  | 8.031          | .766            |
| Weight(Kg.)      | Before yoga | 110 | 42.98  | 10.062         | .959            |
|                  | After yoga  | 110 | 43.75  | 9.073          | .865            |
| Height(Cms.)     | Before yoga | 110 | 151.54 | 11.616         | 1.108           |
|                  | After yoga  | 110 | 151.84 | 11.562         | 1.102           |
| B.M.I.           | Before yoga | 110 | 18.59  | 2.825          | .269            |
|                  | After yoga  | 110 | 18.81  | 2.219          | .212            |
| Chest(Cms.)      | Before yoga | 110 | 72.39  | 7.312          | .697            |
|                  | After yoga  | 110 | 71.60  | 6.903          | .658            |
| Hips(Cms.)       | Before yoga | 110 | 77.74  | 8.111          | .773            |
|                  | After yoga  | 110 | 76.00  | 7.786          | .742            |
| B.P.upper        | Before yoga | 110 | 118.28 | 7.796          | .743            |
|                  | After yoga  | 110 | 118.79 | 4.580          | .437            |
| B.P.lower        | Before yoga | 110 | 77.70  | 5.562          | .530            |
|                  | After yoga  | 110 | 78.55  | 4.046          | .386            |
| P.F.M.           | Before yoga | 110 | 247.78 | 58.357         | 5.564           |
|                  | After yoga  | 110 | 295.02 | 45.350         | 4.324           |
| P.L.(Per/Minute) | Before yoga | 110 | 94.36  | 16.140         | 1.539           |
|                  | After yoga  | 110 | 73.41  | 6.328          | .603            |

| B.H.C. | Before yoga | After yoga |       |       |        |       |
|--------|-------------|------------|-------|-------|--------|-------|
|        | 110         | 110        | 16.03 | 18.94 | 10.752 | 1.025 |
|        |             |            |       |       | 5.091  | .485  |

Table 7: T-test for equality of means with respect to yoga status for male: Independent Samples Test

| Variable         | t-test for Equality of Means |                 |                 |   |         |
|------------------|------------------------------|-----------------|-----------------|---|---------|
|                  | t                            | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference |         |
|                  |                              |                 |                 | Lower                                     | Upper   |
| Waist(Cms.)      | 1.326                        | .186            | 1.473           | -.715                                     | 3.661   |
| Weight(Kg.)      | -.595                        | .553            | -.768           | -3.314                                    | 1.778   |
| Height(Cms.)     | -.192                        | .848            | -.300           | -3.380                                    | 2.780   |
| B.M.I.           | -.628                        | .531            | -.215           | -.890                                     | .460    |
| Chest(Cms.)      | .825                         | .410            | .791            | -1.099                                    | 2.681   |
| Hips(Cms.)       | 1.620                        | .107            | 1.736           | -.376                                     | 3.849   |
| B.P.upper        | -.600                        | .549            | -.517           | -2.216                                    | 1.182   |
| B.P.lower        | -1.291                       | .198            | -.846           | -2.139                                    | .446    |
| P.F.M.           | -6.704                       | .000            | -47.241         | -61.129                                   | -33.352 |
| P.L.(Per/Minute) | 12.677                       | .000            | 20.955          | 17.697                                    | 24.212  |
| B.H.C.           | -2.570                       | .011            | -2.915          | -5.151                                    | -.680   |

### III. STATISTICAL DISCUSSION

All the values were presented as mean, standard deviation and standard error. Comparison of mean values of parameters was done between controlled and non-controlled group using t- test. In table 2 and 3 we analyzed the combined sample with respect to yoga status. The effect of yoga on physical health of students is apparent from the above analysis. There is a marked difference between peak flow meter, breathe holding capacity of lungs and pulse rate before and after intervention. All three variables are statistically significant at 5% level of significance. Difference can be observed in weight, chest, BMI and blood pressure of students who practiced yoga. Though the difference is not statistically significant, still it does not dilute the impact of yoga on physical health. It might be because of the short duration of yoga (three months). It indicates us that yoga leaves the positive impact on all parameter of physical development. The same result was observed when we analyzed the data with respect to sex (table 4, 5, 6 & 7).

*Abbreviations:* B.P. >Blood pressure, P.F.M. >Peak flow meter, P.L.> Pulse rate, B.H.C. >Breathe holding capacity

### IV. CONCLUSION

We conclude from our study that the physical fitness and anthropometric parameters are higher in the controlled group than those of the Non-controlled group of residential school children of age 8 to 14 years. So, regular exercise and nutritious diet under the guidance increases the physical fitness and growth in growing children. Physically fit

children are easily adapt for stress. Their neuromuscular tension is less. They do not suffer from easy fatigability. Therefore, regular exercise under the guidance of expert can be undertaken as a part of curriculum to gift physically fit youth of the country.

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#### REFERENCES

- [1]. Atare, UF and Nkangude, AT (2014): Body mass index and academic performance of undergraduate university students, *Asian Journal of management sciences and education*, Vol. 3, No. 1, pp 105-112.
- [2]. Badami S (2013). A comparative study of physical fitness index and predicted maximum aerobic capacity between students of medical education and physical education. MD (Physiology) Thesis, RGUHS Bangalore, Karnataka India.
- [3]. Caballero, B., Clay, T., Davis, S.M., Ethelbah, B., Rock, B.H., Lohman, T., Norman, J., Story, M.J., Stone, E., Stephenson, J. & Stevens, J. (2003). Pathways: a school-based, randomized controlled trial for the prevention of obesity in American Indian school children. *American Journal of Clinical Nutrition*, Vol. 78, No. 5, pp 1030 - 1038.
- [4]. Choudari, SK (2000): Text book of Concise Medical Physiology, 3rd Ed., New central book agency Ltd, Calcutta.
- [5]. Choudhari, D, Aithal, M and Kulkarni, VA (2002): Maximal expiratory pressure in Residential and Non-Residential school children. *Indian Journal Padiatrics*, Vol. 69, pp 229-232.
- [6]. Choudhari, D., Choudhari, S., Kulkarni, VA (2002): Physical fitness: A comparative study between students of residential (saini) and non-residential schools (aged 12-14 years), *indian journal of physiology and pharmacology*, Vol. 46, No. 3, pp 328-332.
- [7]. Clarke HH (1971): Basic understanding of physical fitness, *Physical Fitness Research Digest series*, Vol. 1, No. 2, pp. 1-10.
- [8]. Das, SKR (1993): Determination of physical fitness Index (PFI) with modified Harvard Step Test (HST) in young men and women, *Indian Journal of Physiology & Allied Science*, Vol. 47, No. 2, pp. 73-76.
- [9]. Deurenberg, P.; Westrate, J. A. & Seidell, J. C. (2007). BMI to body fat percentage formula Body Mass Index as a measure of Body fatness: Age-and Sex-specific Prediction formulas. *British Journal of Nutrition*, 65(2), 105-114. PMID 2043597.
- [10]. Goyal, BB (2012): *Swasthya parikshan*, Sterling Publication.
- [11]. Kaestner, R; & Grossman, M. (2009). Effects of weight on children's educational achievement. *Economics of Education Review*, 28, 651-661. doi:10.1016/j.econedurev.2009.03.002
- [12]. Khodnapur JP, Dhanakshirur GB, Bagali S, Mullur LM and Aithala M (2012). Status of Physical Fitness Index (PFI%) and Anthropometric parameters in Residential school children compared to Non Residential school children. *Journal of Krishna Institute of Medical Sciences*, Vol. 1, No. 2, pp 137-141.
- [13]. Khodnapur, JP, Dhanakshirur, GB and Aithala, M (2012): Role of exercise and nutrition on cardiopulmonary fitness and pulmonary functions on residential and non-residential school children, *Indian Journal of Physical Pharmacol*, Vol. 56, No. 3, pp 239-244.
- [14]. Kulinna, PH, Martin, J, Lai, Q, Kliber, A and Reed, B (2003): Student physical activity patterns: Grade, gender, and Activity influences, *Journal of Teaching in Physical education*, Vol. 22, pp 298-310.
- [15]. Pansare MS (1986): *Physiology of Fitness*, Medical Journal of Western India, Vol. 14, pp. 18-20.
- [16]. Pratt, M, Ekelund, U, Yngve, A, Sallis, JF and Ojha P (2003). International Physical Activity Questionnaire: 12-country reliability and validity, *Medicine and Science in Sports and Exercise*, Vol. 5, No. 8, pp 1381-1395.
- [17]. Sabia; J. (2007). The effect of body weight on adolescent academic performance. *Southern Economic Journal*, 73(4), 871-900.
- [18]. Shashikala L, Geethanjali HT, Banner R, Kumar, S and Natraj SM (2014): Efficiency of recovery pulse rate as an index of physical fitness, *Indian Journal of Fundamental and Applied Life Sciences*, Vol. 4, No. 2, pp 216-219.
- [19]. Vanhees, L, Lefevre, J., Philippaerts, R, Martens, M, Huygens, W, Troosters, T. and Beunen, G. (2005): How to assess physical activity? How to assess physical fitness? *European Journal of Cardiovascular Prevention and Rehabilitation*, Vol. 12, pp 102-114.
- [20]. Wang, GY and Pereira, B (2003): Leisure physical activity and health related physical fitness: A randomised trial from 4 public schools in Portugal, *Proceeding of 8th Annual Congress European College of Sport Science*. July 9-12, 2003, Salzburg, Austria.