International Journal of Yoga, Physiotherapy and Physical Education
ISSN: 2456-5067, Impact Factor: RJIF 5.24
Received: 20-01-2021, Accepted: 05-02-2021, Published: 01-04-2021
www.sportsjournal.in
Volume 6, Issue 2, 2021, Page No. 17-20

Study of cardio respiratory fitness in relation to somatotype components among Bengali adolescent school girls

Pintu Sil
Assistant Professor, Institute of Physical Education for Women, Hastings House, Kolkata affiliated to University of Calcutta, Kolkata, West Bengal, India

Abstract
Cardio-respiratory fitness (CRF) reflects the body's ability to transport oxygen during sustained physical activity. Somatotype is defined as the qualification of the present shape and composition of the human body. Adolescence is a transitional stage of physical and psychological human development that generally occurs during the period from puberty to legal adulthood. Present study is designed to find out the influence of different somatotype componentsi.e. endomorph, mesomorph and ectomorph on VO_2 max among the adolescent school girls. A total of eighty six (86) Bengali school girl students in between the age of 12 to 15 years were selected randomly for this study. Somatotype and its components - endomorph, mesomorph and ectomorph and cardio respiratory fitness (CRF) were the criterion of the study. Both parameters were measured by the standard tests. The mean value and standard deviation were used as descriptive statistics and the coefficient of correlation (r-value) was computed using Pearson Product Moment Method. Only 0.05 level of significance was considered in this study. Result revealed that the average CRF value was 1097.04 Yards and the subjects had higher value of endomorphy followed by the mesomorphy and ectomorphy. Findings revealed that the correlation between CRF with endomorphy was negative and not significant ($p>0.05$). This correlation was negative but statistically significant ($p<0.05$) for mesomorphy but positive and statistically insignificant ($p>0.05$) for ectomorphy.

Keywords: cardio-respiratory fitness, somatotype, adolescent school girls

Introduction

Cardio-respiratory fitness (CRF) reflects the body's ability to transport oxygen during sustained physical activity. It is the ability of the circulatory and respiratory systems to supply oxygen to skeletal muscles during sustained physical activity. The primary measure of CRF is VO_2 max (*Ross et al., 2016)* [16]. There are several factors which might influence aerobic ability or CRF of a person. These are age, gender, altitude etc. Age plays a central role with CRF. It typically is peaking by age 20 and declining by nearly 30 percent by age 65. A man's CRF is generally be 20 percent higher than a woman's with same body size, blood volume, and hemoglobin content. In high altitude there is less air to consume. Higher CRF are associated with certain endurance sports, most specifically cycling, rowing, distance running, and cross-country skiing. It is important to note, however, that CRF are not inherently linked to sports excellence. There are other factors that arguably play a larger role in CRF including sports training, psychological preparation, lactate threshold training, and nutrition. There are many benefits of high level of cardio-respiratory fitness. It can reduce the risk of heart disease, lung cancer, type 2 diabetes, stroke, and other diseases. Cardio-respiratory fitness helps improve lung and heart condition, and increases feelings of wellbeing (Donatello, 2005*)* [10]. Additionally, there is mounting evidence that CRF is potentially a stronger predictor of mortality. Recent study demonstrated the levels of CRF were associated with early deaths (*Chao et al. 2020)* [7].

Physical activity is a behavior that can potentially improve CRF. Regular exercise makes these systems more efficient by enlarging the heart muscle, enabling more blood to be pumped with each stroke, and increasing the number of small arteries in trained skeletal muscles, which supply more blood to working muscles. Exercise improves not just the respiratory system but the heart by increasing the amount of oxygen that is inhaled and distributed to body tissue (Donatello, 2005*)* [10]. A 2005 Cochrane review demonstrated that physical activity interventions are effective for increasing cardiovascular fitness (Hillsdon, Foster and Thorogood, 2005*)* [12].

Somatotype is defined as the qualification of the present shape and composition of the human body. (Heath and carter, 2002) [5]. The technique of somatotyping is used to appraise body shape and composition. It is expressed in a three-number rating representing endomorphy, mesomorphy and ectomorphy components respectively, always in the same order. Endomorphy in the relative fatness, mesomorphy is the relative musculo-skeletal robustness, and ectomorphy is the relative linearity or slenderness of a physique. For example, a 3-5-2 rating is recorded in this manner and is read is three, five, two. These numbers give the magnitude of each of the three components. The rating is phenotypical, based on the concept of geometrical size-dissociation and applicable to both genders from childhood to old age. Adolescence is a transitional stage of physical and psychological human development that generally occurs during the period from puberty to legal adulthood. Present study is designed to find out the influence of different somatotype components i.e. endomorph, mesomorph and ectomorph on VO_2 max among the adolescent school girls. Findings will be help full to identify the body type of the Bengali adolescent school girls and also be helpful to find out the co-relationship between

cardio respiratory fitness (CRF) with different somatotype components among adolescent school girls.

Material and Methods

The Subject

A total of eighty six (86) Bengali school girl students in between the age of 12 to 15 years were selected randomly for this study. All the subjects were selected from different secondary schools of Calcutta metro city area of West Bengal.

Criterion Measures

Following criterion were measures in this study:

- Somatotype - Endomorph, Mesomorph and Ectomorph
- Cardio Respiratory Fitness (CRF).

Instrument and Tools Used

Following tools and instruments were used to collect the data.

- Somatotype was measured by Heath & Cater Somatotyping method (Heath & Cater Somatotyping manual, 2002).
- CRF was measured by the 9 min Run and Walk Test (AAHPARD Health Related Fitness Test, 1984).

Design of the study and Statistical Procedure used

The study was a relationship study in nature. Maximum value, minimum value, mean value and standard deviation were used as descriptive statistics. The coefficient of correlation (*R-value*) was computed using Pearson Product Moment Method. Only 0.05 level of significance was considered in this study. All statistical calculations have done by the standard statistical software (Excel 2010).

Result and Findings

The findings on subjects' physical parameters and CRF have presented in the Table No.-1. The Table-1 have shown that the average age of the subjects was 13.06 Years and the average height and weight of the subjects were 149.93 cm and 48.34 Kg respectively. The average value of CRF was 1097.04 Yards. The findings on somatotype of the adolescent girls have presented in Table-2. The table revealed that the average value of Endomorphy, Mesomorphy and Ectomorphy were 5.16, 3.15 and 1.98 respectively. The average somatotype for the subjects found in this study was 5.16-3.15-1.98. The findings have presented graphically in Figure-1.

Table 1: Presentation of descriptive statistics for physical parameters and CRF

Parameters	Age (Yrs)	Height (cm)	Weight (Kg)	CRF (Yard)
Maximum	15	174	70	1405
Minimum	12	136	26	715
Mean	13.06	149.93	48.34	1097.04
SD	1.004	6.55	9.19	174.09

Table-2: Presentation of descriptive statistics for somatotype components

Parameters	Endomorphy	Mesomorphy	Ectomorphy
Maximum	9.13	7.62	7.28
Minimum	1.70	0.10	0.10
Mean	5.16	3.15	1.98
SD	1.37	1.81	1.63

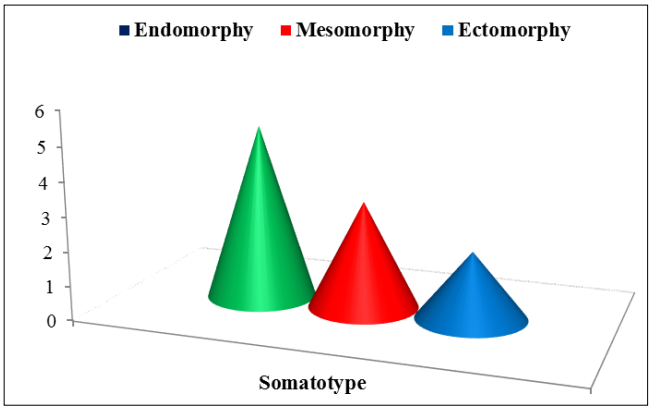

Fig 1: Somatotype of the subjects - Mesomorphic-Endomorph

The correlation between CRF with different somatotype components i.e. endomorphy, mesomorphy and ectomorphy have been computed by Pearson Product Moment method and result have presented in Table No-3. Table-3 revealed that the r-value between CRF and Endomorphy was -0.199. The computed r-value between CRF and mesomorphy was -0.237 and the computed r-value between CRF and ectomorphy was 0.115. Findings have shown that the correlation between CRF with endomorphy somatotype component was negative and not significant statistically ($p>0.05$). Table-3 have also revealed that the correlation between CRF with mesomorphy somatotype component was negative but statistically significant ($p<0.05$). But the correlation between CRF with ectomorphy somatotype component was positive and statistically insignificant ($p>0.05$).

Table 3: Computed coefficient of correlation (*r*-value) between CRF with different somatotype components

Parameters	Endomorphy	Mesomorphy	Ectomorphy
CRF	-0.199	-0.237*	0.115

*Significant statistically (To be significant the r value would be 0.217 at df 84).

Discussion on Findings

Present study found the average CRF of the subjects was 1097.04 yards which indicated a good status of their health. However the findings revealed that the subjects had higher value of Endomorphy components followed by the Mesomorphy component and Ectomorphy component. Earlier study reported the same findings of Mesomorphic-Endomorph somatotype of adolescent school girls (Mandal and Sil, 2016) [13]. It has already been pointed out that the endomorphy component represent body fat, mesomorphy component represent muscle mass and ectomorphy component represent thinness which indicate dominance of skin and bone mass. The adolescent girls usually have more amount of fat in their body during this stages of growth and development. Findings of the present study was same with the several modern studies conducted in this area (Bhadra, Mukhopadhyay, and Bose, 2005; De, 2016; Chakrabarty and Bharati, 2010; Banik, 2014) [4, 9, 6, 2].

The coefficient of correlation (r-value) computed between CRF and Endomorphy found negative and not significant in this study. Several study reported that the more fat mass is detrimental to the physical performance (González-Gross *et al*. 2003; Tyagi, 2001; Barbara *et al*. 2002; Mcleod, 1983) [11, 18, 3, 15]. Hence, the finding trend supported the fact that fat mass is not ideal for improvement of CRF performance.

A negative and significant correlation was reported between VO_2 max and body fat % ($r = -0.702$, $p<0.01$) by Marangoz and Var, (2018) [14]. In the same study they have found negative and significant correlation between VO_2 max and endomorph value ($r = -0.702$, $p<0.01$).

The coefficient of correlation (r-value) computed between CRF and Mesomorphy (*r=-0.237*) found negative but significant ($p<0.05$) in this study. This findings was quite opposite to the traditional thinking that the more muscle mass is ideal to improve the physical performance like strength, endurance etc. But present finding revealed that mesomorphy has significantly negative correlation between CRF Performance. Marangoz and Var, (2018) [14] conducted a study and reported the significantly negative correlation between VO_2 max and mesomorph value ($r = -0.703$, $p<0.01$). The causes might be the nature of physiological capacity of the adolescent girls. The CRF performance involved both cardiac and respiratory systems to execute the performance. The higher demand of oxygen in muscle cell might not be sufficiently supplied by the functions of these two system for the subjects during the test. The development of cardio-respiratory system might not be up to date to meet the demand of the muscle during prolonged endurance activities in this growth period of the girls. Another cause might be psychological in nature. As the girls become more mature during adolescent period they have developed several psychological and sociological problems related to the execution of physical performance on the open field in front of spectators. They expressed several hesitation to take part in the 9 min run and walk test. Same fact have been reported by Sil (2013). The researcher motivated them to complete the test but observed that they have not given their best effort on the ground. The higher class of the students have shown more hesitation and that might be the main cause of the significant negative correlation between these parameters in this study.

The coefficient of correlation (r-value) computed between CRF and Ectomorphy found positive but insignificant in this study. The ectomorphy represent the thinness of the body thus indicated absence or lower amount of fat in the human body. Therefore positive correlation between ectomorphy Component with CRF performance was as per anticipation of the researcher. Study conducted by Chaouachi *et al.* (2005) [8] in this area reported that the Meso-ecto and the Meso groups showed the greatest performance in aerobic capacity.

Conclusions

On the basis of above findings and discussion the following conclusions have been drawn in this study:

- Adolescent school girls possessed Mesomorphic-Endomorph somatotype.
- Mesomorphy component had a significant negative correlation with CRF among adolescent school girls.
- Endomorphy and ectomorphy had no significant correlation with CRF among adolescent school girls.

References

1. AAHPERD. Health Related Physical Fitness Test Technical Manual. Reston, Virginia: American Alliance for Health, Physical Education, Recreation and Dance, 1984.
2. Banik D. The menarche, nutritional status and body size in 10 to 12 year old girls from Kashipur, Purulia, West Bengal India, Malaysian journal of nutrition, 2014:20(1):39-49.
3. Barbara Sternfeld, Long Ngo, William A. Satariano and Ira B. Tager, Associations of Body Composition with Physical Performance and Self-reported Functional Limitation in Elderly Men and Women, *Am J* Epidemiol,2002:156:110-21.
4. Bhadra M, Mukhopadhyay A, Bose K. Difference in body composition between pre menarcheal and menarcheal bengalee hindu girls of Madhyamgram, West Bengal, India, anthropologist,2005:113:141-145.
5. Carter JEL. The Heath-Carter Anthropometeric-Somatotyp Instruction Manual; San Diego, CA.U.S.A, 2002, 1&3. Web link: http://www.somatotype.org/Heath-CarterManual.pdf
6. Chakrabarty S, Bharati P. Adult body dimension and determinants of chronic energy deficiency among the shabar tribe living in urban rural, and forest habitats in Orissa, India, *ann human boil*, 2010;37(2):149-67.
7. Chao Cao, Yang Lin, Cade W, Todd Racette, Susan B, Park Yikyung *et al* Friedenreich, Christine M.; Hamer, Mark; Stamatakis, Emmanuel; Smith, Lee. "Cardiorespiratory Fitness is Associated with Early Death among Healthy Young and Middle-aged Baby Boomers and Generation Xers". The American Journal of Medicine,2020:0:(0).
8. Chaouachi M, Chaouachi A, Chamari AK, Chtara M, Feki M, Amri YM *et al*. Effects of dominant somatotype on aerobic capacity trainability, British Journal of Sports Medicine,2005:39(12). Web source: http://dx.doi.org/10. 1136/bjsm. 2005.019943
9. De K. Nutritional status and menarcheal age of rural adolescent girls of Salboni block of Paschim Medinipur, West Bengal, India, Journal of child adolescent and behavior,2016;4(5):1-4.
10. Donatello RJ. Health, the Basics. San Francisco: Pearson Education, Inc,2005.
11. González-Gross M, Ruiz JR, Moreno LA, Rufino-Rivas P, Garaulet M, Mesana A *et al*. Body composition and physical performance of Spanish adolescents: the AVENA pilot study, *Acta Diabetol*,2003:40:299-301.
12. Hillsdon M, Foster C, Thorogood M. "Interventions for promoting physical activity". The Cochrane Database of Systematic Reviews,2005,(1).
13. Mandal S, Sil P. Somatotype and Motor fitness abilities of early and later adolescent girls belong to a Metropolitan city, Unpublished MP Ed thesis, State Institute of Physical Education for Women, Hastings House, Kolkata, University of Calcutta, 2016.
14. Marangoz I, Var SM. The Relationship among Somatotype Structures, Body Compositions and Estimated Oxygen Capacities of Elite Male Handball Players; Asian Journal of Education and Training, 2018:v4(n3):p216-219.
15. Mcleod WD. Performance measurement and percent body fat in the high school athlete, The American Journal of Sports Med,1983:11(6):390-397.
16. Ross R, Blair SN, Ross A, Church TS, Després, Jean-Pierre *et al*. Importance of Assessing Cardio respiratory Fitness in Clinical Practice: A Case for Fitness as a Clinical Vital Sign: A Scientific Statement From the American Heart Association". Circulation, 2016:134(24):e653-e699.
17. Sil P. Somatotype, Physical Growth Status and Motor

Fitness Profile of 10 To 14 Years Boys of Rajbansi Community of Coochbehar, *Unpublished PhD Thesis*, University of Kalyani, Kalyani Nadia, 2013.
18. Tyagi PK. Obesity assessment -a realistic approach, Indian J. Aerospace Med,2001;45(2):67.