

Original article

Longer duration of Leisure-Time Physical Activity and its effect on Somatotype and Cardiovascular Health among the Bengali Hindu Children of Kolkata, India: A Brief Report

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ABSTRACT

Objectives: People of South Asian origin are ethnically predisposed to adverse cardiovascular health, and adoption of sedentary lifestyle from early childhood increases the disease susceptibility later in adult life. The study examined the effect of longer duration of leisure-time physical activity (LTPA) on somatotype and cardiovascular health of Bengali Hindu children on their somatotype and cardiovascular health. **Material and Methods:** A total of 888 Bengali Hindu children (including 471 boys and 417 girls) of age 5-9 years living in the northern part of Kolkata, India were studied and all participants represented from low-to-middle socio-economic strata. Anthropometric measures and body composition were calculated using standard techniques. Somatotype was calculated following Heath-Carter method. LTPA was based on tentative time spent over such activities daily that require very less or no physical activity and divided into two groups as LTPA > 1 hour and ≤ 1 hour. **Results:** The analysis of covariance (ANCOVA) test with age as covariate showed that children who spend > 1 hour of LTPA had significantly higher ($p < 0.001$) endomorphy (sign of relative fatness), higher mesomorphy (sign of musculoskeletal robustness relative to stature), and significantly lower ($p < 0.001$) ectomorphy (sign of relative linearity), than their counterparts who spend ≤ 1 hour, irrespective of sex. **Discussion:** We found that cardiovascular health among the children was adversely affected by less physical activity thereby causing more deposition of fat mass and leading to a potential future risk of developing diabetes mellitus and cardiovascular disease (CVD). Less physical activity perhaps mediated through habitual practice of sedentary behaviour during childhood seems to be an independent risk factor towards early predisposition to CVD risk in adulthood. **Conclusion:** Hence promotion of physical activity from early childhood is of utmost importance at the national level for saving our next generation from the risk of poor cardio-metabolic health.

Key words: Body composition, Somatotype, cardiovascular health, Children, Leisure-time activity

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INTRODUCTION

Level of physical inactivity has increased globally in recent years with more than a quarter of the world's population are insufficiently active. The drop-in physical activity is partly due to inaction during leisure time and sedentary behaviour both at home and at work station (WHO, 2021). Leisure-time physical activity (LTPA) patterns, as spent during childhood, like any other aspects of human behaviour are believed to exhibit change and continuity not only later in adulthood but across the life span as well. The physical, psychological, and social circumstances put impact, as individual age, on the ways they use their free time (Scott & Willits, 1998). Although adult leisure behaviour is shaped by various factors, it is the leisure involvement and education during childhood that shapes the leisure participation in later life. Accumulation of risk factors if started in early childhood and remains sustained over a long period is believed to have a greater impact on CVD mortality (Tanha et al., 2011). It is the period when preconditions for chronic diseases are established through learned behaviour or emotional experiences (Byrne et al., 2007). Childhood onset of physical inactivity is associated with developing cardiovascular disease (CVD) and diabetes during adult life. Moreover, poor leisure-time physical activity (LTPA) has been found to be strongly associated with diabetes and CVD (Moe et al., 2013). To the contrary, regular physical activities appear to attenuate the negative consequences of sedentary behaviour (Lavie et al., 2019) and central obesity (Czeczewski et al., 2020) on cardiovascular health.

The present study was therefore aimed to find out the effect of duration of LTPA on somatotype and cardiovascular health among the Bengali Hindu boys and girls due to differences in living in Kolkata, India.

MATERIALS AND METHODS

Study population

A total of 888 Bengali Hindu children (including 471 boys and 417 girls) of age 5-9 years living in the northern part of Kolkata, India were studied with all participants belonging to low-to-middle socio-economic status. All the children are school-goer studying in primary school from class I-IV.

Anthropometric measures and body composition

To determine anthropometric somatotype following measurement were taken using standard techniques (Lohman et al., 1988). Height (in cm) was measured nearest to 0.1cm using portable anthropometer. Weight (in kg) was recorded nearest to 0.1kg using a movable weighing scale. Skinfolts including triceps, sub-scapular, supraspinale and calf were measured using Slim guide skinfold caliper (CESCORF, Brazil). Calf girths, bicep girth, waist circumference, hip circumference (all in cm) were measured with an inelastic tape (CESCORF, Brazil). Epicondylar breadth of humerus and condylar breadth of femur (both in cm) was measured sliding caliper (CESCORF, Brazil).

Somatotype

Somatotype was calculated as per Health-Carter somatotype method (Carter & Heath, 1991). The three somatotypes representing the physique viz., 1) endomorphy - the level of fatness, 2) mesomorphy – denotes musculoskeletal robustness, and 3) ectomorphy –relative linearity of a physique, were calculated accordingly.

Leisure-time physical activity

LTPA levels were ascertained by means of a questionnaire which includes the frequency and intensity of leisure-time physical activity i.e., time spent on those activities that require either very less physical activity or no physical activity at all. It is understandable that physical activity level of children is difficult to calculate solely from the participants themselves as they have difficulties in recalling their activities accurately. We therefore insisted them to fill out the questionnaire by taking the necessary help from their parents and class teachers. Later all participants were divided into two groups: i) LTPA > 1h - children spending more than one hour daily on activities that hardly requires any physical exercise, and ii) LTPA ≤ 1h – children spending no more than an hour on leisure activities. The activities include time spent over watching television, movies, playing video games, use of cell/smart phones, and sheer gossiping.

Statistical analysis

For comparison between two groups of LTPA the significance of BMI, WC, % body fat, and each component of somatotype were determined by means of analyses of covariance

(ANCOVA) with age as covariate, separately for boys and girls. It was followed by multivariate analysis of covariance (MANCOVA) test in order to establish whether the groups of LTPA (as independent variables) are statistically significantly differ on the somatotypes (as dependent variables) components (i.e., endomorphy, mesomorphy, and ectomorphy) with age as covariate. The Wilks' Lambda value was considered for MANCOVA statistics and partial eta-square was calculated in order to find out the effect size-variance explained by the given variable. The means of the somatotypes of both the groups were plotted in the somatochart using X and Y co-ordinates following standard equation: Value of the X coordinate = Ectomorphy – Endomorphy, and Value of the y coordinate = 2 x Mesomorphy – (Endomorphy + Ectomorphy). All statistical analyses were performed on IBM SPSS (version 25) with level of significance was set at $p < 0.05$ (two tailed).

RESULTS

The frequency of children falling under the category of $LTPA > 1h$ and $LTPA \leq 1h$ by age and sex are given in Table I. The descriptive and inferential statistics of the study participants are given in Table II. By performing ANCOVA test with age as covariate, we found that there exists a statistically significant difference ($p < 0.001$) in mean BMI, WC, and % body fat among boys with $LTPA > 1h$ as compare to their counterparts with $LTA \leq 1h$. Similarly, among girls there exist a statistically significant difference in mean BMI ($p = 0.007$), WC ($p = 0.005$), % body fat ($p < 0.001$), endomorphy ($p < 0.001$), mesomorphy ($p = 0.026$), and ectomorphy ($p < 0.001$) between girls with $LTPA > 1h$ as compare to their counterparts with $LTA \leq 1h$. The ANCOVA test also resulted that children with $LTA > 1h$ had significantly higher ($p < 0.001$) mean endomorphy, and significantly lower mean ectomorphy, irrespective of sex. In MANCOVA test, statistically significant differences were noticed in the combined somatotype components between LTPA levels, after controlling for age in both boys and girls. In boys, the significant difference between LTPA groups on the combined somatotype components after controlling for age were Wilks' $\lambda = 0.318$, $p < 0.001$, and partial $\eta^2 = 0.682$, indicating that ~68% of the total variance is explained by LTPA out of the total variance in the model. Similarly, among girls, the difference between LTPA groups had significant difference on the combined somatotype components were Wilks' $\lambda = 0.334$, $p < 0.001$, and partial $\eta^2 = 0.666$ explaining ~67% of the total variance by LTPA out of the total variance in the model. It was found that

LTPA was significantly associated with somatotype and explained over two-third of the total variance after controlling for age, and irrespective of sex.

Table I: Frequency of leisure-time physical activity by age and sex

Age (years)	Boys (n = 471)		Girls (n = 417)		Total
	LTPA > 1 h	LTPA ≤ 1 h	LTPA > 1 h	LTPA ≤ 1 h	
5	38	54	52	41	185
6	63	30	57	33	183
7	37	58	32	31	158
8	31	60	30	45	166
9	45	55	43	53	196
Total	214	257	214	203	888

Table II: Descriptive and inferential statistics of the children by leisure-time physical activity

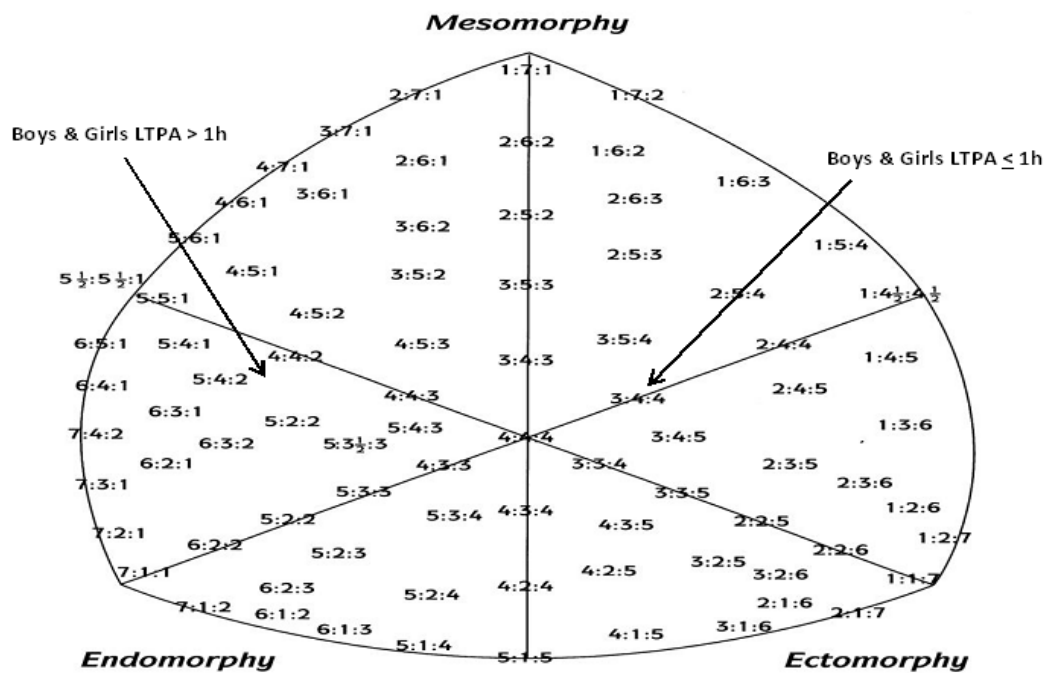
	LTPA > 1 h	LTPA ≤ 1 h	LTPA > 1 h vs. LTPA ≤ 1 h			Partial η^2
	Mean ± SD	Mean ± SD	Wilk's λ	F value	P	
Boys	n = 214	n = 257				
BMI (kg/m ²)	16.97 2.54	15.58 2.20	-	39.99	<0.001	
WC (cm)	47.02 3.90	46.49 3.92	-	13.13	<0.001	
Body fat (%)	22.10 1.84	19.31 2.82	-	154.27	<0.001	
Endomorphy	4.90 0.92	2.74 0.62	-	957.58	<0.001	
Mesomorphy	4.57 1.27	4.17 1.43	-	17.69	<0.001	
Ectomorphy	2.54 1.26	4.18 1.52	-	157.27	<0.001	
Somatotype*			0.318		<0.001	0.682
Girls	n = 214	n = 203				
BMI (kg/m ²)	16.80 2.65	16.08 2.68	-	7.28	0.007	
WC (cm)	46.77 3.97	46.75 3.86	-	8.11	0.005	
Body fat (%)	22.74 2.08	20.82 2.90	-	59.59	<0.001	
Endomorphy	4.98 1.00	2.86 0.58	-	797.76	<0.001	
Mesomorphy	4.85 1.20	4.64 1.16	-	5.00	0.026	
Ectomorphy	2.73 1.42	4.13 1.78	-	75.57	<0.001	
Somatotype*			0.334		<0.001	0.666

*Statistical differences in overall somatotype tested by MANCOVA, with age as the covariate; differences in BMI (body mass index), WC (waist circumference), body fat, somatotype components determined by ANCOVA, with age as the covariate; LTPA – leisure time physical activity, SD – standard deviation, p – probability, and η^2 is the partial eta squared value explaining the effect size

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The somatochart with mean somatotype of both the groups are illustrated in Figure 1. It clearly indicates that children with LTPA > 1h had developed more endomorphic physique – a sign of relative fatness whereas, children under LTA ≤ 1h group had more ectomorphic physique – a sign of leanness.

Figure 1: Somatochart with mean somatotype among children by leisure-time physical activity



Value of X coordinate = Ectomorphy – Endomorphy and Value of Y coordinate = 2x Mesomorphy – (Endomorphy – Ectomorphy)

DISCUSSION

Sedentary behaviour and leisure time physical inactivity are the most leading modifiable risk factors for poor cardiovascular health and all-cause mortality worldwide (Lavie et al., 2019). Regular physical activity helps children improve cardiorespiratory fitness, control weight, build strong bones and muscles, reduce symptoms of depression and anxiety, and reduce the risk of heart disease, high blood pressure, obesity, diabetes (CDC, 2020) etc. by the time they become adult. Adapting sedentary lifestyle during early childhood has stronger modifying

effect on later activity patterns. Whereas, participation in physical activity on regular basis has been shown to be beneficial to cardiovascular health and reduce CVD mortality (Salonen et al., 1988). In a study it was found that children who were physically active had a lower risk factor score for CVD than their counterparts who had less physical activity. Significant association between low levels of activity and high composite risk factors of CVD in children were mostly driven by body fat composition (Tanha et al., 2011). Active participation in school sports and physical activity during childhood and adolescence promote more active lifestyles with health benefits in adulthood (Powell et al., 1987). In a nation-wide survey in Germany, it was found that children with congenital heart diseases (CHD) had markedly reduced physical activity (Siaplaouras et al., 2020). Development of metabolic disease manifesting in adulthood usually starts in early childhood. Child hood obesity and sedentary lifestyle are known to represent major contributing factors (Olsen et al., 2017). Adiposity measures like BMI and particularly greater WC also indicates the risk of developing cardiovascular disease (Czeczewski et al., 2020) and children in the present study were found have significant different with respect to PTPA, irrespective of boys and girls.

Children across the globe, now-a-days are spending most of their leisure time indoors with less or no physical activity at all, as compared to the past. They are spending more time in watching television, surfing internet and smart phones, and playing video games, which hardly require any physical activity. The World Health Organization has recommended recommends to perform at least 60 minutes of moderate to vigorous-intensity physical activity on regular basis, for children which include playing games, cycling, walking, sports, and physical education (WHO, 2021). However, globally only one in five children is estimated to meet the guidelines. The transition from childhood to adulthood is a developmentally sensitive time during which if adopted sedentary behaviour, may lead to overweight, which last further into later adulthood and perhaps making them more vulnerable to lifestyle-driven co-morbidities (Anderson & Butcher, 2006) than children with physically active behaviour.

Asian Indians are more susceptible to chronic disease (McKeigue et al., 1991; Mohan, 2004) including the children (Mohan et al., 2007). In the present study we focused on leisure time activity instead of only physical activity. That is, time spent on those activities that either demands very less physical activity or no physical activity at all. It was found that children

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spending LTPA > 1 hour have had significantly higher endomorphy which is a poor sign of cardiovascular health than their counterparts, and it could eventually put them at risk to CVD risk during their early adulthood. The study reports that children spending leisure time more on such activities that requires either very less no physical activity at all have had statistically significant higher endomorphy and lower ectomorphy as compare to their counterparts. Increase in high relative adiposity/fat mass therefore seems to be a major public health threat for even for children. As the health consequences do persist into adulthood, this perhaps increases the susceptibility towards greater risk of metabolic syndrome, CVD, and diabetes later in adulthood (Yeung et al., 2010). It is quite ascertained that how one spends leisure time during his/her childhood (whether physically inactive or active) does affect the behavioural development of chronic diseases later in adulthood. Longer duration of LTPA was found to be significantly associated with poor cardiovascular health and marked endomorphy has been found to be associated with such co-morbidities (Buffa et al., 2007). Therefore, physical activity perhaps mediated through habitual practice of sedentary behaviour during childhood, seems to be an independent risk factor to develop diabetes, and CVD later in adulthood.

Limitations

The sample size is small and only representing the Bengali Hindu children living in Kolkata hence it is not a true representative of the Asian Indians. Such studies with larger sample size from other ethnic communities of our country would give better insight into this public health issue.

CONCLUSION

The present population-based study confirms that children (below 10 years) who were spending long hours of leisure-time with no or limited physical activity had adverse cardiovascular health as manifested through somatotypes. Children spending more leisure time had significantly higher endomorphy than their counter, irrespective of sex. This could severely affect their cardiovascular health by the time they reach adulthood and could become more susceptible to chronic diseases. Hence, early intervention of physical activity level and its promotion among the children is of utmost importance for withstanding against the future threat of CVD risk among them.

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Conflict of Interest

The authors declare that they do not have any conflicts of interest among them.

Ethical Considerations

The protocol of the present study was approved by the Institutional Ethics Committee of the West Bengal State University, Kolkata, India following the guidelines as laid down by the Indian Council of Medical Research and it in accordance with the Declaration of Helsinki for protection of human subjects. Written consent was obtained from all participants with due permission form their parents or class teachers, prior to the commencement of the study.

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Authors Contribution

Puja Pathak did the necessary field work, data collection, verification and data entry. Anup Adhikary provided necessary instrumental support and somatotype calculation. Mithun Das primarily designed the study, necessary statistical analyses, and writing of the manuscript.

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