Association between Family History of Chronic Diseases and Endomorphic Somatotype among the Bengali Hindu Children and Adolescents of Kolkata, India

Puja Pathak[1], Anup Adhikari[2]*, Mithun Das[3]

[1]Research Scholar, Department of Anthropology, West Bengal State University, Kolkata, India.

[2]Anthropometrist & Kinesiologist, Anthropometrica, Toronto, Ontario, Canada.

[3]Associate Professor & Head, Department of Anthropology & Tribal Studies, Sidho-Kanho-Birsha University, Purulia, WB, India

*Corresponding author: Email – dranupadhikari@yahoo.com

ABSTRACT

Objectives: Children with family history of chronic diseases like diabetes, cardiovascular disease, hypertension, dyslipidaemia along with adoption of less physical activity increases the susceptibility of the diseases in adult life among them later. The present study examined the effect of family history of chronic disease (FHD) on somatotype among the Bengali Hindu children and adolescents. **Material and Methods**: A total of 2267 Bengali Hindu children (including 471 boys and 417 girls of age 5-9 years) and adolescents (including 688 boys and 691 girls of age 10-17 years) living in the northern part of Kolkata, India from low-to-middle socio-economic strata were studied. Anthropometric measures and body composition were calculated using standard techniques. Somatotype was calculated following Heath-Carter method. All participants were classified in to two groups viz., 1- FHD+ (with family history), and 2- FHD- (without family history). **Results:** The analysis of covariance (ANCOVA) test with age as covariate showed that children and adolescents having FHD+ had significantly higher ($p<0.001$) endomorphy (indicator of relative fatness), and significantly lower ($p<0.001$) ectomorphy (indicator of relative linearity), than their counterparts, irrespective of age and sex. **Discussion:** Family history of chronic disease adversely affecting the cardiovascular health as reflected through poor somatotype scale. **Conclusion:** Children and adolescents with positive family history of chronic diseases are becoming more endomorphic-sign of fatness than their counterparts. Early screening and health protocol is urgently needed to avoid chronic disease burden among the younger generation.

KEYWORDS: Family history, endomorphic, somatotype, children, adolescent, Bengali, Asian Indian

INTRODUCTION

Most of the common chronic diseases like cardiovascular disease (CVD), type 2 diabetes, dyslipidaemia, hypertension, metabolic syndrome etc., are the result of interactions between multiple genetic variants and environmental factors. Genetic susceptibility, shared environment and common behaviour are the consequences that reflect through family history of chronic diseases. (Yoon et al., 2002). Family history of chronic diseases (FHD) by itself is the most useful for predicting disease when the relationship among relatives is close, there are multiple family members affected, and disease is premature, i.e., it occurs at younger ages than would be expected (Yoon et al., 2002). However, collection and interpretation of FHD has been rarely applied in the field of preventive medicine to influence early detection and assess disease risk, and preventive strategies (Scheuner et al., 1997; Williams et al., 2001). The present study was therefore aimed to evaluate the effect FHD on somatotype and cardiovascular health among the Bengali Hindu boys and girls living in Kolkata, India.

MATERIALS AND METHODS

Study population

A total of 2267 Bengali Hindu school-going children (including 471 boys and 417 girls of age 5-9 years) and adolescent (including 688 boys and 691 girls of age 10-17 years) were studied belonging to low-to-middle socio-economic status. The children were from primary school (class I-IV) and adolescent from high school (class V-XII) living in the northern part of Kolkata, India. The protocol of the present study was approved by the Institutional Ethics Committee of the West Bengal State University, Kolkata. Written consent was obtained from all participants with due permission form their parents or class teachers, prior to the commencement of the study.

Anthropometric measures, body composition, and somatotype

Height (in cm), weight (in kg), and waist circumference (in cm) were measure following standard techniques (Lohman et al., 1988) as well as skinfolds including triceps, sub-scapular, supraspinale and calf were measured using Slim guide skinfold caliper (CESCORF, Brazil). Somatotype was calculated as per Health-Carter somatotype method (Carter & Heath, 1991). Accordingly the three somatotypes representing the physique were calculated viz., 1) ectomorphy –relative linearity of a physique, 2) mesomorphy – denotes musculoskeletal robustness, and 3) endomorphy - the level of fatness.

Family history of Chronic Disease (FHD)

FHD was obtained from each participant through questionnaire filled by their respective parents which include CVD, diabetes, hypertension, dyslipidaemia, and or currently under medication. According to the information the FHD was classified in to two groups: 1- FHD+ and 2- FHD-.

Statistical analyses

Mean differences in adiposity, body composition and somatotype between two groups between viz., 1 – with family history (FHD+), and 2- without family history (FHD-) were determined by analyses of covariance (ANCOVA) with age as covariate, separately for boys and girls. The means of the somatotypes of both the groups were plotted in the somatochart using X and Y co-ordinates following standard equation. 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 and adolescents falling under the two categories by age and sex are given in Table I. The descriptive and inferential statistics of the children (5-9 years) are given in Table II. The ANCOVA test with age as covariate, showed that there exist a statistically significant difference in mean BMI, % body fat, and somatotypes among both boys and girls of FHD+ as compare to their counterparts, FHD-. Similarly, among adolescents (10-17 years.) there also exist a statistically significant difference in mean, % body fat ($p<0.001$), endomorphy ($p<0.001$), mesomorphy ($p=0.026$), and ectomorphy ($p<0.001$) between the groups as shown in Table III. The ANCOVA test also resulted that children adolescents with family history had significantly higher ($p<0.001$) mean endomorphy, and significantly lower mean ectomorphy ($p<0.001$), than their counterparts without having family history, irrespective of sex.

Table I: Frequency of family history of chronic disease by Age and Sex

	Males		Females	
Age (years)	FHD+	FHD-	FHD+	FHD-
5	49	43	43	50
6	49	44	35	55
7	28	67	26	37
8	33	58	31	44
9	35	65	45	51
10	35	56	35	56
11	31	45	35	42
12	31	39	36	39
13	33	46	36	40
14	45	48	44	49
15	48	47	41	54
16	30	61	28	63
17	43	50	42	51
Total	490	669	477	631

FHD+ : with family history, FH- : without family history

Table II: Descriptive and inferential statistics of the children by family history

CHILDREN (5-9 YEARS)	FHD+ MEAN (± SD)	FHD- MEAN (± SD)	F value	P
MALES (n=471)	**(n=194)**	**(n=277)**		
BMI (kg/m^2)	16.71 (2.48)	15.86 (2.38)	14.12	<0.001
WC (cm)	46.68 (3.78)	46.76 (4.00)	0.054	0.816
Body fat (%)	21.49 (2.14)	19.95 (3.02)	37.28	<0.001
Endomorphy	4.52 (1.28)	3.17 (1.03)	161.05	<0.001
Mesomorphy	4.27 (1.33)	4.40 (1.41)	1.02	0.313
Ectomorphy	2.62 (1.34)	4.01 (1.37)	102.78	<0.001
FEMALES (417)	**(n=180)**	**(n=237)**		
BMI (kg/m^2)	16.90 (2.88)	16.11 (2.48)	9.08	0.003
WC (cm)	47.15 (3.95)	46.47 (3.86)	3.09	0.080
Body fat (%)	22.51 (2.31)	21.27 (2.84)	22.77	<0.001
Endomorphy	4.74 (0.92)	3.35 (0.92)	148.62	<0.001
Mesomorphy	4.55 (1.24)	4.90 (1.12)	8.93	0.003
Ectomorphy	2.89 (1.48)	3.81 (1.84)	30.57	<0.001

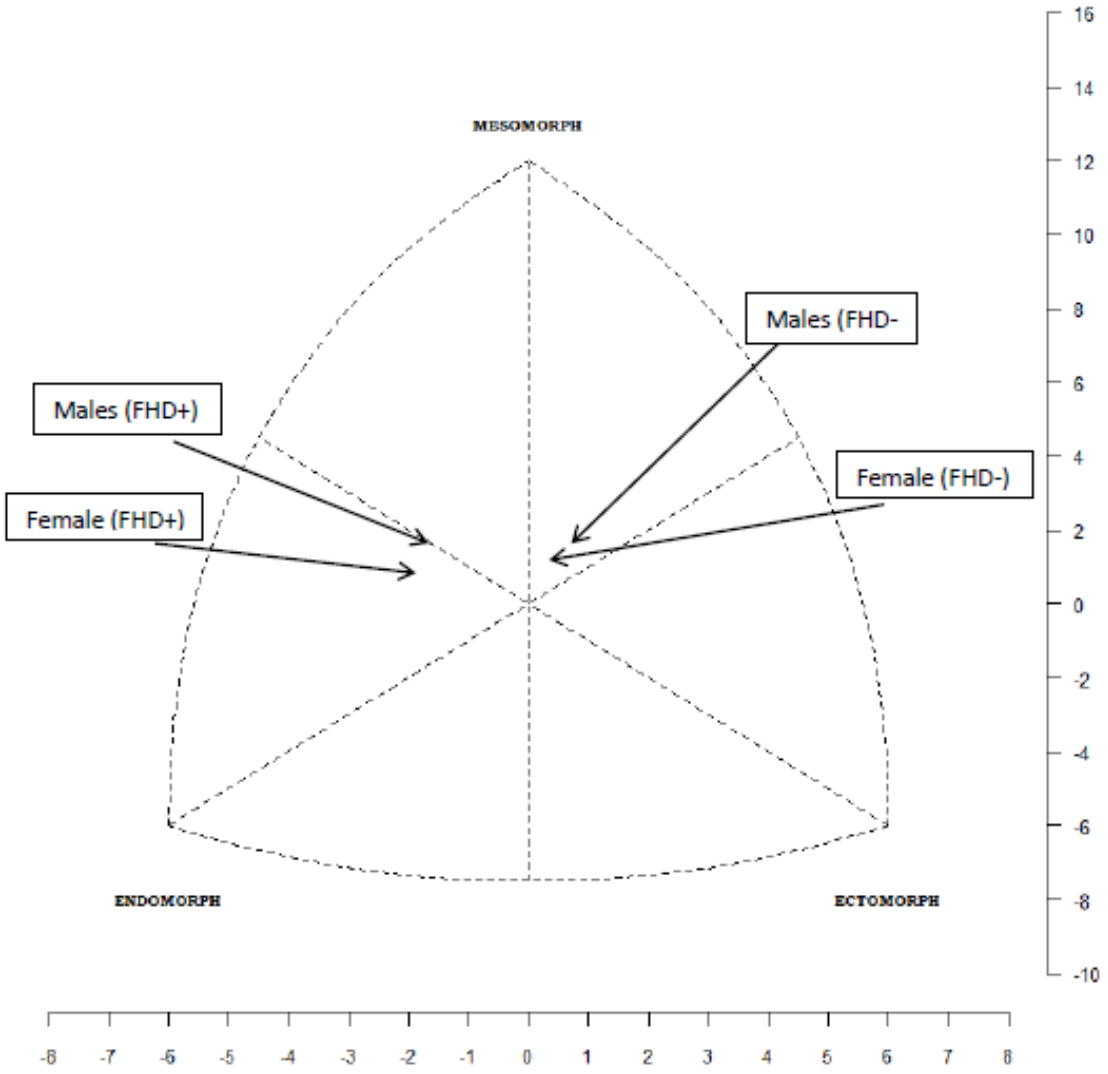
Table III. Descriptive and inferential statistics of the adolescents by family history

ADOLESCENT (10-17 YEARS)	FHD+ MEAN (± SD)	FHD- MEAN (± SD)	F value	P
MALES (n=688)	**(n=296)**	**(n=392)**		
BMI (kg/m^2)	20.10 (4.25)	18.69 (3.81)	20.88	<0.001
WC (cm)	68.76 (9.32)	67.70 (9.98)	2.01	0.156
Body fat (%)	28.54 (5.04)	25.38 (5.32)	62.49	<0.001
Endomorphy	5.52 (1.61)	3.27 (1.27)	415.26	<0.001
Mesomorphy	4.14 (1.42)	4.25 (1.54)	0.98	0.322
Ectomorphy	3.11 (1.23)	4.43 (1.35)	174.98	<0.001
FEMALES (691)	**(n=297)**	**(n=394)**		
BMI (kg/m^2)	19.41 (3.63)	18.91 (3.23)	3.67	0.056
WC (cm)	68.32 (9.62)	68.09 (9.82)	0.092	0.761
Body fat (%)	29.24 (5.25)	26.93 (5.51)	30.01	<0.001
Endomorphy	5.19 (1.48)	3.32 (1.14)	353.49	<0.001
Mesomorphy	4.22 (1.38)	4.41 (1.52)	2.85	0.092
Ectomorphy	3.19 (1.39)	4.29 (1.60)	88.83	<0.001

*statistical differences in BMI (body mass index), WC (waist circumference), body fat, somatotype components determined by ANCOVA, with age as the covariate; FHD – Family history of chronic diseases, SD – standard deviation, and p – probability.

The somatochart of children and adolescents with mean somatotype of the groups are illustrated in Figure 1 and 2 respectively. It clearly indicates that children with FHD+ had developed more endomorphic physique – a sign of relative fatness than children without FHD- who had more ectomorphic physique – a sign of leanness.

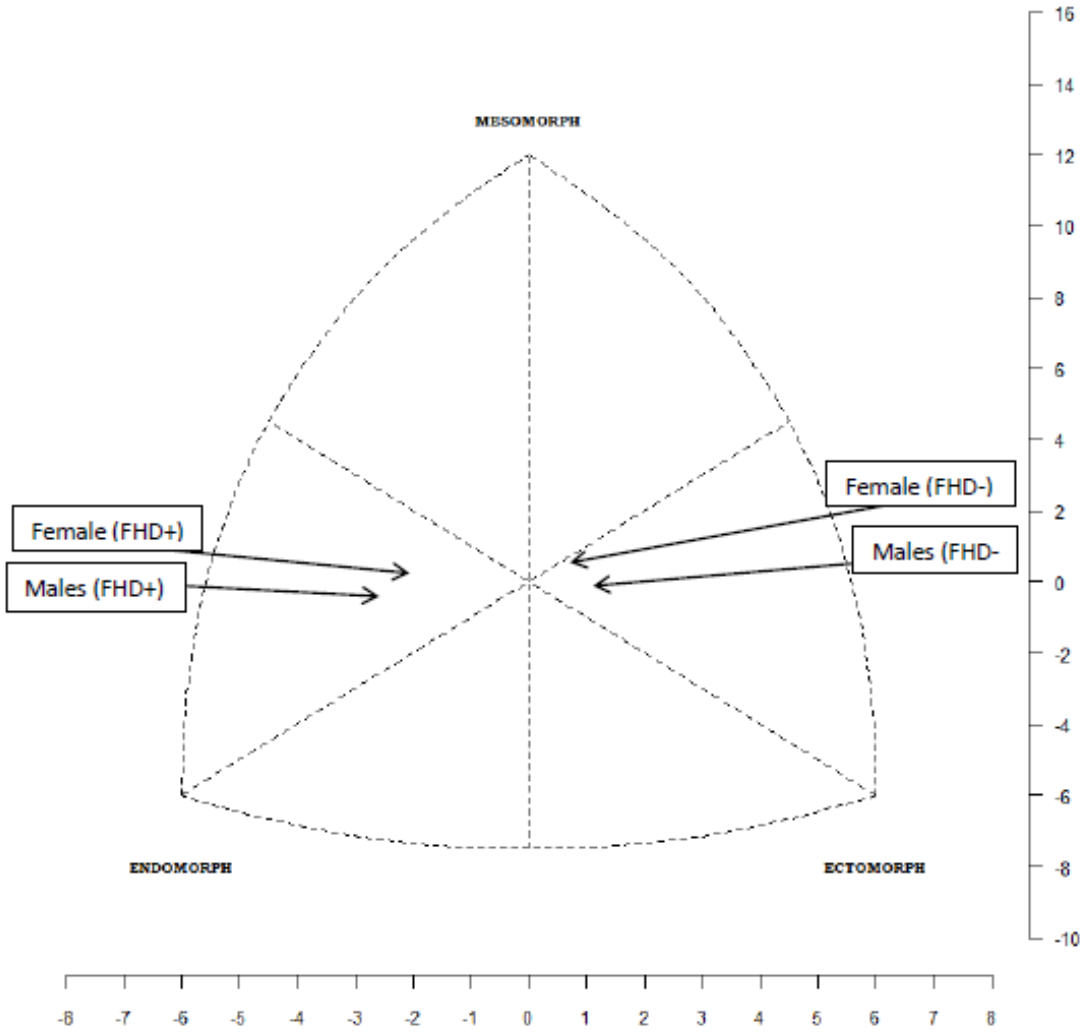
Figure 1: Somatochart of the children by family history of chronic diseases



DISCUSSION

FHD is not only a risk factor for the disease but is also positively associated with risk awareness and risk-reducing behaviours. It provides a useful screening tool for detection and preventions of such chronic diseases (Hariri et al., 2006). In a study among the US population, family history of diabetes showed significant, independent, and graded association with the prevalence of diabetes (Valdez et al., 2007a). In another study in US adults without diabetes, family history of diabetes showed significant and independent association with metabolic syndrome and its trait (Ghosh et al., 2010). In an another study it was found that not only adults, but even the youths with FHD+ showed signs of increased risk for the chronic conditions which indicates the importance of family history approach to screening among children at risk of chronic diseases (Valdez et al., 2007b).

Figure 2: Somatochart of the adolescents by family history of chronic diseases



In clinical medicine, family history has been recognized as an important, yet non-modifiable disease risk factor that when present the probability of a suspected diagnosis might get influenced. FHD increases its salience and does not change one's perceived ability to prevent the disease (Acheson et al., 2010). Raising awareness of personal health is crucial to ensure the utility of family history for the assessment of risk and disease prevention (Janssens et al., 2012). The present study was therefore undertaken to find out effect of FHD on somatorype and cardiovascular health among the Bengali children and adolescent. It was found that children and adolescent with FHD+ had significantly higher BMI, % body fat, and endomorphy- a sign of relative fatness than those without FHD-. Conversely, children and adolescent having FHD- had significantly higher Ectomorphy – a sing of leanness than their counterparts, irrespective of sex. This shows that children and adolescent with FHD+ are developing more fat mass and less muscle mass indicating a poor cardiovascular health. FHD+ is disrupts the adiposity and body composition that could

lead to greater susceptibility of chronic diseases among them by the time they attain adulthood. Since, the health consequences do persist into adulthood it therefore increases the susceptibility towards greater risk of metabolic syndrome, CVD, and diabetes later in adulthood (Yeung et al., 2010) among them who already have a positive family history of such chronic diseases, and poor cardiovascular health and marked endomorphy has been found to be associated with such co-morbidities (Buffa et al., 2007).

.CONCLUSION

The present population-based study confirms that both children (5-9 years) and adolescents (10-17 years) family FHD+ had adverse cardiovascular health as manifested through somatotypes than their counterparts (FHD-), irrespective of sex. This could severely affect their cardiovascular health by the time they reach adulthood, and could become more susceptible to such chronic diseases. Hence, early screening, detecting, and management are essential overcome the future threat of chronic diseases.

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CONFLICT OF INTEREST

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

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REFERENCES

Acheson LS, Wang C, Zyzanski SJ, Lynn A, Ruffin MT, Gramling R, et al., (2010). Family history and perceptions about risk and prevention for chronic diseases in primary care: A report from the family healthcare impact trial. *Genet Med*; 12: 212-218.

Buffa, R.G., Floris, P.F. & Carboni, L. (2007). Somatotype in elderly type 2 diabetes patients. *Collegium Antropologicum*, 31, 733-737.

Carter, L. & Heath, B. (1991). *Somatotyping development and applications*. Cambridge University Press, Cambridge.

Ghosh A, Liu T, Khoury MJ, Valdez R (2010). Family history of diabetes and prevalence of the metabolic syndrome in US adults without diabetes: 6-year results from the National Health and Nutrition Examination Survey (1999-2004). *Public Health Genomics*; 13: 353-359.

Hariri S, Yoon PW, Qureshi N, Valdez R, Scheuner MT, Khoury MJ (2006). Family history of type 2 diabetes: a population-based screening tool for prevention? *Genet Med*; 8: 102-108.

Janssens AC, Henneman I, Detmar SB, Khoury MJ, Steyerberg EW, Eijkemans MJ, et al., (2012). Accuracy of self-reported family history is strongly influenced by the accuracy of self-reported personal health status of relative. *J Clin Epidemiol*; 65: 82-89.

Lohman, T.G., Roche, A.F. a& Martorell, R. (1988). *Anthropometric standardization reference manual*. Champaign, Illinois, Human Kinetics Books.

Scheuner MT, Wang SJ, Raffel LJ, Larabell SK, Rotter JI (1997). Family history: a comprehensive genetic risk assessment method for the chronic conditions of adulthood. *Am J Med Genet*; 71: 315-324.

Valdez R, Yoon PW, Liu T, Khoury MJ (2007a). Family history and prevalence of diabetes in the U.S. population: the 6-year results from the National Health and Nutrition Examination Survey (1999-2004). *Diabetes Care*; 30: 2517-2522.

Valdez R, Greenlund KJ, Khoury MJ, Yoon PW (2007b). Is family history a useful tool for detecting children at risk for diabetes and cardiovascular diseases? A public health perspective. *Pediatrics* 2007; 120 Suppl 2: S78-S86.

Valdez R, Yoon PW, Qureshi N, Green RF, Khoury MJ. (2010). Family history in public health practice: a genomic tool for disease prevention and health promotion. *Ann Rev Public Health*; 31: 69-87.

Williams RR, Hunt SX, Heiss G, Province MA, Bensen JT, Higgins M, et al., (2001). Usefulness of cardiovascular family history data for population based preventive medicine and medical research. *Am J Cardiol*; 87: 129-135.

Yeung, E.H., Willett, W.C., Zhang, C., Germaine, M., Willett, W.C. & Hu, F.B. (2010). Childhood size and life course weight characteristics in association with the risk of incident type 2 diabetes. *Diabetes Care*, 33, 1364-1369.

Yoon PW, Scheuner MT, Peterson-Oehlke KL, Gwinn M, Faucett A, Khoury MJ. (2002). Can family history be used as a tool for public health and preventive medicine. *Genet Med*; 4: 304-310.