Original Article

RELATION BETWEEN FAMILY HISTORY, OBESITY AND RISK FOR DIABETES & HEART DISEASE IN PAKISTANI CHILDREN

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ABSTRACT

Objective: To assess the differences in relative risk of developing diabetes and CHD, obesity, fasting blood glucose, insulin and lipids of children having family history of diabetes or heart disease in first or second degree relatives as compared to control group.

Design: Children were given a questionnaire to collect demographic data and to assess their dietary habits and family history. Anthropometric measurements and blood samples for fasting blood glucose, insulin and lipids of 8-10 years old children from 4 schools was taken.

Setting: The samples of ninety-nine children were obtained to assess fasting blood glucose, insulin and lipids of children.

Subjects: Children having positive family history of diabetes (n=44) or heart disease (n=16) in first or second degree relatives were compared with a control group (n=39).

Results: Children having positive family history for diabetes had slightly higher mean values for BMI, waist circumference, arm fat % as compared to the controls but the differences were not statistically significant. Overweight children (>85th Percentile of BMI for age) did not differ significantly in terms of various risk indicators however those who were in the uppermost tertile of arm fat % had significantly higher total Cholesterol, Triglycerides, LDL-C, LDL:HDL and Insulin levels ($P<0.05$ in each case).

Conclusion: Diabetes and CVD risks from positive family history for the disease are probably mediated through increased body fat percentage. Thus even when information about family history of disease is lacking, arm-fat-percentage could be used as an important screening tool for determining the risk status of children.

KEYWORDS: Family history, obesity, diabetes, heart disease

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INTRODUCTION

Diabetes and heart disease are found to be highly prevalent in urban areas of Pakistan[1]. Genetic pre-disposition is considered to be a primary cause. Family history is found to be associated with the incidence of diabetes[2] and heart disease[3] among adults. It has been known for several decades now that hyper-cholesterolemia could be identified at an early age. Reduction in cholesterol helps in reducing risk of developing heart disease in later life and thus screening is often recommended[4]. More recently with the emergence of type 2 diabetes in children, suggestions for screening of children for hyper-insulinemia are also made.[5,6] In

Pakistan also, it would be justified to focus on high risk groups like children having family history of diabetes or heart disease if they are found to have higher than average risk for the development of these disorders.

Objective:

1. To study the association between biochemical parameters and obesity indicators in children with and without family history of Diabetes and Coronary Heart Disease.

SUBJECTS AND METHODS

Design:

This was a cross sectional comparative study of three groups of children having

1) family history of diabetes with or without heart disease,
2) family history of heart disease without diabetes,
3) No family history of diabetes or heart disease (control).

Subjects:

Data was collected from school children in Karachi from October 2001 to May 2002. After getting informed consent from the parents, 132 children (n=44 in each group) were to be recruited from primary schools in Karachi, Pakistan. Ethical approval for the study was obtained from the departmental ethical review board.

A total of ninety nine 8-10 year old school children were finally selected from four primary schools of Karachi Pakistan for the main study. In each school the selection was done in two phases; initially in the first phase, all the children of corresponding age were screened for birth-weight, their own health history, family history of relevant diseases, and current body weight status. The children needed in each group according to the family history were selected and the purpose and procedures of the study was explained and all the eligible children were invited to participate in the second phase of the study. If the children were willing then letters for participation in the study were sent to parents in batches. A total of 333 children took part in this study out of which 158 children were selected on the basis of family history. Out of these 63% (n=99) were willing to have the blood tests done.

Data collection:

Anthropometric measurements

Anthropometric measurements (height, weight, waist, hip and skin-folds), blood pressure measurement and blood samples were taken in school by a team of medical professionals from BIDE.

Height was measured with a portable stadiometer following standard procedures[7]. Portable weighing scale was used for weighing. All the subjects were weighed without shoes in single layer of indoor clothing. Holtain skinfold calipers was used for measuring skinfold thickness over triceps[7]. Mid-arm circumference was measured by holding measuring tape around mid point between the shoulder and elbow. Waist circumference was measured by holding the non-stretchable measuring tape snugly around the waist at the midpoint between the bottom rib and tip of hipbone. Hip circumference was measured at the fullest part of the hips.

Blood test:

Blood sample was collected in schools and transported to laboratory for analysis within 30 minutes in appropriate containers (Sodium fluoride tubes for Glucose while other sample in plain test tube for serum analysis). Prior to blood testing, the fasting status confirmation sheet, signed by parents was received and subjects were also asked whether they had eaten or drank anything that morning. A doctor and a school teacher were present during the entire proceedings. Breakfast was provided to all the children who came fasting. Blood was analyzed for fasting blood glucose, fasting insulin levels, total lipids, cholesterol, tri-glycerides, LDL & HDL.

Diet and activity:

All the participating children also filled a questionnaire about their usual diet and activ-

ity pattern. Data from diet and activity questionnaire was used to compare food consumption and activity pattern of children.

Data entry and analysis:

Data was entered and analyzed on SPSS 7.5. Data was weighted for sex. ANOVA was used for estimating statistical significance of differences in means of continuous variables. Correlation in continuous variables was assessed by Spearman's regression analysis. Significance of differences in categorical variables was assessed using chi-square test.

RESULTS

The data was planned to be collected from 44 children from each of the three groups namely: the controls with no family history for diabetes or heart disease (Group-A), those having family history of diabetes (Group-B); those having family history of heart disease but not diabetes (Group-C). However due to difficulty in finding children having positive family history for heart disease without diabetes only 16 children could be recruited in this group. In other groups also parental reluctance to allow their children to participate in the study was a hindrance. The resulting sample consisted of 39 controls, 44 children with family history of diabetes and 16 with family history of heart disease. The children from the three groups did not have any statistically significant differences in mean ages and birth weights.

Family history for diabetes or heart disease and Biochemical parameters of children

Mean values for total cholesterol, triglycerides, HDL-C, LDL-C, LDL:HDL are given in table-II. In group B (those with family history of diabetes) the mean values for HDL were lower and LDL values were higher as compared to the other group (A&C). Children

Table-I: Age sex and birth weight of children

		Family History					
		Group-A None		*Group-B Diabetes*		*Group-C CVD*	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*
AGE (YR)	Mean	9.94	9.50	9.56	9.70	9.67	9.50
	SD	0.85	0.86	0.51	0.70	0.82	0.53
	n	19	20	20	24	8	8
Birth weight (pound)	Mean	6.96	7.38	7.05	6.97	7.30	6.46
	SD	1.66	1.27	1.13	1.24	0.67	1.46
	n	19	20	20	24	8	8

Table-II: Mean values for indicators of dyslipedemia according to family history

	Group-A Control		*Group-B Diabetes*		*Group-C CVD*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
T. Lipids	630.8	(52.1)	608.9	(68.3)	612.6	(51.2)
T. Cholesterol	167.1	(15.7)	170.7	(20.5)	166.2	(14.2)
Triglycerides*P (0.001)	95.8	(22.3)	82.9	(18.2)	89.5	(18.0)
HDL* n-d (P= 0.043)	44.1	(5.7)	42.1	(5.4)	43.9	(4.8)
LDL* n-d (P= 0.019)	103.8	(18.1)	111.7	(19.0)	104.1	(15.5)
LDL:HDL * n-d (p=0.009)	2.4	(0.6)	2.7	(0.7)	2.4	(0.6)

from the control group had significantly higher mean value for triglycerides. Mean values for FBS and fasting insulin are given in table-III. Mean values for Fasting Plasma Glucose were significantly higher among those having family history for Cardiovascular disease. Mean insulin value was also markedly higher among this group but the difference did not reach statistical significance. Mean values for BMI, waist circumference, waist-hip ratio, mid arm circumference, skinfold thickness and arm fat percentage are given in table-IV. The group with family history for diabetes had the highest mean values for BMI, waist-circumference, mid-arm-circumference, skin-fold-thickness and arm-fat-percentage. However the difference between the three groups reached statistical significance only for Body Mass Index.

Associations between biochemical parameters and obesity indicators

Body Mass Index (BMI), Waist, Mid Arm Circumference (MAC), Subcutaneous Fat Tissue (SFT), Arm-fat-% had significant positive correlation ($P<0.05$ in each case) with fasting insulin levels. SFT and Arm-fat-% had significant positive correlation with total cholesterol, LDL and LDL:HDL ratio. Arm-fat-% had significant positive correlation with Total lipids also (table-V). Thus arm-fat-% correlated with the largest

Table-III: Mean values for indicators of glycemic control according to family history

	Group-A Control		*Group-B Diabetes*		*Group-C CVD*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
FBG* d-h (p=0.031)	69.0	(8.9)	67.4	(8.5)	72.0	(7.7)
INSULIN	6.1	(2.7)	6.0	(3.7)	6.5	(2.7)

Table-IV: Mean values for obesity indicators according to family history

	Group-A Control		*Group-B Diabetes*		*Group-C CVD*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
BMI* d-c,h P	15.2	(2.3)	16.1	(3.2)	14.3	(2.0)
WAIST (cm)	55.0	(12.6)	56.3	(10.2)	55.8	(9.6)
WHR	0.9	(0.0)	0.8	(0.1)	0.8	(0.1)
MAC (cm)	18.3	(2.1)	18.7	(3.4)	18.3	(2.7)
SFT (mm)	10.7	(3.8)	11.7	(5.4)	10.6	(4.0)
ARM FAT (%)	36.2	(10.0)	38.4	(11.9)	35.6	(8.9)

Table-V: Correlation (Pearson) between obesity indicators and insulin

	BMI		*WAIST*		*MAC*		*SFT*		*ARMFAT*	
	r	*P*	*r*	*P*	*r*	*P*	*r*	*P*	*r*	*P*
T. Lipids	0.038	ns	0.028	ns	-0.001	ns	0.143	ns	0.236	0.005
CHOL	0.083	ns	0.043	ns	0.083	ns	0.191	0.023	0.246	0.003
LDL	0.112	ns	0.080	ns	0.097	ns	0.191	0.022	0.230	0.006
LDL:HDL	0.117	ns	0.100	ns	0.064	ns	0.160	0.058	0.200	0.018
INSULIN	0.210	0.012	0.231	0.006	0.271	0.001	0.329	0.000	0.285	0.001

Table-VI: Mean values for indicators of physical activity level according to family history

	Group-A Control		*Group-B Diabetes*		*Group-C CVD*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Weekly Reading Hours	14.8	(6.8)	14.8	(8.2)	17.1	(8.6)
Weekly Watching Hours	12.6	(6.5)	15.8	(12.3)	11.2	(7.5)
Weekly Running Hours	8.6	(4.4)	7.2	(4.7)	6.6	(4.4)

Table-VII: Food habits (mean frequency per week) according to family history

	Group-A Control		*Group-B Diabetes*		*Group-C CVD*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Fruit & Vegetables	11.3	(2.5)	10.9	(2.0)	11.3	(1.6)
Meat & egg*	8.9	(1.4)	9.7	(1.4)	9.1	(1.6)
Bread & Cereal*	12.9	(1.6)	13.0	(1.7)	14.6	(1.3)
Fried Food	2.9	(0.7)	2.8	(0.7)	2.6	(0.9)
Milk & its products	3.3	(0.9)	3.4	(0.9)	3.9	(0.5)
Sweet food	3.1	(0.8)	3.3	(0.7)	2.9	(0.6)

* P value <0.01

number of risk parameters. Triglycerides, HDL and FBS did not have any significant association with any of the parameters of obesity. Waist- hip-ratio also did not have any significant association with blood lipids, sugar or insulin. In terms of mean values those children who were in the uppermost tertile of arm fat % also had significantly higher T. Cholesterol, TG, LDL-C, LDL:HDL and fasting insulin levels (P<0.05 in each case).

Family history for diabetes or heart disease and life style of children

Physical activity habits and food habits of children were also compared. Children who had a family history of diabetes and heart disease on an average spent more time in sedentary activities and less in running games as compared to controls; but none of these difference reached statistical significance (table-VI). Children with family history of diabetes ate meat and egg more frequently and those with family history of CVD ate bread and cereals more frequently (P<.01 in each case) as compared to the controls (table-VII).

DISCUSSION

Several studies have been done to discern the impact of family history of disease on the lipid profiles, glucose and insulin levels of children. In these studies although family history was found to be a strong predictor of the risk, observations were found to vary with age, sex and environmental factors[3-4,8-17]. In one such large prospective study, associations were found to change with age and it was concluded by authors that "Parental history is an important surrogate measure for cardiovascular risk in the offspring. However, parental history information alone is not sufficient to designate younger children for selective screening for high cholesterol, because of the young age of children"[18]. In another comprehensive study of children with family history of coronary artery disease; seven of the nine intermediate

traits evident suggested significant mean differences between children with and without a strong family history of CAD in particular age and BMI subgroups in nonsmokers that were not expected given the results from separate age-dependent or BMI-dependent marginal analyses. From these analyses, authors concluded that the study documented the complexity of the associations between intermediate traits and risk of CAD[19]. Studies in Canadian Inuit suggest that environmental factors can override an apparently high level of genetic susceptibility to CHD[20].

The results of our study shows that blood lipid and glucose levels of children are likely to differ according to their family history for diabetes and heart disease. Furthermore parental history for diabetes also increases the likelihood of developing obesity in children. However it could not be ascertained without further studies whether genetics or life style factors have a relative contribution in the emergence of these differences. Families with or without history of disease may also differ in food and activity habits and children by adoption of these family trends could attain similar biochemical profiles. As diabetes and heart disease are probably two different manifestations of an underlying metabolic derangement, it is possible that the youngsters from families having history for any of the disease have some underlying physical predisposition to develop any of the two disorders. The exact nature and order in which biochemical parameters begin to vary from the norms is probably determined by dietary factors. For example in this study, higher LDL level of the groups of children having family history for diabetes could be attributed to their relatively higher intake of food intake from meat and egg group.

Obesity and particularly higher level of body fat percentage is almost always found to be predictive of higher risk of dyslipidemias and hyperinsulinemia even in childhood and adolescence[8-9,21-23]. In studies where impact of lifestyle interventions has been done the interventions were found to be effective in reducing the risk even in children having positive family history for heart diseases[24]. Thus on the basis of observations made in this study and similar studies done in others countries fatness could be used as a basic screening tool for identifying children having relatively higher risk for developing any metabolic disorder in later life. The general health education programs should aim at increasing physical activity level of children and encouraging balanced diet in all children regardless of bodyweight, fatness or family history. Families with positive history for diabetes or heart disease should be educated to encourage healthy lifestyle in their offspring. Measurement of skin fold thickness needs to be included in regular health assessment of children at school or elsewhere to identify children needing further attention. Further studies need to be done to ascertain accurate associations between arm-fat-%, lipid profile and insulin levels in larger group of children. We need to identify levels of arm fat percentage that indicate the risk level at which interventions are needed in Pakistani children. Development and use of skin fold thickness or arm-fat-% could prove to be an effective screening tool and would hopefully contribute to future health of Pakistani children.

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