

SHORT COMMUNICATION

ANTHROPOMETRIC CHANGES PRECEDE THE CHANGES IN LIPID PROFILE AMONG THE HEALTHY YOUNG INDIVIDUALS WITH FAMILY HISTORY OF TYPE 2 DIABETES MELLITUS

SHOBHA M.V., RAVINDRA P.N.* AND DEEPALI A.

*Department of Physiology,
Sri Siddhartha Medical College and Hospital,
Agalakote, Tumkur – Karnataka – 572 107*

(Received on June 11, 2012)

Abstract : Increase in diabetes mellitus (DM) is a major health concern. Offspring's of subjects with diabetes are known to express various trait characteristics. In the present study, anthropometric and metabolic parameters among healthy offspring's with (cases, n=50) and without (control, n=50) family history of type 2 DM is compared. Anthropometric measurements, fasting blood sugar and lipid profile were estimated. Cases showed significant increase in their anthropometric measurements than controls and they also demonstrated significant increase in total cholesterol, LDL and decreased HDL and HDL/LDL ratio. Cases were further categorized into two subgroups based on BMI (group 1, BMI=21.55±1.7 kg/m², group 2, BMI=29.03±4.3 kg/m²). Groups 2, inspite of showing significant increase in their anthropometric measurements than group1 the lipid profiles were comparable. Thus, demonstrating a temporal dissociation between anthropometric and lipid changes, former preceding the later. Therefore, in younger age group, anthropometric measures could be used for risk stratification and as a metric to evaluate the efficacy of preventive intervention.

Key words : family history
anthropometric variables

type 2 DM
lipid profile

INTRODUCTION

Type 2 Diabetes Mellitus (DM) is an inherited disorder where the lifestyle and environmental factors play an important role in its pathogenesis (1). The incidence of type 2 DM is emerging as a major global health problem, India being major contributor

especially from southern states where 47% population has family history of diabetes (2, 3). The life time risk of developing DM is about 3-5 times in offspring's with single parent and 6 times with both the parents having type 2 DM (4).

Offspring's with family history are known

*Corresponding author : Dr. Ravindra P.N., Associate Professor, Department of Physiology, Sri Siddhartha Medical College and Hospital, Tumkur, Karnataka – 572 107; Contact : 09448934488; Email : ravindrapinna@gmail.com

to be more obese, have increased Body Mass Index (BMI) (5) and the risk of developing type 2 DM increases fourfold with early onset DM (6). However, Indians are known to exhibit a unique 'Asian Indian Phenotype' characteristic with higher central obesity but with lower BMI (2). There is also clustering of cardiovascular risk factors like, dyslipidemia in the offspring with family history of type 2 DM (7). Lipoprotein abnormalities with insulin resistance are commonly reported in this risky group and these lipid abnormalities are demonstrated even before the development of type 2 DM (8).

Most of the studies evaluating the risk among offspring with family history DM were in the age range of 35-40 years and are from the western part of the globe (1, 9) and a very few studies are conducted among Indian young healthy adults (8). But, diabetic scenario in India is being unique as mentioned above, the present study attempts to evaluate the risk stratification among healthy young subjects between 18-25 years age group with family history of diabetes. Therefore, anthropometric, blood sugar and lipid profile in young offspring's with family history of type 2 DM is evaluated and compared with their counterparts without family history of type 2 DM.

MATERIALS AND METHODS

A case control study (n=100) of healthy non smokers and non alcoholics subjects (18-25 years) comprising of both genders. Cases (n=50, male=28, females=22) were with family history of type 2 DM (individual sharing at least 50% of genetic relation with their probands) and controls (n=50, male=24,

female=26) were without family history of type 2 DM. This population based study was conducted in 2010, in Sri Siddhartha medical college, Tumkur, Karnataka, after Institutional Ethical Committee approval. The protocol was explained to the subjects and written informed consent was obtained. Subjects were screened clinically for any acute or chronic medical, psychiatric conditions and on any medications. All the female subjects had normal menstrual cycle. If subjects were found to be suffering from any disease condition on any medications they were excluded.

Subjects reported with 12 hrs fasting, anthropometric measurements were obtained. Weight (kg) was measured using standard calibrated balance scale (sensitivity ≈ 0.1 kg). Height (cm) was obtained using stadiometer and BMI was calculated. Waist circumference (WC) was measured (cm) at the level of umbilicus after normal expiration in standing position with feet together and arms by the side of the body. Hip circumference (HC) was measured (cm) as the maximum girth around the hip. Waist to hip ratio (WHR) and Waist to height ratio (WHtR) were calculated. Venous blood was drawn in sitting posture, centrifuged (5000 rpm) and serum was separated. Fasting blood sugar (FBS) by glucose oxidase method, Total cholesterol (TC), triglyceride (TG) and high density cholesterol (HDL) by enzymatic calorimetric test using ERBA diagnostic Mannheim GmbH kit was estimated. Low Density Lipoprotein cholesterol (LDL) was calculated using friedwalds formula $LDL = (Total\ cholesterol - HDL) - TG/5$, approximate Very Low Density Lipoprotein (VLDL) concentration was derived using $TG/5$.

Descriptive statistics is given in mean and SD. Comparison of variables between groups was done using ANOVA by SPSS version 15. $P < 0.05$ is considered as level of significance.

RESULTS

The mean and SD of anthropometric, FBS and lipid variables and their comparison between both the groups are depicted in Table. No. I. Subjects were age matched, but, cases weighed more than controls. BMI, WC and WHtR was significantly more among cases than controls ($P < 0.001$). Whereas, WHR did not showed any significant difference between the two groups.

Fasting blood sugar did not show any significant difference between two groups. Total cholesterol and LDL were significantly ($P < 0.001$) more and interestingly, HDL was significantly less in cases when compared to controls ($p = 0.009$). Thus, HDL/LDL ratio was significantly less in cases than control

($p = 0.001$). Whereas, triglycerides and VLDL were comparable between two groups.

BMI among cases ranged from 18 kg/m^2 to 37.20 kg/m^2 encompassing normal to obese range, with average being $24.39 \pm 4.7 \text{ kg/m}^2$, which is quite near to overweight value. Therefore cases were further classified into two subgroups based on BMI (median split 24.9 kg/m^2) and their anthropometric and lipid profile were compared. Group.1 ($n = 31$) average BMI was $21.55 \pm 1.7 \text{ kg/m}^2$ which is in normal range and Group 2 ($n = 19$) average BMI was $29.03 \pm 4.3 \text{ kg/m}^2$ are in overweight range. The difference in their BMI was statistically significant ($P < 0.001$). Group 2 weighed ($75.94 \pm 16.09 \text{ kg}$) more than group 1 ($60.83 \pm 8.5 \text{ kg}$) $P < 0.001$. Similarly, WC of group 2 (89.94 ± 11.8) was significantly ($P < 0.001$) more than group 1 ($75.83 \pm 8.8 \text{ cm}$). Therefore, WHR also followed the same (group 1 = 0.816 ± 0.05 , group 2 = 0.865 ± 0.05 , $p = 0.003$). The WHtR among group 1 (0.45 ± 0.04) and group 2 (0.53 ± 0.06) was significantly different ($P < 0.001$). However,

TABLE I: Comparison of anthropometric, FBS and lipid parameters between controls and cases.

Variable	Controls (n=50)	Cases (n=50)	F value	P value
Age (years)	20.58 ± 1.61	20.94 ± 1.90	1.04	0.309
Weight (kgs)	56.4 ± 9.56	66 ± 13.9	18.17	0.000**
Height (cm)	165.4 ± 8.2	167.72 ± 7.64	1.17	0.281
Body Mass Index (BMI) Kg/m^2	20.6 ± 2.29	24.39 ± 4.71	25.31	0.000**
Waist Circumference (cm)	74.32 ± 8.47	81.2 ± 12.14	10.79	0.001**
Waist Hip Ratio	0.81 ± 0.066	0.83 ± 0.058	2.55	0.113
Waist Height Ratio	0.44 ± 0.04	0.48 ± 0.06	11.63	0.001**
Fasting blood sugar (mg/dl)	84.42 ± 4.33	85.6 ± 3.67	2.086	0.152
Total cholesterol (mg/dl)	152.95 ± 17.88	169.3 ± 25.75	13.62	0.000**
Triglycerides (mg/dl)	117.63 ± 13.24	120.12 ± 16.7	0.676	0.413
HDL (mg/dl)	38.22 ± 2.03	37.22 ± 1.7	7.077	0.009**
LDL (mg/dl)	92.84 ± 16.5	108 ± 24.06	13.618	0.000**
VLDL (mg/dl)	23.55 ± 2.62	24.05 ± 3.47	0.659	0.419
HDL/LDL ratio	0.41 ± 0.066	0.36 ± 0.063	12.012	0.001**

the most surprising and interesting was that the lipid profile which was comparable between both the groups.

In summary, our results have demonstrated that the offspring's with family history of type 2 DM are endowed with more BMI, WC, WHtR, total cholesterol, LDL and less HDL and HDL/LDL ratio when compared to offspring's without family history of type 2 DM. Cases who were overweight (i.e. Group 2) demonstrated comparable lipid profile than their counterparts with normal weight (i.e. Group 1). Thus, demonstrating that anthropometric changes precedes the alteration in lipid profile among youngsters of high risk group.

DISCUSSION

Family history of type 2 DM and obesity are the risk factors for development of type 2 DM (6). In contrast to WHO criteria, the BMI > 23 kg/m² in Indians is considered to be the high risk factor for developing DM - 'unique Asian phenotype (2, 10). Accordingly, the cases in the present study could be considered to be at higher risk to develop DM. In addition, indicators of visceral obesity like WC, WHtR, the predictors of glucose intolerance and insulin resistance (2, 11) were significantly higher among cases. Thus, the cases in the present study are known to be endowed with high risk physical characteristics that favour to develop type 2 DM. Increased BMI and WC are known to be one of the major causative factor to alter lipid profile (12). Further, insulin resistance which may be a genetically inherited trait (1) is also known to enhance lipolytic activity increasing fatty acid levels thus bringing about these altered changes in lipid profile and can also cause dyslipidemia in individuals

with normal glucose tolerance (12). However, not estimating the insulin resistance in the present study is the limitation to directly correlate with the observed changes. Yet, the present study offers an important observation that the young healthy individuals with positive family history of diabetes who are euglycemic has shown difference in anthropometric and lipid profile favoring higher risk to develop DM. These measures could be used as the risk stratification tools and also the yard to assess the effectiveness of any preventive intervention.

In the process of evaluating the results, it was observed that BMI had a very wide range among the cases ranging between 18 kg/m² to 37.20 kg/m² (median BMI 24.9 kg/m²) from normal BMI to obesity range, which could be one of the major confounding factors for the observed changes in the lipid profile. Therefore, based on BMI cases were further divided into two subgroups (group 1 = 21.55 kg/m², group 2 = 29.03 kg/m²). Therefore, in accordance with cutoff for Asian Indians phenotype i.e. BMI > 23 kg/m² group 2 are at higher risk of developing type 2 DM. Anthropometric variables (WC, WHR and WHtR) in group 2 were significantly higher than group 1. However, the most interesting and intriguing finding was that the lipid profiles were comparable between these two groups. This is the unexpected but a unique observation of the present study. This observation offers an insight that the changes in anthropometric variables may not be aligned with the changes in lipid profiles. Our observation demonstrates that anthropometric changes could precede the alteration in lipid profile among healthy youngsters of high risk group to develop type 2 DM. There is a report demonstrating similar findings (13) in

children (10-14 years) with family history of type 2 DM where increase in BMI was not temporally linked to alterations in insulin levels. In similar lines, the present study has also demonstrated such a temporal dissociation between BMI and lipid profile among adolescents. To the best of our knowledge this is the second study other than earlier (14) wherein similar finding was reported among mixed age group in both children and adolescents. Thus, demonstrating that changes in anthropometric variables and lipid profile may not be temporally linked among healthy young adolescent with family

history of type 2 DM. However, long term follow up study is warranted to understand the sequential changes.

Therefore, this study gives a glimpse that anthropometric changes precede far earlier than the onset of changes in lipid profile. In spite of limitations like not evaluating insulin levels, the present preliminary study, can potentially put forth that the anthropometric variables would be a better measures for risk stratification for diabetes among high risk euglycemic younger age group with family history of type 2 DM.

REFERENCES

- Boer JMA, Feskens EJM, Kromhout D. Characteristics of NIDDM in elderly men; effect modification by family history. *International Journal of Epidemiology* 1996; 25: 394-402.
- Mohan V, Sandeep S, Deepa R, Shah B, Varoghese C. Epidemiology of type 2 diabetes: Indian Scenario. *Indian J Med Res* 2007; 125: 217-230.
- Mananta BN, Mahanta TG. Clinical profile of persons with family history of Diabetes Mellitus with special reference to body fat percentage. *JAPI* 2009; 57: 641-643.
- Mohan V. Why Indians are more prone to develop diabetes. *JAPI* 2004; 52: 468-474.
- Padaki S, Vijayakrishna K, Dambal A, et al. Anthropometry and physical fitness in individuals with family history of type 2 Diabetes mellitus: A comparative study. *Indian Journal of Endocrinology and Metabolism* 2011; 15: 327-330.
- LeRoith D, Taylor SI, Olefsky JM. Diabetes Mellitus A fundamental and clinical test. Newyork, Lippincott-Raven: 479-480.
- Papazafiropoulou A, Sotiropoulos E, Skliros E, Kardara M, Kokolaki, Ourania A, Pappas S. Familial history of diabetes and clinical characteristics in Greek subjects with type 2 diabetes. *BMC Endocrine Disorders* 2009; 9: 1-12.
- Praveen EP, Kulshreshtha B, Khurana ML, Sahoo J, Gupta N, Kumar et al. Low HDL-cholesterol among normal weight, normoglycemic offspring of individuals with type 2 diabetes mellitus. *Hormones* 2011; 10(1): 57-66.
- Pontirolu AE, Costa MS, San, et al. In middle - aged siblings of patients with type 2 diabetes mellitus normal glucose tolerance is associated with insulin resistance and with increased insulin secretion. The SPIDER study. *European Journal of Endocrinology* 2000; 143: 681-686.
- Barba C, Manila M, Sforza TC et al. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet* 2004; 363: 157-163.
- Meisinger C, Doring A, Thorand B, Heier M and Lowel H. Body fat distribution and risk of type 2 diabetes in the general population: are there difference between men and women? The MONICA/KORA Augsburg cohort study. *Am J Clin Nutr* 2006; 84: 483-489.
- Steinberger J, Daniels SR. Obesity, insulin resistance, diabetes, and cardiovascular risk in children. *Circulation* 2003; 107: 1448-1453.
- Moran MR, Romero FG. Hyperinsulinemia in healthy children and adolescents with a positive family history for type 2 diabetes. *Paediatrics* 2006; 118: 1516-1522.
- Anjana RM, Lakshminarayanan S, Deepa M, Farooq S, Pradeepa R, Mohan V. Parental history of type 2 diabetes mellitus, metabolic syndrome, and clardio metabolic risk factors in Asian Indian adolescents. *Metabolism* 2009; 58: 344-350.