ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare & Pharmascope Foundation Journal Home Page: https://ijrps.com

Body fat distribution, cardiorespiratory fitness, and lipid profile in first degree relatives with type 2 diabetes mellitus

Shaik Azmatulla*[1], Rinku Garg[2], Anil Kumar Sharma[3], Navpret Mann[2]

[1]Research Scholar, Department of Physiology, Santosh Medical College, Santosh Deemed to be University, Ghaziabad, Delhi NCR, Uttar Pradesh, India
[2]Department of Physiology, Santosh Medical College, Santosh Deemed to be University, Ghaziabad, Delhi NCR, Uttar Pradesh, India
[3]Department of General Medicine, F H Medical College, Tundla, Uttar Pradesh, India

Article History:

Received on: 15.05.2019
Revised on: 20.08.2019
Accepted on: 26.08.2019

Keywords:

Body fat, cardiorespiratory fitness, high-density lipoproteins, visceral fat

ABSTRACT

Evaluation of people at increased risk like first degree relatives of type 2 diabetes mellitus (FDRDM) may be useful to reduce the risk of disease progression, development, early intervention, and to take precautionary measures. By considering the multifactorial pathophysiological changes of D.M., we have examined the body fat distribution, cardiorespiratory fitness, and lipid profile of FDRDM. Similar age, height, waist-hip ratio (WHR) in both groups, significantly higher body mass index (BMI) in FDRDM, was observed in our study. Percentage body fat and blood glucose levels in fasting were elevated considerably, and 12 min walk distance was low in FDRDM. Visceral fat was slightly high, but it was not statistically significant. In FDRDM, High-density lipoproteins (HDL) were less but not statistically significant. Significantly higher levels of Total cholesterol (T.C.), triglycerides (TGL), low-density lipoproteins (LDL), and very-low-density lipoproteins (VLDL) were seen high in FDRDM when compared to controls. Higher body fat percentage reduced cardiorespiratory function and abnormal lipid profile in FDRDM may lead to the development of severe cardiovascular events and necessitates lifestyle modification at early phases of disease development

*Corresponding Author

Name: Shaik Azmatulla
Phone: 9670772421
Email: azmatshaik.786@gmail.com

ISSN: 0975-7538

DOI: https://doi.org/10.26452/ijrps.v10i4.1637

Production and Hosted by

IJRPS | https://ijrps.com

INTRODUCTION

With 61.3 million diabetes (D.M.) population, India became a global hub for type 2 diabetes (Tabák *et al.*, 2012). The prevalence of diabetes and prediabetes is increasing worldwide. Experts projected that by 2030, the numbers might reach 470 million (Anjana *et al.*, 2011). In 2011, the Indian Medical Association estimated that 62.4 million people are living with diabetes in India (Paul *et al.*, 2012). The manifestations of diabetes in Indians are faster than western people (Ramachandran *et al.*, 1988).

Indians are more susceptible to D.M. because of the role of genetics and improper habits. Currently, the presence of D.M. became very prevalent in youngsters, especially in India. The primary reason could be due to the hereditary effect e of D.M. In addition to that, offsprings/first-degree relatives D.M. tend to have similar lifestyle, social, economic, and cultural habits, which could increase the risk of development of D.M. along with the role of genetics.

Complications of D.M. in young people affect the

quality of life, unlike, D.M. patients, first-degree relatives of diabetes mellitus (FDRDM) don't experience the features of D.M., and they neglect the signs and symptoms. But, few studies have reported the derangements of the autonomic nervous system, which increases the cardiovascular events in FDRM, and studies have reported the autonomic failure and increased cardiovascular risk in FDRDM (Eriksson *et al.*, 1989; Muktabhant *et al.*, 2015a). It is advised to asses FDRDM individuals for the risk factors that are vital to reduce disease progression and implementation of early care, precautions. By considering the multifactorial pathophysiological changes of D.M., we have examined the body fat distribution, cardiorespiratory fitness, and lipid profile in first degree relatives on type 2 diabetes mellitus.

MATERIALS AND METHODS

Ethics clearance was obtained, and informed written consent was taken from all the participants. The site of conduct of experiments was the Department of Physiology's research laboratory, F.H. Medical College, Agra, India.

Subjects

Individuals of the FDRDM group (n = 37) were recruited in the age group of 18 – 30 years, from the individuals attending F.H. Medical College and Hospital, Agra, India Hospital, along with D.M. patients. We had excluded the individuals if they are on medication for any health-related illness, any condition which prevents participating moderate form of physical activity, subjects if they are doing routine physical activity like exercise, yoga, meditation, and any other biofeedback practices. The control group (n =37) were people without a family history of D.M., and young age and gender-matched individuals.

They were instructed to have adequate rest one day before testing and not to do heavy exercise, not to take coffee, or any other beverages, alcohol, and nicotine products one day before the examination. After overnight fasting, they have attended the laboratory (Sacks *et al.*, 2011). A blood sample was taken from median cubital vein sodium fluoride containers soon after coming to the laboratory.

Recording of anthropometric and basal parameters

After they emptied the bladder, participants' height, weight was measured, and Body mass index (BMI) was calculated. Waist Hip circumference was measured as an index of abdominal fat proportion.

Measurement of Body composition

Was done under the principle of bioelectrical impedance analysis (BIA) method.

Lipid profile

T.C. was estimated by cholesterol oxidase peroxidase by using a Diagnostic kit. HDL estimation was carried out with Diagnostic equipment. TGL was measured with GPO-PAP-ESPAS by using the Diagnostic Kit using an automated clinical chemistry analyzer. Friedwalds's formula was used to calculate VLDL (Muktabhant *et al.*, 2015b).

Assessment of cardiorespiratory fitness

was carried out by using cooper's 12 minutes walk test.

RESULTS AND DISCUSSION

Table 1 shows the comparison between baseline parameters. Both groups had similar age, height, and WHR. FDRDM has significantly more weight and BMI. Table 2 shows the comparison of total body fat, visceral fat, cardiorespiratory function, and fasting blood glucose. Body fat and fasting blood glucose were significantly high, and 12 min walk distance was low in FDRDM. Visceral fat was slightly elevated, but it was not statistically significant. Table 3 shows the comparison of the lipid profile. In FDRDM, HDL cholesterol was less but not statistically significant. Total cholesterol, triglycerides, low-density lipoproteins, and very-low-density lipoproteins were significantly high in FDRDM when compared to controls.

The chief aim of this research was to analyze the body fat distribution, cardiorespiratory function, and lipid profile in FDRDM. While both groups were similar for age, height, and WHR. FDRDM individuals had significantly higher weight and BMI.

The higher levels of body fat percentage this may be because of genetic exposure (Hsu *et al.*, 2005), and fasting blood glucose was significantly elevated. This could be due to increased body fat percentage, which in turn leads to insulin resistance (Gokulakrishnan *et al.*, 2011) Visceral fat was slightly high, but it was not statistically significant. This higher insulin resistance and reduced insulin sensitivity lead them to increased risk of development of diabetes and cardiac diseases.

In this study, we assessed cardiorespiratory fitness by using cooper 12 min walk distance test. We found 12 min walk distance was low in FDRDM, which indicates that in FDRDM individuals, the cardiorespiratory fitness was reduced. This could be due to inflammation and oxidative stress (Aronson *et al.*, 2004); this study was in line with the study reported by (Sharma *et al.*, 2019).

The lipid abnormalities of FDRDM subjects we

Table 1: Demographic profile of controls and FDRDM

Sl.No	Parameter	Mean + S.D.		P-value
		Controls	Cases (FDRDM)	
1	Age (years)	20.64 +1.96	20.67 +1.78	0.951
2	Height (cms)	167.32 + 8.44	163.08 + 10.50	0.060
3	Weight (kg)	58.91 + 9.98	67.51 + 12.45	0.002
4	BMI (kg/m2)	21.0189 + 2.38	25.9649+ 4.40	0.000
5	WHR	0.8186 + 0.07	0.84 + 0.04	0.77

Table 2: Body fat distribution, cardiorespiratory fitness, and blood glucose levels of controls and FDRDM

Sl.No	Parameter	Mean + S.D.		P-value
		Controls	Cases (FDRDM)	
1	Body fat (%)	24.22 + 1.77	26.18 + 2.52	0.000
2	Visceral fat (%)	6.52 + 0.53	7.00 + 1.46	0.064
3	12 min walk (meters)	2765.05 + 88.25	2387.83 + 86.23	0.000
4	FBS (mg/dl)	84.08 + 4.32	87.43 + 4.38	0.001

Table 3: Lipid profile of controls and FDRDM

Sl.No	Parameter	Mean + S.D.		P-value
		Controls	Cases (FDRDM)	
1	TC (mg/dl)	166.67 + 26.42	209.83 + 15.06	0.000
2	HDL (mg/dl)	41.8216 + 6.56	39.81 + 5.51	0.158
3	TGL (mg/dl)	126.78 + 19.94	146.89 + 14.83	0.000
4	LDL (mg/dl)	99.49 + 18.96	140.97 + 17.14	0.000
5	VLDL (mg/dl)	25.35 + 3.98	29.32 + 2.99	0.000

reported in this study were increased triglycerides, low-density lipoproteins, total cholesterol, and decreased high-density lipoprotein.

This may be a dominant risk factor for the development of atherosclerosis (Temelkova-Kurktschiev and Hanefeld, 2004) in this population. During insulin resistance, the removal of triglycerides may be reduced because of decreased lipoprotein lipase action. As triglycerides increase -still within the so-called reasonable limit -abnormalities, low-density lipoprotein (LDL) and HDL become more evident. The mean concentration of LDL cholesterol in those with type 2 diabetes is not significantly different from those individuals who do not have diabetes. In particular, patients with diabetes tend to have a higher proportion of smaller and denser LDL particles, more susceptible to oxidation, and may thereby increase the risk of cardiovascular diseases (Kannel and Mcgee, 1979).

Low-density lipoproteins (LDL) cholesterol is the primary lipid marker in cardiovascular risk estimation. Reduced HDL positively associated with cardiovascular events. Previous studies have reported that higher HDL is correlated associated with reduced cardiovascular risk in high -risk individuals such as patients with T2DM (Solano and Goldberg, 2006). High levels of LDL cholesterol and low HDL cholesterol may be a consequence of obesity, increased calorie intake, and a lack of muscular exercise in first degree relatives of type 2 diabetes mellitus.

CONCLUSION

Higher body fat percentage reduced cardiorespiratory function and abnormal lipid profile in FDRDM may lead to the development of severe cardiovascular events and necessitates lifestyle modification at early phases of disease development.

REFERENCES

Anjana, R. M., Pradeepa, R., Deepa, M., Datta, M., Sudha, V., Unnikrishnan, R., Bhansali, A., Joshi, S. R., Joshi, P. P., Yajnik, C. S., Dhandhania, V. K.,

Nath, L. M., Das, A. K., Rao, P. V., Madhu, S. V., Shukla, D. K., Kaur, T., Priya, M., Nirmal, E., Parvathi, S. J., Subhashini, S., Subashini, R., Ali, M. K., Mohan, V. 2011. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: phase I results of the Indian Council of Medical Research-INdia DIABetes (ICMR-INDIAB) study. *Diabetologia*, 54:3022–3027. ICMR-INDIAB Collaborative Study Group.

Aronson, D., Sheikh-Ahmad, M., Avizohar, O., Kerner, A., Sella, R., Bartha, P., Markiewicz, W., Levy, Y., Brook, G. J. 2004. C-Reactive protein is inversely related to physical fitness in middle-aged subjects. *Atherosclerosis*, 176:173–179.

Eriksson, J., Franssila-Kallunki, A., Ekstrand, A., Saloranta, C., Widén, E., Schalin, C., Groop, L. 1989. Early metabolic defects in persons at increased risk for non-insulin-dependent diabetes mellitus. *The New England Journal of Medicine*, 321:337–343.

Gokulakrishnan, K., Deepa, M., Monickaraj, F., Mohan, V. 2011. Relationship of body fat with insulin resistance and cardiometabolic risk factors among normal glucose-tolerant subjects. *Postgraduate Medical Journal*, 57:184–188.

Hsu, F. C., Lenchik, L., Nicklas, B. J., Lohman, K., Register, T. C., Mychaleckyj, J., Langefeld, C. D., Freedman, B. I., Bowden, D. W., Carr, J. J. 2005. Heritability of body composition measured by DXA in the diabetes heart study. *Obesity research*, 13:312–319.

Kannel, W. B., Mcgee, D. L. 1979. Diabetes and cardiovascular risk factors: the Framingham study. *Circulation*, 59:8–13.

Muktabhant, B., Sanchaisuriya, P., Trakulwong, M., Mingchai, R., Schelp, F. P. 2015a. 2015)a. A first-degree relative with diabetes mellitus is an important risk factor for rural Thai villagers to develop type 2 diabetes mellitus. *Asia Pacific Journal of Public Health*, 27:385–393.

Muktabhant, B., Sanchaisuriya, P., Trakulwong, M., Mingchai, R., Schelp, F. P. 2015b. 2015)b. A first-degree relative with diabetes mellitus is an important risk factor for rural Thai villagers to develop type 2 diabetes mellitus. *Asia Pacific Journal of Public Health*, 27:385–393.

Paul, U. K., Sinharay, K., Bhattacharyya, A. K., Pal, S. K. 2012. Update in diabetic neuropathy with special reference to Indian scenario. *Journal of the Indian Medical Association*, 110:616–622.

Ramachandran, A., Jali, M. V., Mohan, V., Snehalatha, C., Viswanathan, M. 1988. High prevalence of diabetes in an urban population in south India. *British Medical Journal*, 297:587–590.

Sacks, D. B., Arnold, M., Bakris, G. L., Bruns, D. E., Horvath, A. R., Kirkman, M. S., Lernmark, A., Metzger, B. E., Nathan, D. M. 2011. Guidelines and Recommendations for Laboratory Analysis in the Diagnosis and Management of Diabetes Mellitus. *Diabetes Care*, 34:61–99.

Sharma, V. K., Nandeesha, H., Vinod, K. V., Subramanian, S. K., Sankar, D. S., Rajendran, R. 2019. Comparison of anthropometric, cardiovascular, autonomic, baroreflex sensitivity, aerobic fitness, inflammatory markers and oxidative stress parameters between first degree relatives of diabetes and controls. *Diabetes & Metabolic Syndrome*, 13:652–658.

Solano, M. P., Goldberg, R. B. 2006. Lipid Management in Type 2 Diabetes. *Clinical Diabetes*, 24:27–32.

Tabák, A. G., Herder, C., Rathmann, W., Brunner, E. J., Kivimäki, M. 2012. Prediabetes: a high-risk state for diabetes development. *Lancet*, 379:60283–60292.

Temelkova-Kurktschiev, T., Hanefeld, M. 2004. The lipid triad in type 2 diabetes - prevalence and relevance of hypertriglyceridaemia/low high-density lipoprotein syndrome in type 2 diabetes. *Experimental and Clinical Endocrinology & Diabetes*, 112:75–79.