International Journal of Pharmaceutical Science Invention
ISSN (Online): 2319 – 6718, ISSN (Print): 2319 – 670X
www.ijpsi.org Volume 5 Issue 3 ǁ June 2016 ǁ PP.31-34

Correlations between Some Anthropometric Parameters, the Lipid Profile and Glycated Hemoglobin in Bulgarian Women with Type 2 Diabetes Mellitus

Baltadjiev A[1], Vladeva S[2], Tineshev S[3], Andreenko E[3]
[1]*Medical University, Department of Anatomy, Histology and Embryology, Plovdiv, Bulgaria*
[2]*Medical University, Department of Endocrinology, St.George University Hospital, Plovdiv, Bulgaria*
[3]*University "Paisii Hilendarski", Department of Anatomy and Physiology, Plovdiv, Bulgaria*

ABSTRACT: *The study aimed to investigate the correlations between some anthropometric and lipid profile parameters, as well the glycated hemoglobin (HbA1c) values of Bulgarian females with type 2 Diabetes mellitus (T2DM). 212 women of Bulgarian ethnicity with T2DM of the age groups 40-60 and 61-80 years were included in the research. The anthropometric parameters: waist and hip circumferences were measured, and body mass index (BMI) and waist/hip ratio (WHR) were calculated. We also studied the lipid profile parameters: total cholesterol, triglycerides, high density lipoprotein (HDL), low density lipoprotein (LDL) and very low density lipoprotein (VLDL). A comparative study of the lipid profile criteria revealed significant differences in the levels of triglycerides, HDL-cholesterol and VLDL between the two age groups. Differences were found with regard to the values of glycated hemoglobin too. Correlations between the above anthropometric parameters and the lipid profile of patients with T2DM were examined. In patients of the age group 40-60 years a moderate strength correlation in opposite direction (negative or inverse correlation) was found between HbA1c and BMI (Pearson correlation coefficient 0.30-0.50, p<0.05). In the age group 61-80 years a low strength negative correlation was found between BMI and total cholesterol, as well as between BMI and LDL.*
Keywords: *Anthropometry, Glycated hemoglobin, Lipid profile, Type 2 diabetes mellitus, Women*

I. Introduction

Type 2 Diabetes mellitus (T2DM) is a metabolic disease associated with violation of the metabolism. In recent years, it is gaining more signs of social problem due to the rapidly growing number of people affected by the disease worldwide. Globally as of 2010 it was estimated that there were 285 million people with type 2 diabetes, and this was equivalent to about 6% of the world's adult population [1]. In Bulgaria patients with T2DM amounted to about 6-8% of the population, with a trend of rapid growth. Diabetes is common both in the developed and the developing world. Conducted surveys focused exclusively on clarifying the etiology, pathogenesis, clinical course and treatment of the disease. Limited number of studies aimed at clarifying the relationship between anthropological parameters governing humans' body constitution, and the lipid profile and glycated hemoglobin values of T2DM patients [2, 3, 4]. Many similar studies have been conducted in India [2-8, 10, 11]. Both lipid profile and body fat have been shown as very important predictors for metabolic disturbances including dyslipidaemia, hypertension, diabetes, cardiovascular diseases, and hyperinsulinaemia [4].

II. Aims & Objectives

The aim of the investigation was to look for correlations between the levels of the lipid profile parameters and glycated hemoglobin on the one hand, and some anthropometric indicators of Bulgarian females with T2DM - on the other, and to compare our results with the results of foreign authors.

III. Patients And Methods

The study involved 212 females with T2DM, diagnosed and followed by a specialist in endocrinology. The duration of disease was more than five years. All patients were treated with oral anti-diabetes drugs and were in a compensated condition. All patients were ethnic Bulgarians. They were divided into two groups: Group 1: 40-60 years of age - 92 patients (mean age 52.87 ± 0.56 years). Group 2: 61-80 years of age - 120 patients (mean age 68.95 ± 0.57 years). The control group consisted of 40 for each age group, matched by age and gender Bulgarian healthy subjects.

Anthropological methods: Direct measurement anthropometric parameters were body height, body weight, and waist and hip circumferences. Calculated indexes were: Body mass index (BMI) and Waist-hip ratio (WHR). Lipid panel - total cholesterol, triglycerides, high density lipoprotein (HDL), low density lipoprotein (LDL) and very low density lipoprotein (VLDL).Laboratory variables – values of glycated hemoglobin (HbA1c).

Statistics. Data were analyzed using statistical software SPSS version 15 (SPSS Inc., Chicago, IL). Parametric statistical methods were relevant. Independent Samples t Test was used to compare the means of two independent anthropologic parameters or group of patients in order to determine whether there was statistical evidence that the means were significantly different. The one-way analysis of variance (ANOVA) was used to determine whether there were any significant differences between the means of three or more independent parameters. P<0.05 (two tailed) was considered statistically significant. We used Pearson's correlation to assess associations between variables, and Pearson's correlation coefficient (PC) was calculated. The value of the coefficient was used to rate the correlation's strength: low correlation – 0.01-0.30; moderate – 0.30-0.50; strong 0.50-0.70; high – 0.70-0.90; very high >0.90. P<0.05 (two tailed) was considered statistically significant.

IV. Results And Discussion

The lipid profile consists of detailed measurement of fat in the blood. It includes examination of total cholesterol, HDL, LDL, VLDL and triglycerides. The lipid profile and the values of glycated hemoglobin of the T2DM patients from both tested age groups are presented in **Table 1.**

Table 1: Comparatively presentation of the lipid profile parameters and glycated hemoglobin values between the two age groups of Bulgarian women with T2DM

	Females 40-60 years				**Females 61-80years**				
	N	**Mean**	**SE**	**SD**	**N**	**Mean**	**SE**	**SD**	**P**
Total cholesterol mmol/l Border levels 5.2-6.2	92	5.80	0.16	1.48	120	5.57	0.13	1.23	>0.05
Triglycerides mmol/l Border levels 0.6-1.7	92	2.80	0.41	3.70	120	1.96	0.12	1.13	**<0.05**
***HDL-cholesterol mmol/l Border levels 1.00-1.68**	92	1.21	0.08	0.37	120	1.40	0.09	0.46	**<0.05**
***LDL-cholesterol mmol/l Border levels 2.6-3.3**	92	4.50	0.22	2.02	120	4.68	0.12	1.15	>0.05
***VLDL mmol/l Border level < 1 mmol/l.**	92	1.23	0.20	1.67	120	0.89	0.55	0.51	**<0.05**
***HbA1c % Border levels 4.00-5.6**	92	9.64	0.27	1.86	120	9.18	0.21	1.42	**<0.05**

*HDL - high-density lipoprotein cholesterol, *LDL - low-density lipoprotein cholesterol, *VLDL -very low-density lipoprotein, *HbA1c - glycated haemoglobin;

Total cholesterol is the sum of different fats in the blood. The same model is involved in the construction of all cells of the body and the structure of a number of hormones. High cholesterol levels are risk to accumulate fatty deposits in blood vessels and the development of cardiovascular diseases, atherosclerosis, heart attack or stroke. The mean total cholesterol levels did not exceed the border levels and we did not find difference in this respect between the two age groups of Bulgarian T2DM women.

All calories adopted by foods, which the body does not need at the moment, are stored as triglycerides. High levels of triglycerides can be due to excessive intake of carbohydrate food, drinks, and alcohol in people with obesity or diabetes. The mean values of triglycerides in our patients exceeded the border levels and were significantly higher in women 40-60 years of age compared to those 61-80 years of age.

HDL-cholesterol (high density lipoproteins) assists the removal of LDL-cholesterol from arteries, thus eliminating the risk of accumulation of atherosclerotic plaques, which narrow the lumen of blood vessels and impair blood flow. The low levels of HDL-cholesterol represent high risk for atherosclerosis and heart disease. Higher mean levels of HDL-cholesterol were found in Bulgarian T2DM women 61-80 years of age. We found no a risky low mean values of HDL-cholesterol in our patients, which is a good prognostic sign.

LDL-cholesterol (low density lipoprotein) has the ability to form fatty deposits on the walls of blood vessels. Elevated levels of LDL-cholesterol are associated with a high risk of development of heart attack or stroke because of embarrassment of blood supply to vital organs. The mean values of LDL-cholesterol in our patients were higher than the listed border levels, without distinction between the two age groups of T2DM females. This indicates that the patients are actually at risk of cardiovascular disease.

Main lipoproteins transporting triglycerides are VLDL in the fasted state and chylomicrons postprandial. VLDL-cholesterol is a lipoproten of very low density, which acts on the arterial wall like LDL-cholesterol. The desired levels are <1 mmol/l. In our patients, such desired levels was observed in women over the age of 60, whose VLDL-cholesterol values were significantly lower than those of women 40-60 years old.

Glycosylated hemoglobin (HbA1c %) is the ratio between the associated with plasma glucose hemoglobin A (HbA) and the total HbA. HbA1c is the main indicator which is used for evaluation of glycemic control in

diabetes mellitus. The high values of HbA1c were associated with an increased risk of complications in patients with diabetes mellitus type 1 and type 2. A statistically significant association was found between the high levels of HbA1c and the mortality rates associated with diabetes. If the value of HbA1c was ≥8%, the risk of death was 15.3% higher than in HbA1c <6% [1]. In our T2DM patients from both age groups, the HbA1c values exceeded the listed limits and were reliably higher in the first group than the second.
The investigated lipid panel of T2DM Bulgarian women showed two unfavorable tendencies: elevated levels of triglycerides and LDL-cholesterol. Gloomy prediction provided the excess percentage of HbA1c too. It seems that women of 40-60 years are slightly more vulnerable in this respect compared to the 61-80 age group. Diabetes mellitus is a chronic disease which affects all organ systems. To be well controlled T2DM requires an individualized to the patient multidisciplinary approach. This multidisciplinary approach induced us to look for correlations between some anthropometric parameters and the lipid panel, as well as HbA1c levels of Bulgarian females with T2DM. The data from our studies are shown in Table 2 and Table 3.

Table 2 Correlations between some anthropometric parameters, the lipid profile, and glycated hemoglobin values of 40-60 years of age Bulgarian females with T2DM

Anthropometric parameters	Total cholesterol		Triglycerides		HDL		LDL		VLDL		HbA1c	
	PC*	P	PC	P	PC	P	PC	P	PC	P	PC	P
BMI	-0.16	>0.05	0.02	>0.05	0.23	>0.05	-0.13	>0.05	0.22	>0.05	-0.33	**<0.05 S**
Waist circumference	0.07	>0.05	0.24	>0.05	0.22	>0.05	0.02	>0.05	0.24	>0.05	-0.38	>0.05
Hip circumference	0.08	>0.05	0.18	>0.05	0.2	>0.05	0.05	>0.05	0.18	>0.05	-0.36	>0.05
WHR	-0.003	>0.05	0.21	>0.05	0.12	>0.05	-0.06	>0.05	0.21	>0.05	-0.33	>0.05

* PC – Pearson correlation coefficient, BMI – Body mass index, WHR – waist/hip ratio, S statistical significance

Table 3 Correlations between some anthropometric parameters, the lipid profile, and glycated hemoglobin values of 61-80 years of age Bulgarian females with T2DM

Anthropometric parameters	Total cholesterol		Triglycerides		HDL		LDL		VLDL		HbA1c	
	PC*	P	PC	P	PC	P	PC	P	PC	P	PC	P
BMI	-0.21	**<0.05 S**	0.01	>0.05	-0.21	>0.05	-0.21	**<0.05 S**	0.10	>0.05	-0.14	>0.05
Waist circumference	0.02	>0.05	0.23	>0.05	-0.13	>0.05	-0.03	>0.05	0.24	>0.05	-0.56	>0.05
Hip circumference	-0.07	>0.05	0.18	>0.05	-0.16	>0.05	-0.1	>0.05	0.21	>0.05	-0.31	>0.05
WHR	0.13	>0.05	0.14	>0.05	-0.002	>0.05	0.09	>0.05	0.14	>0.05	-0.44	>0.05

* PC – Pearson correlation coefficient, BMI – Body mass index, WHR – waist/hip ratio, S statistical significance

Our study demonstrated a limited number of reliable correlations between the anthropological parameters, lipid profile and glicated hemoglobin of Bulgarian females with T2DM. Only three significant correlation coefficients were established: between HbA1c and BMI in the group 40-60 years of age, and between BMI and total cholesterol, as well BMI and LDL in the group 61-80 years of age. The correlation HbA1c - BMI was of moderate correlation's strength and surprisingly negative: an increase in the values of BMI should reduce those of HbA1c. Inverse correlations of low correlation's strength were found between BMI - LDL and BMI - total cholesterol of females aged 61-80 years: an increase in the values of BMI should decrease those of LDL and total cholesterol. Similar studies have been conducted by other authors [5-10]. Y. Himabindu et al. reported statistically significant positive correlation between BMI (≥25 kg/m^2) and VLDL (PC=0.273, P=0.033), and significant inverse correlation between WHR and HDL in T2DM patients without hypertension (PC= -0.261, P=0.048) [2]. SW Masram et al. found a positive correlation between the total cholesterol and HbA1c (PC=0.586 p <0,001), and inverse correlation between HbA1c and HDL-cholesterol (PC = -0.22) [3]. HS Sandhu et al. reported that in females of age group 41–50 with T2DM, statistically significant inverse correlation (r = - 0.26) was found between WHR and LDL-cholesterol, while positively significant correlations were noted between WHR and serum cholesterol (r=0.48), LDL-cholesterol (r = 0.35) and triglyceride (r = 0.35) [4]. J. Sheth et al. found in T2DM significant linear associations of hyper-total cholesterol, hyper-LDL-cholesterol and hyper-non-HDL-cholesterol with HbA1c. They observed that higher waist circumference (WC) or higher BMI per se had no independent association with HbA1c levels in diabetic women [11]. Chan et al. reported that total cholesterol and LDL-cholesterol correlated positively with HbA1c, HDL-cholesterol

correlated negatively with BMI and WC, while triglycerides correlated positively with HbA1c, BMI, and WC. They found that WHR was not significantly associated with abnormal lipid parameters in both male and female with T2DM [12]. Besides Indian authors similar studies have been conducted in other nations too [12, 13, 14, 15]. Only one of the aforementioned correlations between anthropometric parameters and parameters of the lipid profile of T2DM patients was in line with some of our findings, namely "HDL-cholesterol correlated negatively with BMI" [12].

V. Conclusion

In the present study we found that Bulgarian females aged 40-60 years with T2DM showed a significant inverse correlation between HbA1c and BMI. At the same time Bulgarian females of the age group 61-80 years with T2DM showed significant negative correlations between BMI and total cholesterol, as well between BMI and LDL. Discrepancies among the reported in the literature diverse and divergent correlations between the anthropometric parameters, the lipid profile values, and the biomarker HbA1c are probably due to the lifestyle, lifestyle and diet, and other specific factors in different nations. Methodological differences are also very important. The multidisciplinary approach to T2DM requires along with anthropometric parameters, the lipid profile need also be monitored.

Conflict of Interests The authors declare that there is no conflict of interests regarding the publication of this paper.

References

[1]. Williams textbook of endocrinology. (12th ed.). Philadelphia: Elsevier/Saunders. pp. 1371–1435. ISBN 978-1-4377-0324-5.
[2]. Hmabindu Y, Sriharibabu M, Alekhya K, Saisimanth K,Lakshmanrao N, Komali K. Correlations between anthropometry and lipid profile in type 2 diabetics. Indian J Endocrinol Metab. 17(4), 2013, 727–729.
[3]. Masram SW, Bimanpalli MV, Suresh Ghangle. Study of lipid profile and glycated hemoglobin in Diabetes Mellitus. Indian Medical Gazette. 2012, 257-65.
[4]. Sandhu HS, Koley S, Sandhu KS A study of correlation between lipid profile and waist to hip ratios in patients with Diabetes Mellitus. Anthropologist, 10(3), 2008, 215-218.
[5]. Jayarama N , P. Raja Reddy, M. Madhavi Reddy, V. Mahesh. Relation between waist-hip ratio and lipid profile in type 2 diabetes mellitus patients Asian Journal of medical sciences. 5, (3), 2014, 51-53.
[6]. Tayde P., Borle A., Zanwar Y., Rode M., Phatak M. Glycated hemoglobin pattern and its correlation with lipid profile in type-2 diabetics in central India. National Journal of Community Medicine. 4(4), 2013, 564-9.
[7]. Kumar A. Prevalence of glycemic status, obesity and waist circumference in Punjabi type 2 diabetics. Journal of Exercise Science and Physiotherapy, 9(1), 2013, 1-5.
[8]. Samatha P, Siva Prabodh, Chowdary NVS, Ravi Shekhar. Glycated Hemoglobin and Serum Lipid Profile Associations in Type 2 Diabetes Mellitus Patients. JPBMS, 17(12), 2012, 256-261.
[9]. VitnodMahato R, Gyawali P, Raut PP, Regmi P, Singh KP, Pandeya DR, Gyawali P. Association between glycaemic control and serum lipid profile in type 2 diabetic patients: Glycated haemoglobin as a dual biomarker. Biomedical Research, 22 (3), 2011; 375-380.
[10]. Maria A.K., Verma K, Kumar S., Gupta V., Kumar M. Comparative analysis of anthropometric parameters and lipid profile of type 2 diabetic patients in south west Punjab. Sch. Acad. J. Biosci, 3(5),2015; 489-496.
[11]. Sheth J., Shah A., Sheth F., Trivedi S., Nabar N. et all. The association of dyslipidemia and obesity with glycated hemoglobin. Clinical Diabetes and Endocrinology, 2015, 1:7, DOI 10.1186/s40842-015-0004-6
[12]. Chan WB, Tong PC, Chow CC, So WY, Ng MC, Ma RC, Osaki R, Cockram CS, Chan JC. Triglyceride predicts cardiovascular mortality and its relationship with glycaemia and obesity in Chinese type 2 diabetic patients. Diabetes Metab. Res. Rev. 21(2), 2005; 183–188.
[13]. Elochukwu A, Uchenna EA, Nasir IA, Faith EA, Babay A. et all. Evaluation of fasting lipid profile and glycated hemoglobin in obese subjects at University of Calabar teaching hospital, Nigeria. International Journal of Biomedical Research 6(03), 2015, 200-209.
[14]. Ozder A. Lipid profile abnormalities seen in T2DM patients in primary healthcare in Turkey: a cross-sectional study. Health and Disease, 13, 2014,183-188.
[15]. Bleibil A, Hassan Y, Abulelahdujaili J, Azizah N. Pattern of dyslipidemia in type 2 diabetic patients in the state of Penang, International Journal of Pharmacy and Pharmaceutical Sciences. 2012; IS