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Scenario of serum electrolyte, lipid and thyroid profile in Type II Diabetes Mellitus of Kashmir Valley India

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Abstract
Diabetes Mellitus (DM) is a metabolic disease of great concern worldwide and is a global pandemic disease characterized by chronic hyperglycemia. Apart from other factors, the underlying mechanism pertaining to the electrolyte imbalance, lipid imbalance and thyroid imbalance has to be explored. Hence the study was designed to evaluate scenario of serum biochemical parameters, electrolyte and thyroid profile in the Type II Diabetes Mellitus (T2DM) in Kashmir valley India. This study is Hospital-based case-control study and was carried out in major referral SMHS hospital in Kashmir. In our study Cases (n-100) were composed of patients with Type II Diabetes Mellitus, and controls (n-100) were healthy volunteers. The study showed a significant increase in all lipid parameters, except HDL in T2DM patients on comparison with normal controls. Thyroid dysfunction has been frequently encountered in diabetic patients with hypothyroidism being the most common type of dysfunction as in our study the levels of serum TSH was significantly increased but T3 and T4 levels were significantly decreased in cases when compared to controls, while status of electrolytes showed significantly elevated sodium (hypernatremia), mild elevation of potassium (hyperkalemia), chloride (hyperchloridemia), but decrease in Magnesium levels (Hypomagnesaemia). These aberrations could be due to the hyper tonicity of blood and redistribution of water and electrolytes noticed in DM. It may be concluded that in type II DM, assessment of electrolytes, lipid and thyroid related abnormalities are important to monitor the prognosis of type II DM patients. Hence there is need for the routine assay of these above parameters in diabetic patients so that there will be improvement in the quality of life and reduce the morbidity rate in diabetic patients.

Keywords: fasting blood sugar (FBS), diabetes mellitus (T2DM), electrolytes, lipid profile, thyroid profile

Introduction

The term Diabetes Mellitus describes a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion and/or insulin action. Diabetes, for the whole world is not an epidemic anymore but has turned into pandemic (Rabia., *et al* 2018, Mushtaq., *et al* 2017) [1, 2]. The worldwide surveys reported that diabetes is affecting nearly 10% of the population also according to the World Health Organization projections, the prevalence of diabetes is likely to increase by 35% by the year 2025 (Asaduzzaman., *et al* 2018) [3]. India has high prevalence of diabetes and the numbers are increasing at an alarming rate also in India alone, diabetes is expected to increase from 40.6 million in 2006 to 79.4 million by 2030 (Mehta., *et al* 2009) [4].

The most common form of diabetes is type 2 diabetes which constitutes about 85 to 95% of all diabetes in developed countries (Yanling., *et al* 2014) [5], and accounts for an even higher percentage in developing countries. Type II diabetes is the most common form of the disease, accounting for about 90 to 95 % of all diagnosed cases of diabetes (Badyal and Kaur 2008) [6]. The incidence of type 2 diabetes is increasing among all age groups, including adolescents, among whom type 2 diabetes was formerly very rare (Metzger, 2006) [7] T2DM is mainly characterized by insulin resistance, but impairment in insulin secretion also occurs in type 2 diabetes (Tabassum., *et al* 2015) [8].

Diabetes is a global health problem and is a common endocrine problem associated with multiple disorders that include metabolic, cellular and blood disturbances. Type-II diabetes is a multi causal disease which develops slowly and initially, it commences with insulin resistance, which progress gradually with the passage of time (Vikram, *et al.*, 2013 *and* Shekhar., *et al* 2012) [9, 10]. The prevalence of DM is of great concern worldwide because 21% to 52% of new-onset type II DM is observed in young generation recently *(*Saddaf., *et al* 2017*)* [11].

The measurement of the lipid profile of diabetic patients is needed to investigate how the lipid metabolism is affected by diabetes, as they have different genetic compositions and lifestyles (Vibha., *et al* 2013) [23]. Thyroid diseases and diabetes mellitus are the two most common endocrinopathies encountered in clinical practice. Diabetes and thyroid disorders have been shown to mutually influence each other and an association between these two conditions has been reported in literature *(*Wild., *et al* 2004*)* [13]. So aim of this study was to analyze the status of serum electrolytes, lipid and thyroid profile in Type II Diabetes Mellitus in Kashmir Valley India.

Materials & methods

Sample collection: This case-control study was carried out at the Department of Biochemistry, Government Medical College (GMC), Srinagar, Research centre-University of Kashmir. A total of 100 cases (male 40 and female 60) of type 2 diabetes mellitus (T2DM) and 100 controls (Male 40 and female 60) were chosen. Subjects with high blood sugar in fasting were taken as cases. Non-diabetic patients visiting hospitals were taken as controls. Laboratory glucose tests were used to confirm the absence of diabetes in the control group. 3ml blood was collected by venipuncture from patients and healthy controls and was immediately transferred into two separate tubes, 2ml in green top Heparinized vial and 1ml in purple top EDTA vial.

Inclusion criteria: Age group: 10 – 80years.
Exclusion criteria: Pediatric age group (1-9 years), Patients with other ailments and metabolic disorders were excluded from the study.

Biochemical analysis: 3ml of fasting venous blood samples taken from cases and controls were transferred immediately into two separate tubes, 2 ml in green top heparinized vials for biochemical and electrolyte analysis and 1 ml in EDTA vials for HbA1c analysis. Plasma was separated and immediately tested for biochemical, thyroid hormones and electrolyte analysis. Thyroid profile was measured by chemi-luminescence Immunoassay method on Abbott C-1000 Auto-analyzer. The lipid profile, HbA1C, FBS and electrolyte levels were analyzed on Abbott C-4000 Auto-analyzer.
Stastical analysis: The Statistical software namely SPSS 16 was used for the analysis of the data. The results of cases and controls were compared by student' test. A p value of <0.05 was considered significant.

Results

In this study, 200 subjects were included in which 100 were diabetic and 100 were age matched healthy controls.

Age wise distribution of cases and controls: Clinical data was studied to find out the age and sex distribution of type II diabetes in the selected patients. It was observed that a highest number (35%) of patients belonged to the age group of 31- 40 yrs (Table I).

Table I: Age wise distribution of the study group

Age in years	Cases (n=100)		Controls (n=100)	
	No	%	No	%
10-20	6	6	6	6
21-30	25	25	25	25
31-40	35	35	35	35
41-50	17	17	17	17
51-60	12	12	12	12
61-70	3	3	3	3
71-80	2	2	2	2
Total	100	100	100	100
Mean ± SD	35.77±14.01		35.82±13.34	

Gender wise distribution of cases and controls: We also observed that majority of the patients (60%) were females and (40%) of the patients were males (Table II).

Table II: Gender wise distribution of the study group

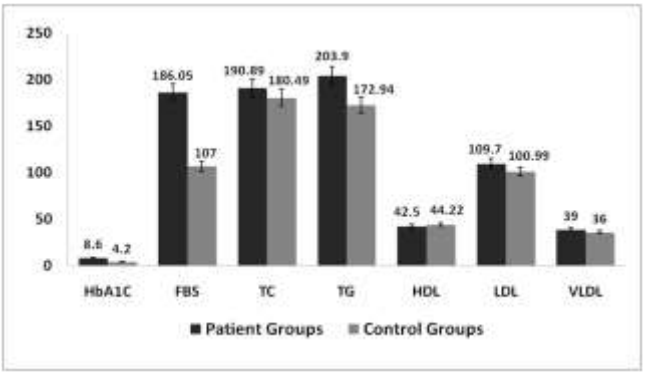
Gender	Cases	No %	Controls	No %
Male	40	40	40	40
Female	60	60	60	60
Total	100	100	100	100

Comparison of biochemical parameters in case and control group: Table III shows the biochemical measurements which includes HbA1C, FBS, TC, TG, HDL, LDL, and VLDL levels in both diabetic and control groups in which all parameters varied between cases and controls significantly (P <0.05) except HDL which was not varied significantly (P >0.05).

Table III: Biochemical characteristics of the study group.

Parameters	Type II Diabetics (n=100)	Control (n=100)	P * Value
HbA1C (%)	8.6 ± 1.80	4.2 ± 0.30	<0.05
FBS (mg/dl)	186.05 ± 79.57	107 ± 14	<0.05
TC (mg/dl)	190.89±6.708	180.49±5.24	<0.05
TG (mg/dl)	203.90±15.80	172.94±10.50	<0.05
HDL (mg/dl)	42.50±4.21	44.22±1.43	>0.05
LDL (mg/dl)	109.70±5.27	100.99±5.01	<0.05
VLDL (mg/dl)	39±2.99	36±2.40	<0.05

P * value < 0.05 then it is considered to be statistically significant

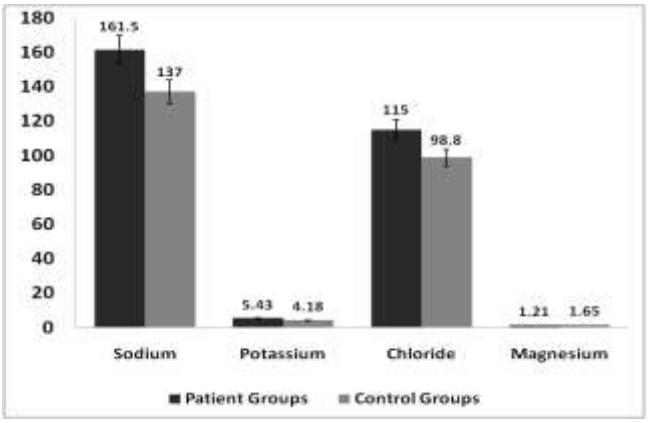


Graph 1: Biochemical Measurements in Type II DM and control group

Comparison of electrolyte profile in case and control group: In diabetic patients sodium levels were found to be high compared with controls and it is statistically significant (P<0.05). It was observed that the potassium and chloride levels were slightly elevated when compared with controls, which is also statistically significant. But there was significant decrease in magnesium level in type 2 diabetic patients as compare to controls (Table IV)

Table IV: Electrolyte profile in the study group

Parameters	Diabetes (n= 100)	Controls (n= 100)	P * Value
Sodium mmol/L	161.5 ± 8.7	137 ± 3.5	<0.05
Potassium mmol/L	5.43 ± 0.65	4.18 ± 0.79	<0.05
Chloride mmol/L	115 ± 5.60	98.8 ± 0.05	<0.05
Magnesium mmol/L	1.21±0.23	1.65±0.66	<0.05

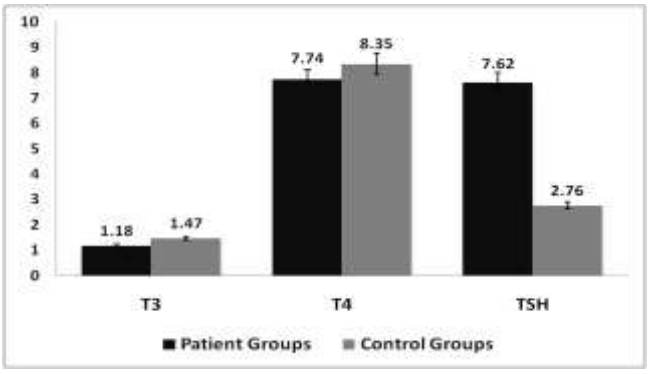


Graph 2: Electrolyte Measurements in Type II DM and control group

Comparison of thyroid profile in case and control group: The levels of T4 were significantly decreased in cases when compared to controls ($p<0.05$) and TSH were significantly increased in cases when compared to controls ($p<0.05$) (Table V). However, T3 levels in T2DM patients were found to be less than that of controls but the difference was not statistically significant. Graph 4.3 shows graphical representations of T3, T4 and TSH levels respectively in T2DM cases in comparison with controls.

Table V: Thyroid Parameters in the study group

Parameter	Cases (n= 100)	Controls (n= 100)	P value
T3 (ng/ml)	1.18 ± 0.89	1.47 ± 0.27	0.1002
T4 (µg/dl)	7.74 ± 3.89	8.35 ± 2.05	0.0023*
TSH (µIU/ml)	7.62 ± 6.72	2.76 ± 1.79	0.0048*



Graph 3: Thyroid Parameters in both Cases and Controls

Table VI shows the correlation of FBS with the electrolytes in which sodium was positively correlated. P* and r * values were found to be (P* 0.017 and r *0.224) which is statistically significant. FBS correlated positively with potassium. The P* and r * values were found to be (P* 0.031 and r * 0.017) and it shows significance. FBS was correlated positively with chloride and P* and r* value was found to be (P*0.04 and r*0.22) which is statistically significant. But FBS was correlated negatively with magnesium and P* and r* value was found to be (P* 0.048 and r* -0.179), and it was also found to be stastically significant.

Table VI: Correlation of FBS with the Electrolytes in Type II DM

Electrolytes		r * value	P * value
Sodium(Na^+)	FBS	0.224	0.017
Potassium (K^+)		0.0170	0.031
Chloride (Cl^-)		0.220	0.04
Magnesium (Mg)		-0.179	0.048

P* value < 0.05 then it is considered to be statistically significant

Discussion

Worldwide people are suffering from diabetes mellitus type 2 and it was likely to increase from current 415 million people to 642 million by 2040. In all developing countries it was seen that number of type 2 diabetes mellitus (T2DM) patients is increasing and 75% of people with diabetes mellitus are living in these developing countries (Satish., *et al* 2018) [14]. The fasting blood sugar level was significantly elevated in cases when compared to controls; these results are in accordance with the studies of Saddaf, *et al.*, and Reeta *et al. (Saddaf., et al.* 2017, *Reeta., et al* 2013*)* [11, 15].

The current study shows elevated levels of HbA1c, triglycerides, LDL and cholesterol in diabetic patients as compared to control group, this abnormal plasma lipid levels may increased risk of coronary heart disease and peripheral vascular disease to these diabetic patients because of the possibility of structural and functional abnormalities that may have impaired the lipid metabolism and transport system in diabetic patients, these findings are in support with the findings of Shaikh *et al*, Samatha *et al* and vinodmahato *et al.* (Shaikh., *et al.* 201, *Samatha P. et al.* 2012 and *VinodMahato., et al.* 2011*)* [16, 17, 18].

In our study it was found that sodium levels in diabetes patients were found high when compared to controls and sodium was correlated positively with glucose and it was found to be statistically significant, which supports the findings of George *et al* who found that there was elevation in the sodium levels in diabetic patients (George., *et al* 2014) [19], which may be due to the hyperglycemia-induced water movement out of the cells that lowers sodium and the glucosuria-induced osmotic diuresis, which tends to raise sodium concentration.

Present study shows that the DM patients were more prone to mild hyperkalemia, when compared to the healthy controls, Hyperkalemia is also associated with impaired insulin secretion and decreased peripheral glucose utilization which results in carbohydrate intolerance and hyperglycemia *(*Berker., *et al* 2008*)* [20]. In this study elevated serum Cl level in diabetic patients was found as compared to normal controls, which may be due to diabetic ketoacidosis *(*Pham., *et al* 2007) [21]. The current result shows significant decrease in Magnesium levels in Type 2 diabetic patients as compare to controls and this is in accordance with the study of *Pham. PC et al. (*Pham., *et al* 2007, Barbagallo., *et al* 2007*)* [21, 22], this hypomagnesemia may impair glucose disposal and contribute to cardiovascular disease, retinopathy, and nephropathy. From all these findings it was concluded that disorder in the levels of electrolyte profile may be considered as contributing factors to the occurrence of T2DM.

The result of the present study also showed that the levels of

T4 were significantly decreased in cases when compared to controls ($p<0.05$) and TSH levels were significantly increased in cases when compared to controls ($p<0.05$). However, T3 levels in T2DM patients were found to be less than that of controls but the difference was not statistically significant. These observations show a high incidence of abnormal thyroid hormone levels in diabetic patients, which is in accordance with studies of Vibha U *et al* and Pasupathi P *et al*. *(*Vibha*., et al* 2013 *and Pasupathi., et al* 2008*)* [12., 24]. The presence of both high and low thyroid hormone levels in diabetic patients be due to modified thyroid releasing hormone (TRH) synthesis and release and may depend on the glycemic status of diabetic patients.

Conclusion

It was concluded after sassing our results that the poor management often encountered in some treated and untreated diabetic patients, which may cause abnormal biochemical, electrolyte, lipid and hormone levels. So there is need for the routine assessment of these above profile parameters in diabetic patients during the follow up, which will be of great benefit and may act as prognostic marker for diabetic patients. Due to this there will be an improvement in the quality of life and reduce the morbidity rate in diabetic patients

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Conflict of interest: Authors declare that they have no conflict of interests.

Author's contribution: All the authors have contributed equally. All authors read and approved the final manuscript.

References

1. Rabia Farooq, Sabhiya Majid b, Showkat Ahmad Bhat, Shajrul Amin, Mohammad Hayat Bhat d, Hilal Ahmad Wani, Parvaiz Ahmad Shah. Association of adiponectin gene polymorphism with type 2 diabetes and metabolic syndrome. Translational Metabolic Syndrome Research 2018; 1:39-47.
2. Mushtaq Ahmad Bhat, Showkat Ahmad Bhat, Sheikh Bilal Ahmad, Wasim Qureshi, Sabhiya Majid, Aarif Ali, Ishraq Hussain, Tehseen Hassan, Muneeb U. Rehman, Manzoor R. Mir. Biochemical profile and genetic polymorphism of MTHFRC677T in risk of type 2 diabetes mellitus. Int J Diabetes Endocrinol. 2017; 2(2):19-25.
3. Asaduzzaman M, Chowdhury S, Shahed JH, Kafi MA, H, Uzzaman MN, Flowra MT, Ahmed MM. Prevalence of Type 2 diabetes mellitus among urban Bihari communities in Dhaka, Bangladesh: A Cross-sectional study in a minor ethnic group. Cureus, 2018:10:1.
4. Mehta SR, Kashyap AS, Das S. Diabetes mellitus in India: The modern scourge. Medical journal armed forces India, 2009: 65:50-54.
5. Yanling Wu, Yanping Ding, Yoshimasa Tanaka, Wen Zhang. Risk Factors Contributing to Type 2 Diabetes and Recent Advances in the Treatment and Prevention. Int J Med Sci. 2014; 11; 11:1185-1200.
6. Badyal DK, Kaur J. Sitagliptin: a new class of oral drug for type 2 diabetes. Jk Science, 2008; 10(2):93-98.
7. Metzger BE. The global increase in diabetes: Unique issues for mothers and children. International Journal of Diabetes in Developing Countries, 2006; 26:2.
8. Tabassum Rashid, Bhat SA, Mohd Urfan Wani, Sabhiya Majid, Iffat Hassan, Sabiya Rashid, Ahmad Arif Reshi. The lipid peroxidation and antioxidant status of type 2 diabetic patients in Kashmir (India). Int J Diabetes Dev Ctries. 2015.
9. Vikram BV, Shubhangi AK, Krunal KT, Anu NG, Meenakshi K, Rajani RA. Thyroid Dysfunction In Patients With Type 2 Diabetes Mellitus At Tertiary Care Centre National Journal Of Medical Research. 2013; 3(4):377-380.
10. Shekhar CY, Alwin S, Biswajit M. Status of Thyroid Profile in Type-2 Diabetes Mellitus. Journal of Nobel Medical College. 2012:1; 2:64-71.
11. Saddaf Naaz Akhtar, Preeti Dhillon. Prevalence of diagnosed diabetes and associated risk factors: Evidence from the large-scale surveys in India. Journal of Social Health and Diabetes. 2017; 5:28-36
12. Vibha U, Vij C, Bedi GK, Vij A, Banerjee BD. Thyroid disorders in patients of type 2 diabetes mellitus. Indian Journal of Clinical Biochemistry, 2013; 28(4):336-341.
13. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes. Diabetes Care, 2004; 27:1047-1053.
14. Satish Basanagouda Biradar, Anasuya Sangaraj Desai, Sangappa Virupaxappa Kashinakunti1, Manjula Rangappa, Gurupadappa Shantappa Kallaganada, Basavaraj Devaranavadagi. Correlation between glycemic control markers and lipid profile in type 2 diabetes mellitus and impaired glucose tolerance. International Journal of Advances in Medicine. 2018, 5(4)832-837.
15. Reeta T, Bindu SM, Smita M. Evaluation of Thyroid Dysfunction in Type II Diabetes Mellitus: A Case Control Study. International Journal of Current Medical and Applied Sciences. 2013; 1(1):16-20.
16. Shaikh MA, Kumar S, Ghouri RA. Type 2 diabetes mellitus and lipid abnormalities. Jlumhs, 2010; 9(3):145.
17. Samatha P, Venkateswarlu MSPV, Siva Prabodh V. Lipid profile levels in type 2 diabetes mellitus from the tribal population of Adilabad in Andhra Pradesh, India. Journal of clinical and Diagnostic Research. 2012; 6(4):590-592.
18. VinodMahato R, Gyawali P, Raut PP, Regmi P, Psd K., Singh DRP, Gyawali P. Association between glycaemic control and serum lipidprofile in type 2 diabetic patients: Glycated haemoglobin as a dual biomarker. Biomedical Research. 2011; 22(3):375- 380.
19. George Liamis, Evangelos Liberopoulos, Fotios Barkas, and Moses Elisaf. Diabetes mellitus and electrolyte disorders. World J Clin Cases. 2014; 10:488-496.
20. Berker D, Aydin Y, Arduç A, Ustün İ, Ergün B, Guler S. Severe hyponatremia due to rosiglitazone use in an elderly woman with diabetes mellitus: a rare cause of syndrome of inappropriate antidiuretic hormone secretion. Endocrine Practice. 2008; 14:8.
21. Pham PCT, Pham PMT, Pham SV, Miller JM, Pham P. TT. Hypomagnesemia in patients with type 2 diabetes. Clinical journal of the American Society of Nephrology. 2007; 2(2):366-373.

22. Barbagallo M, Dominguez LJ. Magnesium metabolism in type 2 diabetes mellitus, metabolic syndrome and insulin resistance. Archives of biochemistry and biophysics. 2007; 458(1)40-47.
23. Vibha U, Vij C, Bedi GK, Vij A, Banerjee BD. Thyroid disorders in patients of type 2 diabetes mellitus. Indian Journal of Clinical Biochemistry. 2013; 28(4):336-341.
24. Pasupathi P, Bakthavathsalam G, Saravanan G, Sundaramoorthi R. Screening for thyroid dysfunction in the diabetic/non-diabetic population. Thyroid science. 2008; 3(8):1-6.