An Elsevier Indexed Journal ISSN-2230-7346

Journal of Global Trends in Pharmaceutical Sciences

STUDY THE EFFECT OF FASTING BLOOD GLUCOSE, SODIUM AND POTASSIUM LEVEL IN SERUM OF IRAQIYOUNG WOMENPATIENTS WITH INSULIN DEPENDENT DIABETES MELLITUS (TYPE 1)

Iman Hashim , Abdul Razzaq, Jinan Hussein Murtadha

Department of Chemistry, College of Science for Women, University of Baghdad, Iraq

*Corresponding author E-mail: imanhashim29@yahoo.com

ARTICLE INFO

Key Words

Diabetes mellitus Type 1, Sodium, potassium level

ABSTRACT

Diabetes mellitus is one of the most common disease in all populations with different aged .Type 1 or juvenile diabetes results from body's failure to produce insulin. This study evaluates the glucose level and electrolytes: sodium and potassium in patients with diabetes type 1. Sixty individuals of Iraqi women(adults)were divided in to three groups , twenty patients (14 – 20 years) and twenty patients (24 -30 years) and the remain were taken as healthy female (control) . The mean value of glucose was increased to 235.65 mg/dl in patients with aged (24 – 30 years) while it was 204.62 mg/dl in all patients. Also the sodium and potassium level were raised compared with healthy female. The effectof insulin therapy in patients that have less than ten unitswas significant ($p < 0.05$) more than they have ten units on their glucose level .The correlation between sodium and potassium was positively and highly significant ($P<0.01$) compared with glucose and sodium or potassium. There is a significant difference between durations of age and fating blood glucose level.

INTRODUCTION

Diabetes mellitus is a heterogeneous group of metabolic disorder characterized by high blood glucose level with alteration in carbohydrate, lipid and protein metabolism resulting from defects in insulin secretion or action [1]. Type 1 diabetes mellitus, previously known as insulin-dependent diabetes or juvenile results due to autoimmune progressive destruction of insulin-producing and macrophages infiltrating the islets [2]. The one and only therapeutic option the life-long supplementation of insulin or it's analogues-was established, affected of type 1 diabetes have been performed, the underlying causes and mechanisms are still far from being completely understood [3] . Insulin therapy is the mainstay of medical management of type 1 diabetes. A variety of insulin regimens can be used , but a few have been studied specifically in children with new-onset diabetes . The choice of insulin regimen depends on many factors, including the child's age, duration of diabetes, family life style , socioeconomic factors and family , physician and patient preferences . Regardless of the insulin regimen used, all children should be treated to meet glycemic targets [4] .Electrolyte is a substance whose components dissociate in solution into

positively (cation) and negatively (anion) charged ions . The electrolytes of physiological importance include Ca^{+2} , Mg^{+2} , K^{+} , Na^{+} , Po_4^{-2} , etc . The total number of positive charges balances the number of negative charges to achieve electrical neutrality. Kidney is the main organ for regulating fluid and electrolyte balance as well as excreting the waste products [5] . Electrolytes are present in the human body and they play an important role in many body processes, such as controlling fluid levels, acid-base balance (pH) , nerve conduction , blood clothing and muscle contraction . Sodium, potassium and calcium are all important for proper electrolyte balance. Electrolyte imbalance resulting from kidney failure , dehydration , fever and vomiting has been contributed as factors toward compilations observed in diabetes and disorders [6] . Increases in plasma glucose concentration can lead to changes in plasma sodium concentration through several mechanisms. Elevations in glucose concentration increase plasma tonicity , creating an osmotic driving force that favors the movement of water from the intracellular space to the extracellular space , therapy diluting thee extracellular concentration of sodium , the plasma sodium level is usually low as a result of this osmotic flux of water [7] . Yurdakokand Oran [8] had reported the relationship between serum electrolyte and blood glucose levels, a positivecorrelation was found between blood glucose and sodium levels in the children in cases of sever metabolic acidosis . The incidence of hyperkalemia is higher in diabetic patients than in the general population , redistribution of potassium from intracellular to the extracellular compartment (shift hyperkalemia) can induce hyperkalemia with no net total body K^{+} increase in many cases include acidosis , insulin deficiency , hypertonicity , rhabdormyolysis and drugs such as beta blockers . Reduced glomerular filtration of K^{+} due to acute kidney injury and chronic kidney disease and many drugs that interfere with potassium excretion are associated with hyperkalemia [9] . The secretion of insulin is tightly linked to plasma glucose levels by a closed loop feedback, which allows glucose levels to remain tightly controlled within a narrow range (70 – 120 mg/dl) , the incidence of type 1 diabetes is increasing worldwide, especially in younger children . The a adolescence is associated with increasing insulin resistance and leads to an increase in insulin requirements 1.2 – 1.6 u/kg/day during this period [10] . This study aims to identify the relationship of serum electrolytes (sodium and potassium) with fasting blood glucose levels in type 1 of diabetes patients .

Materials and methods: In the present study, blood samples were collected from the AL-Tib city hospital in Baghdad – Iraq. Sixty female patients were divided in to three groups , each group include 20 persons as follows : Group (1) and group (2) type 1 with age (14 – 20) years and (24 – 30) years respectively and group (3) was a control group (healthy persons) with age (25-75) years . All subjects were having blood to measure fasting blood sugar and electrolytes: sodium and potassium. Five milliliter of blood sample was collected from a vein puncture after fasting (8 – 10 hours) using a disposable plastic syringe. The blood was collected and separated by centrifuge at 3000rpm for 10 min to obtain serum sample. The serum samples were analyzed for fasting blood sugar test and they were measured by the glucose oxidase method [11], sodium test by method [12] and potassium was measured by Reflotron apparatus

Statistical analysis: The results were analyzed statistically by using statistical analysis system (SAS). Correlation between parameters were assessed ($p<0.01$) , ($p<0.05$) were considered statistically significant [13] .

RESULTS AND DISCUSSION

Fasting blood glucose (FBS): The Table (1) showed the significant differences ($p<0.05$) between levels of blood glucose concentration in patients in each periods compared with control (healthy group) . Also , there is significant differences between two periods . The highest of fasting blood glucose concentration in the female patients with aged (24 – 30) years was 235.65 mg/dl while it's reached 172.85 mg/dl in patients (14 – 20) year compared with healthy female was 97.65 mg/dl . The significant differences ($p<0.05$) was found between fasting blood glucose with female patients in all aged compared with healthy female . The blood glucose concentration in female diabetes type 1 was 204.62 mg/dl as shown in table (1).

Sodium level: The present study indicated the significant differences between the concentration of sodium for each aged period and healthy female ($p<0.05$) . Sodium level elevated to 150.05 mEq/L in female patients with aged (14 – 20 years) while it increased to 148.15 mEq/L compared with healthy female was 141.05 mEq/L as illustrated in figure (2) .

Potassium level: The statistical results illustrated the elevated of potassium concentration was 6.02 mEq/L in the female patients with aged (14 – 20 year) while it was reached to 6.06 mEq/L with aged (24 – 30 years) compared with healthy female was 4.19 mEq/L as shown in figure (3) .

Table (3) and Table (4) indicated the elevated of sodium concentration to 149.26 mEq/L , also the increased of potassium concentration to 6.03 mEq/L in female patients with diabetes type 1 in all aged compared with healthy female . The present results illustrated the significant differences between them ($p<0.05$) .

Effect of aged in fasting blood glucose, sodium and potassium levels for female diabetes type 1: The results illustrated the significant differences($p<0.05$) in blood glucose level between the female aged (14 – 20) years and (24 – 30) years while there is no significant differences in sodium and potassium level as shown in Table 4 .

The effect of insulin therapy in fasting blood glucose, sodium and potassium for female patients with diabetes type 1: Type (5) showed the significant differences between glucose level for female that have insulin units less than ten unit per day , the glucose concentration was 135.14 mg/dl while it was reached 244.52 mg/dl for female that have more than ten unit per day .There is no significant differences between sodium and potassium level for different units of insulin

The correlation between glucose, sodium and potassium level in diabetes mellitus type 1: The results in Table (6) inculcated , there is a strong correlation ($p<0.01$) between glucose , sodium and potassium level .The highest correlation factor (r) was 0.58 between sodium and potassium level while it was reached to 0.47 between fasting blood glucose and potassium level . Also the correlation factor was 0.34 between fasting blood glucose and sodium level. According to our results in fig (1) and table (1) , the glucose level raised in patients with diabetes mellitus type 1 in different aged , these finding maybe contributed to the absolute lack of insulin production due to autoimmune destruction of the insulin-producing beta cells of the pancreas , about 80 – 90 percent of beta cells will have been destroyed [14] .

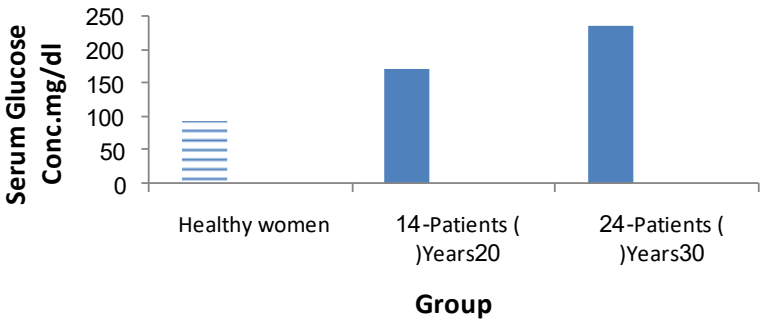

Fig (1): The level of glucose in female patients with diabetes of type 1 compared with healthy female

Table (1): The effect of diabetes type 1 on the fasting blood glucose for female patients compared with healthy female.

Group	Mean ± standard error	P – value
Healthy female	B 97.65 ± 3.17	< 0.05
Patient female	A 204.62 ± 8.41	< 0.05
LSD		

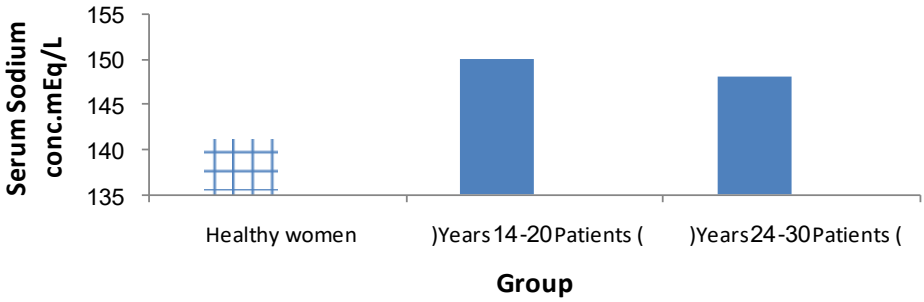

Fig (2) : The sodium level of female patients of diabetes type 1 with different aged periods compared with healthy female

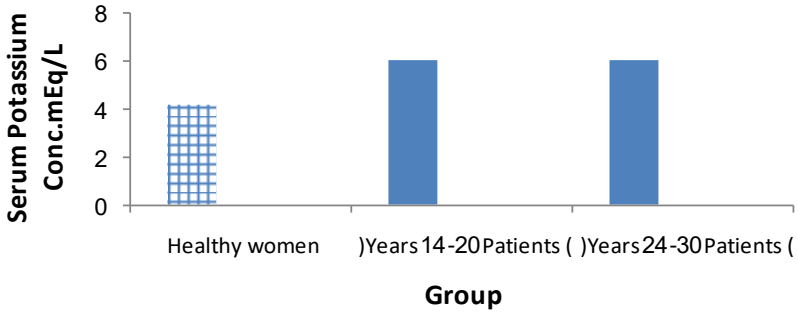

Fig (3) : The potassium level of female patients of diabetes type 1 in different periods aged compared with healthy women .

Table (3): The effect of diabetes type 1 in sodium concentration for female patients compared with healthy female.

Group	Mean ± standard error	P – value
Healthy female	B 141.05 ± 0.76	< 0.05
Patient female	A 149.26 ± 1.22	< 0.05
LSD	4.002 *	

Table (4): The effect of diabetes type1 in potassium concentration for female patients compared with healthy female .

Group	Mean ± standard error	P – value
Healthy female	B 4.19 ± 0.12	< 0.05
Patient female	A 6.03 ± 0.26	< 0.05
LSD	0.188 *	

Table 4: The effect of aged in fasting blood glucose, sodium and potassium level for patients with diabetes type 1

Groups	Mean ± standard error		
	Glucose (mg/dl)	Sodium (mEq/L)	Potassium (mEq/L)
Female patients (14 – 20 years)	B 172.85 ± 1.06	A 150.05 ± 1.10	A 6.02 ± 0.24
Female patients (24 – 30 years)	A 235.65 ± 21.62	A 148.15 ± 1.03	A 6.06 ± 0.26
LSD	33.82 *	NS 3.52	NS 2.69
(p<0.05) * , NS : No Significant			

Table (5): The effect of insulin therapy in fasting blood glucose concentration, sodium and potassium level for female patients with diabetes type 1.

Number of insulin units per day	Mean ± standard error		
	Glucose (mg/dl)	Sodium (mEq/L)	Potassium (mEq/L)
Less than 10 units	B 135.14±2.93	A 148.14± 1.58	A 6.11± 0.45
More than 10 units	A 244.52±19.90	A 149.90± 1.04	A 6.12 ± 0.24
LSD	47.92 *	NS 3.011	NS 0.766
(p<0.05) * , NS : No Significant			

Table (6): The correlation between levels of fasting blood glucose, sodium and potassium for female patients with diabetes mellitus type 1

Parameters	Correlation factor	Significance
Fasting blood glucose (FBS) and sodium	0.34	**
Fasting blood glucose (FBS) and potassium	0.47	**
Sodium and potassium	0.58	**
(p<0.01) **		

Szablewski [15] had studied the effect of insulin hormone that regulation of peripheral glucose uptake,hepatic glucose production and glucose uptake during carbohydrates ingestion. The results illustrated the elevated of sodiumconcentration to 149.26 mEq/L compared with healthy female as shown in figure (2) and Table 2 due to diabetes mellitus , the increased frequency of electrolyte abnormalities factors especially impaired renal function , acid-base disorders , malabsorption and multidrug regimens [16] Totan and Greaby [17] have illustrated the effect chronic hyperglycemia on electrolytes and they found the Na^+ , K^+ATP ase is ubiquitous enzyme that ensures that trans membrane gradients of sodium and potassium concentrations .The elevated of sodium level in this study maybe returned the alterations of this transport enzyme that be linked to several complications of diabetes mellitus . The closely associated with increased proximal renal tubular sodium reabsorption and suppression of membrane sodium-potassium ATP ase activity together with inadequate stimulation of the pump leads to a transitory sodium cell retention [18] . In the present study , potassium level raised to 6.03 mEq/L as shown in figure (3) and Table (3) maybe contributed to Acidosis in diabetes which causes hydrogen ions to move from the extracellular fluid in to the intracellular space . Hydrogen movement into the cell promotes movement of potassium out 0f the cell into the extracellular compartment [19] . Feliget *al* [20] had studied the hormonal interactions in the regulation of blood glucose and they reported the elevated of serum potassium due to an extracellular shift of potassium caused by insulin deficiency , acidemia and hyper tonicity . This study agree with investigation of syedet *al* [21] they had indicated the serum sodium and potassium levels were increased significantly in patient with diabetes mellitus as compared with healthy subjects . Table (5) shows the effect of insulin therapy in female that have less than ten units of Insulin per day compared with they have more than ten units that maybe returned to intensification of insulin therapy is often necessary to maintain glycemic control in patients as disease progresses , this include switching to or adding another type of insulin or increasing the number of injections per day [22].Brown , *et al* [23] illustrated the mechanism of action of insulin in diabetic patients by the low-dose insulin infusions lower the blood glucose concentration entirely by reducing glucose production from the liver and lowered blood glucose concentration by increasing glucose uptake by peripheral fat and muscle tissues or reducing glucose production.

CONCLUSION:

The investigation of various biochemical parameters for healthy (control) and diabetic patients with different aged had indicatedthe significant increase of fasting blood glucose , sodium and potassium level in different aged compared with control . The significant effect of insulin therapy on fasting blood glucose while thereis a highest correlation factor between sodium and potassium.

REFERENCES

1. Kitabchi , A.E.; Umpierre , G.E ; Murphy , M.B.; Kriesberg , R.A.2006 .Hyperglycemic crisis in adult patients with diabetes : A consensus statement from the American diabetes association . Diabetes. Care. 29: 2739 – 2748.
2. Foulis , A.K., Mc Gill M . and Farquharson , M.A. 1991 . Insulitis in type 1 (insulin – dependent) diabetes mellitus in man – macrophages , lymphocytes and interferon-gamma containing cells . Pathology .Vol.165 (2) pp. 97 – 103.
3. Forouchi , N.G. and Merrick , D. 2006 . Diabetes prevalence in

England , 2001

4. Estimates from an epidemiological model. Diabet . med., 23(2) : 189 – 197 .
5. Celine, H.M., Beth, M. and Daniele, P. 2013. Type 1 diabetes in children and adolescents. Can. Diabetes. 37: 153 –162.
6. Dileep, N.L., Andrew , J.P.L. and simon , P.A. 2013 . Basic concepts of fluid and electrolyte therapy , Sweden , ERAS , 24 .
7. Kitabchi , A.E, Umpierrez , G.E., Miles , J.M.andFisher , J.N.2009 Hyperglycemic crises in adult patients with diabetes . Diabetes. care. 32: 1335 – 43 .
8. Husain, F., Arif, M., Sheikh , M., Nawaz , H., Jamil , A. 2009 . Trace elements status in type 2 diabetes. Bangladesh. Med. Sci ., 8 : 52 – 56
9. American Diabetes Association. 2000 . Type 2 diabetes in children and adolescents pediatrics . 105(3) : 671 – 680 .
10. Palmer , B.F. 2004 . Managing hyperkalemia caused by inhibitors of the renin – ongiotensin – aldosterone system . Engl. Med .. Vol. 35(1) : 585 – 592 .
11. Eesh , B . and Ajay , A. 2007 . Insulin therapy for patients with type 1 diabetes . Japi . 55: 29 – 40
12. Trinder , P. 1969 . Ann . Clin.Biochem . 6(24) : 331 – 338 .
13. Deeg ,R.and Ziegenhorn.1983.Clinchem chemistry.Clinical.12(3):63.
14. SAS . 2012 . Statistical analysis system , user's guide . Statistical version 9.1thed. SAS . Inst. Inc . Cary. N.C. USA.
15. Todd , J.A. 2010 . Etiology of type 1 diabetes. Immunity. 32 : 457 – 67 .
16. Szablewski,L.2011.Glucose homeostasis and insulin resistance.Bentham.189(2):520-588.
17. George , L., Evangelos , L., Fotios , B . and Moses , E. 2014 . Diabetes mellitus and electrolyte disorders . world . clin . cases ., 2(10) : 488 – 496.
18. Totan , A.R. and Greaby , M. 2002 . Effect of chronic hyperglycemia and vanadate treatment on electrolyte Na^+ , K^+ , ATP ase and Mg^{++} , ATP ase in streptozotocin in diabetic rats . Acta . Pol . Pharm., 59: 307 – 11 .
19. We der , A.B. 1994 . Sodium metabolism, hypertension and diabetes . Am. Med. Sci., 307(1) : 553 – 559 .
20. Brenner , Z.R. 2006 . Management of hyperglycemic emergencies , Advanced Critical Care. , 17(1) : 56 – 65 .
21. Felig , P., Sherwin , R.S. and Soman , V. 1979 . Hormonal interactions in the regulation of blood glucose . Recent . Prog. Horm. Res., 35 : 501 – 32 .
22. Syed , S., Roomana , R. and Tabassum , M. 2005 . Electrolytes and Sodium transport mechanism in diabetes mellitus . Pakistan . pharm . Sci . Vol . 8 (2) : 6-10 .
23. Hitoshi , I ., Yasuo , T., Hideaki , J., Masanori , T., Masakazu , T. and Takeshi , I. 2013 . Effect of insulin changes on quality of life and glycemic control in Japanese patients with type 2 diabetes mellitus : The insulin – changing study intending to gain patients insights into insulin treatment with patients – reported health outcomes in actual clinical treatments (INSIGHTs) study . Diabetes . Investigation , 4(6) : 560 – 569 .
24. Brown , P.M., Tompkins , C.V., Juul , S. and Sonksen , P.H. 1978 . Mechanism of action of insulin in diabetic patients : a close – related effect on glucose production and utilization , British . Med., 1, 1239 – 1242 .