ORIGINAL RESEARCH PAPER

Medicine

BIOCHEMICAL EFFECTS OF DIABETES AT OUTPATIENT DEPARTMENT KING KHALID HOSPITAL, HAIL,2016.

KEY WORDS: investigate the effects of diabetes on biochemical parameters

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ABSTRACT

Diabetes mellitus is one of the most serious public health problems, faced by both developed and developing countries. Patients with Diabetes often show an unusual biochemical profile. therefore, the aim of the present study was to investigate the evaluation of biochemical parameters in diabetic patients.
Venous blood samples collected from 100 subjects (50 normal and 50 diabetics, and serum analyzed for glucose, ALT, ALS, Total cholesterol, BUN, Creatinine, Triglycerides, calcium and sodium).
All biochemical parameters were measured following standard analytical procedure and show highly significant.

1.1 Introduction

Diabetes Mellitus (DM) is a major health problem worldwide in recent time , and Asia and Africa are the most viable area where the disease is feared to rise 2-3 folds (Jamkhande et al., 2010) it is a metabolic disorder characterized by hyperglycemia and insufficiency of secretion or action of endogenous insulin (Maritim et al., 2002) the sustained hyperglycemia attacks both microvessels throughout the body and leads to various complication like blindness , neuropathy , end stage kidney disease , liver damage and cardiovascular events (Tea and Henrik, 2009) , increased progression of diabetic tissues damage and induced change in the activities of antioxidant enzymes in various tissues (Ceriello, 2000 and ahmed, 2005)

In diabetes mellitus, oxidative stress seems mainly to be due to an increased production of free radicals and/or sharp reduction of antioxidant defenses (Low et al., 1997; Giugliano et al., 1996) free radical production caused by hyperglycemia may occur via at least four different routes;Increased glycolysis Intercellular activation of sorbitol pathway Auto-oxidation of glucose nonenzyematic protein glycation (Williamson et al., 1993)

Calcium is an element that plays an important role not only in skeletal mineralization but also in a wide range of biological functions. Diabetes mellitus is a heterogeneous group of metabolic disorder characterized by high blood glucose level (hyperglycemia) with alteration in carbohydrate, lipid and protein metabolism resulting from defects in insulin Secretion and/or action (Maritim et al., 2003)

DM is classified into insulin –dependent diabetes mellitus (T1DM) and non-insulin-dependent diabetes mellitus (T2DM) on the basis of the history, etiology and clinical presentation of the patient (Fujisawa et al., 2004)

T1DM is a lifelong metabolic disorder characterized mainly a deficiency in endogenous insulin production caused by destruction of insulin –producing beta-cells of the endocrine pancreas. consequently, the patients become dependent on exogenous insulin administration () T1DM is the most common childhood disease in the developed world and is treated with a complex regime of insulin injections, diet and exercise (Kakleas et al., 2009)
On the other hand, T2DM is characterized by insulin resistance (IR), which plays a major role in metabolic abnormalities such as dyslipidemia and hypertension (Goldstein, 2002). T2DM is a polygenic disorder as is T1DM that may be triggered by genetic and environmental factors, including lifestyle habits (Hyer and shehata,2005). Currently, more than 250 million people worldwide suffer from T1DM and T2DM, and this could increase to 350 million within the next 20 years (Hyer and shehata,2005)

Diagnosis of Diabetes and prediabetes:

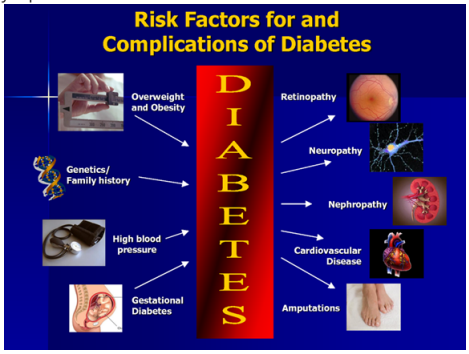
Blood tests are used in the diagnosis of diabetes and prediabetes. lab analysis of blood is needed to ensure that the test results are accurate. Glucose measuring devices used are not accurate enough for diagnosis but may be used as a quick indicator of high blood glucose. Testing enables to find and treat diabetes before complications occur and to find and treat prediabetes. This can delay or prevent diabetes from developing. Mass screening programmes have used glucose measurements of fasting, post parandial or random blood sample.

Blood Test Levels for Diagnosis of Diabetes and Prediabetes

	A1C (percent)	Fasting Plasma Glucose (mg/dL)	Oral Glucose Tolerance Test (mg/dL)
Diabetes	6.5 or above	126 or above	200 or above
Prediabetes	5.7 to 6.4	100 to 125	140 to 199
Normal	About 5	99 or below	139 or below

Definitions: mg = milligram, dL = deciliter
For all three tests, within the prediabetes range, the higher the test result, the greater the risk of diabetes.

Fig(1): the blood test levels for diagnosis of diabetes and prediabetes. Main symptoms of diabetes include increased urination, increased thirst, fatigue, weight loss, blurred vision, increased hunger and aerodromes. Any test used to diagnose diabetes requires confirmation with a second measurement unless clear symptoms of diabetes exist.



Complication of diabetes on liver and kidney:

The liver is a central and essential organ and DM related

complications of liver includes, abnormal liver enzymes, nonalcoholic fatty liver disease (NAFLD), cirrhosis, hepatocellular carcinoma, and acute liver failure.Patients with DM have a high prevalence of liver disease, and patients with liver disease have a high prevalence of DM(Trombetta et al., 2005)

Numerous studies have confirmed a fourfold increased prevalence of hepatocellular carcinoma in patients with DM, as well as an increased prevalence of diabetes in patients with hepatocellular carcinoma (El-serag et al., 2004)

The pathogenic sequence of events leading to hepatocellular carcinoma appears to be insulin resistance, increased lipolysis, lipid accumulation in the hepatocytes, oxidative stress, and cell damage followed by fibrosis and cell proliferation, which are procarcinogenic (Kazachkov et al., 1998)

The kidneys are the main part of human excretory as they regulate homeostasis by excretion of waste products of metabolism. The most important glomerular lesions seen in IDDM are capillary basement membrane thickening, diffuse mesangial sclerosis and nodular glomerulosclerosis.

The glomerular capillary basement membranes are thickened throughout their entire length, but lesions can be also being seen in the tubular structures and surrounding tissue (Perrin,2006) Reduced survival of the podocytes that embrace the glomerular capillaries may also accompany the early progressive nephron damage(Wolf,2005).

The disease advances at an individual rate over the course of several years, but ultimately most of the glomeruli will be destroyed and the patients will suffer from insufficient filtration ability (Bloomgarden,2008)

3. Material and methods:

The study was carried out at College of Applied Medical Sciences, Hail University, and the subjects were selected from the outpatient department of King Khalid Hospital, Hail. Total of 100 subjects were included in the study. out of two groups were formed; 50 diabetic patients and 50 normal, according to American Diabetes Association patient have fasting glucose >7mmol/l will be diabetic. After overnight fasting 8ml of venous blood sample was collected in clean glass tube. for further biochemical investigations serum was separated by centrifugation at 3000 rpm for 10 min and kept at -20 C until analysis.

Chemical and techniques:

Serum analysis for fasting glucose, serum ALT, serum ALS, BUN, total cholesterol, creatinine, calcium and sodium.

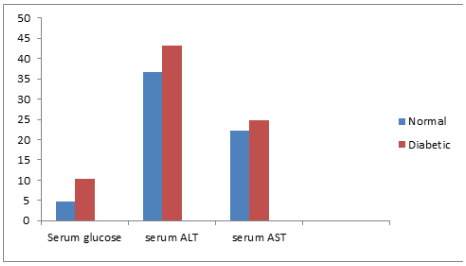
Result and Discussion

The diabetic patients showed a very highly significant increase in serum glucose level and serum ALT as compared with normal subject whereas showed a non-significant increase in serum AST level as compared with normal subject.

Parameters	Normal subject	Diabetic subject
Serum Glucose	**4.79 ±0.09**	**10.21***±0.42**
Serum ALT	**36.65 ±1.94**	**43.10**±3.33**
Serum AST	**22.28 ±1.41**	**24.89±3.02**

***very highly significant

Figure1:



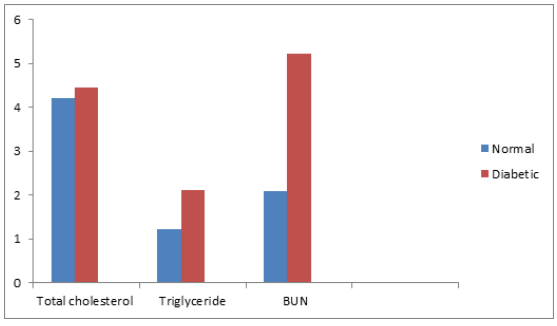
Result:

The diabetic patients showed a highly significant increase in serum Triglyceride level and serum BUN as compared with normal subject whereas showed a non-significant increase in total cholesterol level as compared with normal subject.

Parameters	Normal subject	Diabetic subject
Total cholesterol	4.21±0.18	4.46±0.17
Triglyceride	1.23±0.12	2.11***±0.17
BUN	2.09±0.17	5.23***±0.55

***very highly significant

Figure 2:



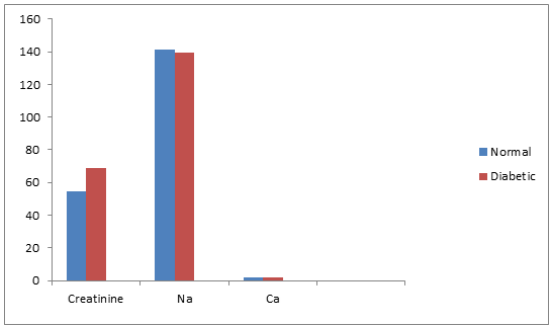
Result:

The diabetic patients showed a highly significant increase in serum creatinine level as compared with normal subject whereas showed a non-significant decrease in serum NA and increase in CA level as compared with normal subject.

Parameters	Normal subject	Diabetic subject
Creatinine	54.71±1.88	68.67***±3.26
Na	141.19±1.50	139.26±0.59
Ca	2.09±0.06	2.18±0.04

***very highly significant

Figure 3:



Discussion:

Kidneys maintain optimum chemical composition of body fluid by acidification of urine and removal of metabolic wastes such as urea, uric acid, creatinine and ions (Virdi et al., 2003). The elevated levels of serum creatinine and blood urea nitrogen are significant markers of renal dysfunction reflecting a decline in the glomerular filtration rate (Mauer et al., 1981) and are considered to be an index of DN, one of the most common microvascular complication of DM where an uncontrolled increase in cellular glucose in kidney in seen (Balakumar et al., 2008). Metabolic factor such as advanced glycation end products (AGEs) sorbitol, beyond blood glucose level are also implicated in the pathogenesis of DN (schrijvers et al., 2004) Moreover, increased lipid oxidation is also thought to trigger DN (Chisolm et al., 1992). This complication is associated with albuminuria and proteinuria (Balakumar et al., 2008). Our results showed a very highly significant increase in the levels of urea and creatinine in diabetic patients when compared with normal patients. These results indicated that diabetes might lead to renal dysfunction.

Liver is regarded as the central metabolic organ in the body, with an important role in glucose and lipid homeostasis (Saravanan and Pari, 2003). In the present study the serum enzyme activities of AST, ALT were increased in diabetic patients. In diabetic patients, the change in the levels of AST and ALT are directly related to

changes in metabolism in which the enzymes are involved (Udayakumar et al., 2009).

The increased activities of transaminases, during DM, could relate to excessive accumulation of AAs (glumate and alanine) in the serum of diabetic patients as result of AAs mobilization from protein stores. These excessive AAs are then converted to ketone bodies (Alpha – keto-glutaric and pyruvate) for which the enzyme GOT and GPT (AST and ALT) are needed, leading to increased enzyme activity.

Insulin resistance may play a pivotal role in the development of diabetic dyslipidemia by influencing several factors.Statins (HMG-CoA reductase inhibitors) The primary actions of statins on lipoprotein metabolism are mediated by increased LDL receptor activity, although reduced hepatic lipoprotein secretion also appears to play an important role. In addition to LDL lowering, statins can, to varying degrees, lower plasma triglyceride levels and raise HDL cholesterol. Statins lower plasma levels of all LDL subclasses and IDL to an equivalent extent, although greater lowering of small LDL has been reported in conjunction with triglyceride reduction (58). Nevertheless, most studies have not reported a reversal of the small dense LDL phenotype associated with diabetic dyslipidemia. (American Diabetes Association)

Insulin resistance and secretion have been shown to depend on calcium homeostasis. The secretion of insulin in response to an elevated concentration of plasma glucose is a Ca2+-dependent process. Alterations in insulin secretion have also been involved with disorders in blood glucose homeostasis, and increasing cytosolic calcium has been associated with an increase in the expression of GLUT4 transporters in the myocyte, which, in turn, increases the insulin-stimulated glucose transport activity in these cells. Because both defects in insulin secretion and insulin action are related to type 2 diabetes, it is expected that abnormal calcium homeostasis could play an important role in the development of type 2 diabetes.Serum sodium levels in poorly controlled patients with diabetes mellitus vary, since these levels are the result of hyperglycemia-induced hyponatremia (dilutional hyponatremia), osmotic diuresis-induced hypotonic losses (losses of water in excess of electrolytes), which tend to increase serum sodium levels, and hypovolemia–induced decrease in serum sodium levels. (Liamis G, Liberopoulos E (2014).

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