Open Access Journal
International Journal of Medical Research and Pharmaceutical Sciences
Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI- 10.5281/zenodo.546200 Impact Factor- 3.109

A PILOT STUDY ON SERUM ADENOSINE DEAMINASE ACTIVITY IN TYPE 2 DIABETES MELLITUS

Pratap GK[*1], Rudrappa G[2] & Manjula Shantaram[3]

[*1]Research Scholar, Department of Studies in Biochemistry, Mangalore University, Post Graduate Centre, ChikkaAluvara, 571 232, Kodagu, Karnataka, India

[2]Associate Professor, Department of Biochemistry, Basaveshwara Medical College and Hospital, Chitradurga, Karnataka, India

[3]Professor, Department of Studies in Biochemistry, Mangalore University, Post Graduate Centre, ChikkaAluvara, 571 232, Kodagu, Karnataka, India

Keywords:
Adenosine, Adenosine Deaminase, Blood Glucose, Type 2 Diabetes Mellitus

Abstract

Diabetes mellitus(DM) is a group of metabolic diseases characterized by a state of chronic hyperglycemia resulting from defect in insulin secretion, insulin action or both. Diabetes mellitus is characterized by an abnormal correlative deficiency of insulin and insulin resistance. Adenosine Deaminase (ADA) is an enzyme involved in purine metabolism.ADA is considered to be a good biomarker of cell mediated immunity.In the present case control pilot study, serum glucose and serum ADA levels were estimated in 20 patients with type 2 DM and compared the results with age and sex matched ten healthy controls. A statistically significant elevation of serum ADA was found in diabetic subjects when compared to controls.This indicates that serum ADA can be considered as a biomarker to diagnose diabetes in a population.

Introduction

Diabetes is a group of metabolic disorders characterizedby a chronic hyperglycemic conditionresulting from insufficientinsulin synthesis in the body (1). Diabetes mellitus(DM) has gained gigantic disgrace in recent years asit is fast becoming the world's largest silent killer. India has been projected by WHO as the country with the fastest growing population of Diabetic patients(2).The Diabetes mellitus is classified in to 3 types,type 1 diabetes, type 2 diabetes and gestational diabetes. Type 2 DM is the most common chronic disease among adults(3). Two metabolic factors cause type 2 diabetes mellitus such asinsulin deficiency and insulinresistance (4). When the blood glucose goes above a certain level, glucose gets into the body tissues to supply the energy the cells need to keep the bodyworking. Some amount of glucose is stored in the liver in the form of glycogen. When the bloodglucoselevel is decreased, storedglycogen releases glucose into the bloodto bring the level back to normal (5). Insulin is a polypeptide hormone synthesized in humans and other mammals by the ß cells of the islets of Langerhans in the pancreas.The islets of Langerhans are endocrine part of pancreas (6). Either the pancreas cannot secrete insulin or the insulin which is secretedcannot work properly.The independent risk factors for pathogenesis in DM are aging, obesity,insufficient energy consumption, alcohol drinking, smoking, etc. (1). Themajor complications ofdiabetes mellitus are coronary arterydisease, peripheral arterial disease,stroke andmicrovascular complications diabetic nephropathy,neuropathy, and retinopathy(7). Diabetes is the major leading cause of kidney failure;10-20% of people with diabetes die of kidney failure. Diabetes mellitus increases the risk of heart disease and stroke and50% of people with diabetes die of cardiovascular diseases(8).

Adenosine Deaminase (ADA)

Adenosine Deaminase, a purine metabolizing enzyme catalyzes the irreversible deamination of adenosine to inosine and 2'-deoxyadenosine to 2'-deoxyinosine. Adenosine increases glucose uptake inside the cells. Further, increase in the ADA activity will decrease adenosine levels and thus decreases glucose uptake into the cells(9).

ADA is considered as a good biomarker of cell mediated immunity. High lymphocyte ADA activities were found to be elevated in diseases(10). ADA is one of the important enzymes for modulating the bioactivity of insulin but its

Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI- 10.5281/zenodo.546200 Impact Factor- 3.109

clinical significance in diabetes mellitus (DM) has not yet been proven(11). Chronichyperglycemia leads to increased oxidativestress by forming free radicals andsuperoxide ions by NADPH oxidase systemand ADA levels will be high(12).Adenosine is called as a retaliatory metabolite and the levels of adenosine are reduced by ADA. It has an anti-lipolytic property and anti-lipolytic effect reduces free fatty acid level. The ADA result shown that intype 2DM patients the level of ADA is higher than that of non-diabetics(13). ADA activity is decreased in erythrocytes from patients with severe combined immune deficiency(14).

Materials and Methods

Diabetic subjects visiting the outpatient department of BasaveshwaraMedical College Hospital and Research Center, Chitradurga were selected for the present study. Informed consent was taken from all the subjects. Ten normal subjectswere selected and 20 patients were type 2 diabetics with ahistory of not less than eight years of type 2 diabetes mellitus.Blood samples were collected by veni-puncture and centrifuged at 3,000 rpm for 10 minutes for the separation of serum. The serum thus obtained was analyzed for glucose and adenosine deaminaseactivity.

Glucose levels were determined according to O-Toluidine method (15).Determination of adenosine deaminase activity in the serum was by the method of Giusti and Galanti (16).Statistical analysis was carried out using Student's 't'test.

Results and Discussion

In the present study, group A represented diabetic subjects (n=20) while group Cconstitutes normal healthy controls(n=10). Serum ADA values of diabetic and healthy controls are tabulated and their p values are indicated in table 1 and 2. Serum glucoseand ADA activity of healthy controlsare depicted in graph 1.Graph 2 shows serum glucose and ADA activity of type 2diabetic subjects. Reference values for ADA:Normal Range:<30 U/L; Suspect: 30-40 U/L; Strong Suspect: > 40-60 U/L; Positive:>60 U/L. ADA levels of both Type 2diabetic male group A and control group C are being compared and shown in the graph 3. ADA levels of both type 2 diabetic male group A and type 2 diabetic female group B are shown in graph 4.Comparison of ADA level in type 2diabetic female group B and control group C shown in the graph 5.Serum glucose levels are shown in both type 2 diabetic male group A and control group C in graph 6.As per the results obtained, serum ADA levels are significantly elevated in diabetic subjects when compared to the healthy controls ($p< 0.001$). Further, it is noted that in the individual values wherever the serum glucose level was high, serum ADA activity was also high(graph 2).

Diabetes mellitus has been recognized with multiple metabolic abnormalities and is general to carbohydrate, lipid as well as protein metabolism and glucose metabolism in particular. It is mainly due to decreased amount of insulin or due to suboptimal functioning of insulin. Though glucose is crystalloid and somewhat freely diffusible, it requires specific transporter molecules to enter into the cells.

Adenosine deaminase is an enzyme necessary for the normal catabolism of purine. ADA catalyzes the conversion of adenosine to deoxyadenosine and inosine to deoxy-inosine. ADA deficiency is the major metabolic cause of severe combined immunodeficiency disease. ADA is important for the development of the immune system in humans. It seems to be associated with the differentiation of epithelial cells and monocytes and with neurotransmission. Monocyte/macrophage activation by intracellular infection and inflammatory diseases lead to the release of ADA and elevated levels in the serum. Experimental evidence indicates that adenosine, in increased amount, may result in increased glucose level. In this study, we observed that there were significantly elevated levels of ADA activity in type 2 DM individuals. When Glucose level increased ultimately ADA activity also increased in the diabetic patients. The normal level of ADA activity in normal subjects within range. The increased ADA activity may be due to altered immunity, therefore ADA may serve as an immune enzyme marker in etio-pathology of type 2 diabetes mellitus.

Conclusion

In this case control preliminary study, it is observed that serum adenosine deaminase activity was significantly increased intype 2 DM cases when compared to healthy controls. Serum ADA seems to be a good biomarker for type 2 DM. To establish it as a routine diagnostic marker in the laboratory, substantial number of samples have to be analyzed.

No conflict of interest declared.

Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI- 10.5281/zenodo.546200 Impact Factor- 3.109

REFERENCES

1. *Kohei KAKU. Pathophysiology of Type 2 Diabetes and Its Treatment Policy. JMAJ 2010; 53(1): 41-46.*
2. *Srinivas P, Devi KP, Shailaja B. Diabetes Mellitus (Madhumeha)-An Ayurvedic Review. Int J Pharm Sci2014;6(1):107-10.*
3. *Habtewold TD, Tsega WD,Wale BY. Diabetes Mellitus in out patients in Debre Berhan Referral Hospital, Ethiopia. Journal of Diabetes Research 2016; Article ID-3571368:6 pages.*
4. *Larijani B, Heshmat R, Rad ME, Khatami S, Valodbeigi S, Saghiri R. Diagnostic Value of Adenosine Deaminase and Its isoforms in Type II Diabetes Mellitus. Enzyme Research 2016; Article ID-9526593:6 pages.*
5. *Diabetes information series from diabetes state/territory organization-copyright2012.*
6. *Piero1 MN, Nzaro GM, Njagi JM.Diabetes mellitus – a devastating metabolic disorder. Asian Journal and pharmalecutical2014; 04(40):1-7.*
7. *Boro MM, Lahon D, Thakur BB. A study of serum adenosine deaminase activity in type 2 diabetes mellitus with and without complications and its co-relation with serum uric acid level in glycemic control. Indian Journal of Basic and Applied Medical Research.2015;5(1):619-33.*
8. *DiabetesFactSheet,WHO,(http://www.who.int/mediacentre/factsheets/fs312/en/) Diabetes Atlas, 4th edition, International Diabetes Federation, 2009.*
9. *Sakran MM, Duais A, Kamal F, Abdel SA, Khamis HA. Correlation of serum Adenosine deaminase activity (ADA) with fasting blood sugar levels in Type II Saudi Diabetic Patients. J Environ Occup Sci 2016;(5).*
10. *Kaur A, Kukreja S, Malhotra N, Neha. Adenosine deaminase activity and its Correlation with Glycated Hemoglobin Levels in Patients of Type 2 Diabetes Mellitus. Journal of Clinical and Diagnostic Research 2012;6(2): 252-56.*
11. *Manjula S, Anusha M.S, Chethana. Serum Adenosine Deaminase Activity in Type 2 Diabetes Mellitus. J Pharm Biomed Sci 2014;04(03):246-48.*
12. *Singh1 P, Khan S, Kumar MR. Adenosine Deaminase Activity and its Relation with Glycated Hemoglobin and Uric Acid in Type 2 Diabetic Patients. Iranian Journal of Diabetes and Obesity 2013;5(1).*
13. *Ramani NS, Krishnamurthy NR, Prasad BR. Role of Adenosine Deaminase to Predict Glycemic Status In Type 2 Diabetes Mellitus J Clin Biomed Sci 2012;2:3.*
14. *Faheem R and Jameel T. Study of Serum Adenosine Deaminase Activity (ADA) In Diabetes Mellitus with Complications. Indian Journal of Fundamental and Applied Life Sciences 2013;3142-49.*
15. *HiMedia Laboratories Pvt. Ltd. A-516,www.himedialabs.com.*
16. *Duran A, Alonzo C, Gladstein J, Sivori M, Patino CM, Kalina M, et al. Adenosine Deaminase Activity for the Diagnosis of Tuberculosis plueral Effusions: A Diagnostic Accuracy Study. European Scientific Journal 2014;(10) No.33.*

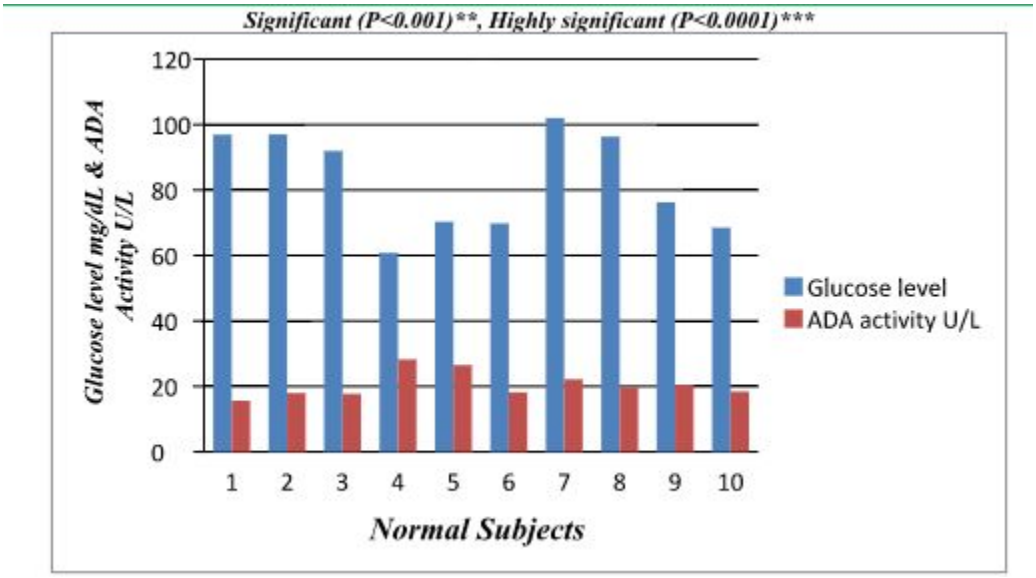
Table 1: Distribution of subjects in group A and C

Group	Male	Female	ADA level (Mean ± SD)	*p* value
Group A(n=20)	10	10	41.3 ±8.77	<0.0001***
GroupC (n=10)	5	5	20.50 ± 4.03	<0.001**

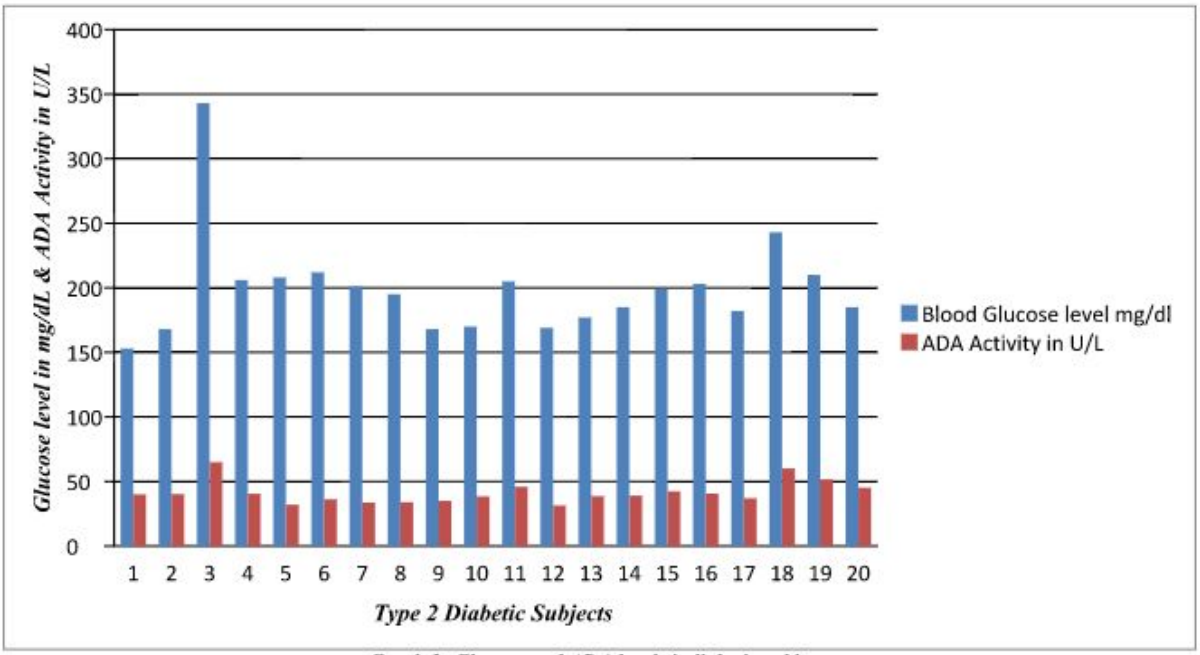
Table 2: Comparison of ADA levels in 3 Groups

Groups	Male	Female	ADA level (Mean ±SD)	Comparison	*p* value
Group A	10	-	38.39 ±5.79	Group A vs B	<0.0001***
Group B	-	10	44.27±11.10	Group A vs C	<0.001**
Group C	5	5	20.50 ± 4.03	Group B vs C	<0.001**

Open Access Journal
International Journal of Medical Research and Pharmaceutical Sciences
Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI- 10.5281/zenodo.546200 Impact Factor- 3.109

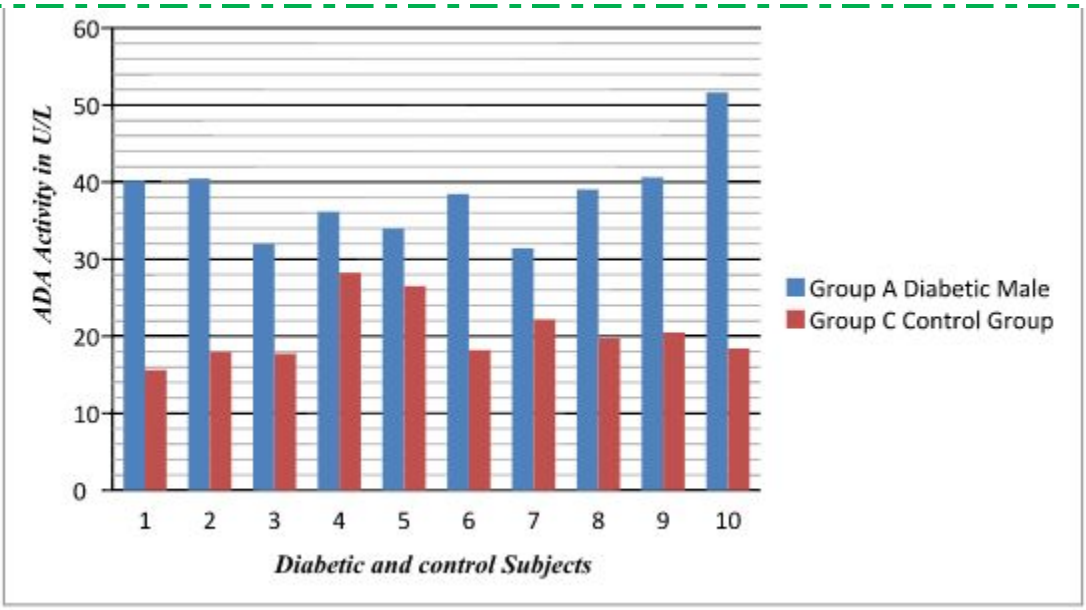


Graph 1: Glucose and ADA levels in normal healthy controls

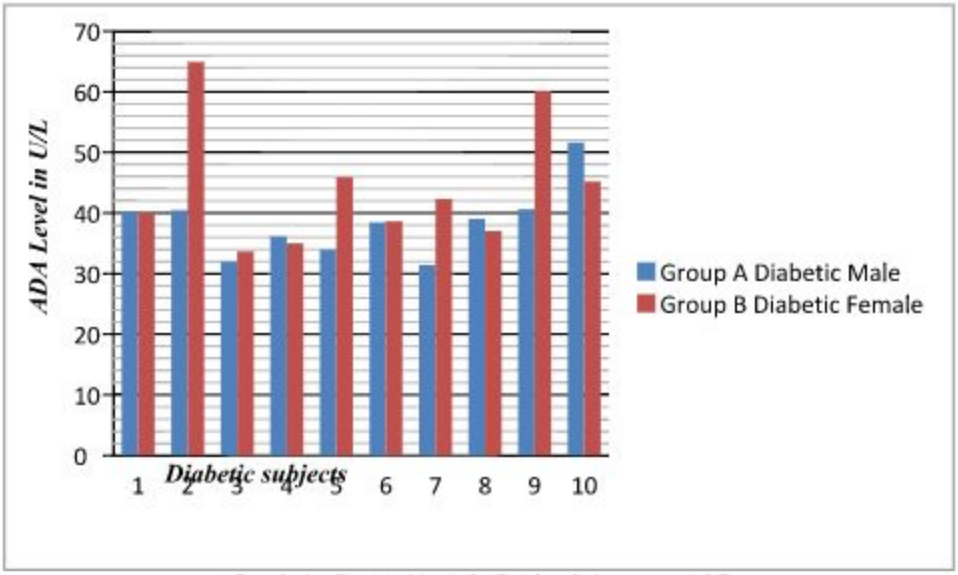


Graph 2: Glucose and ADA levels indiabetic subjects

Open Access Journal
International Journal of Medical Research and Pharmaceutical Sciences
Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI- 10.5281/zenodo.546200 Impact Factor- 3.109

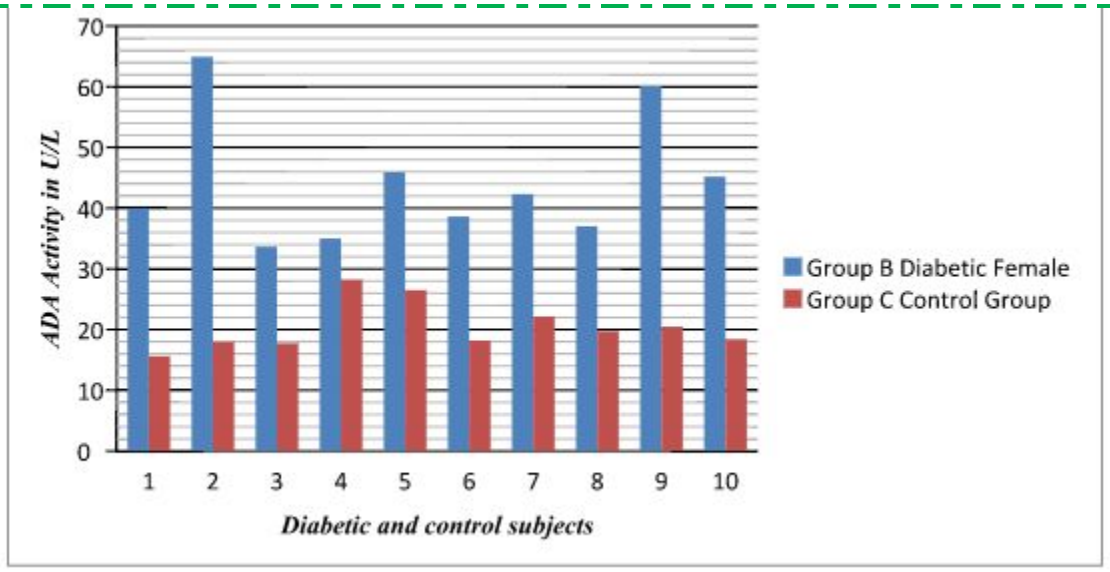


Graph 3: Comparison of ADA level in group A & C

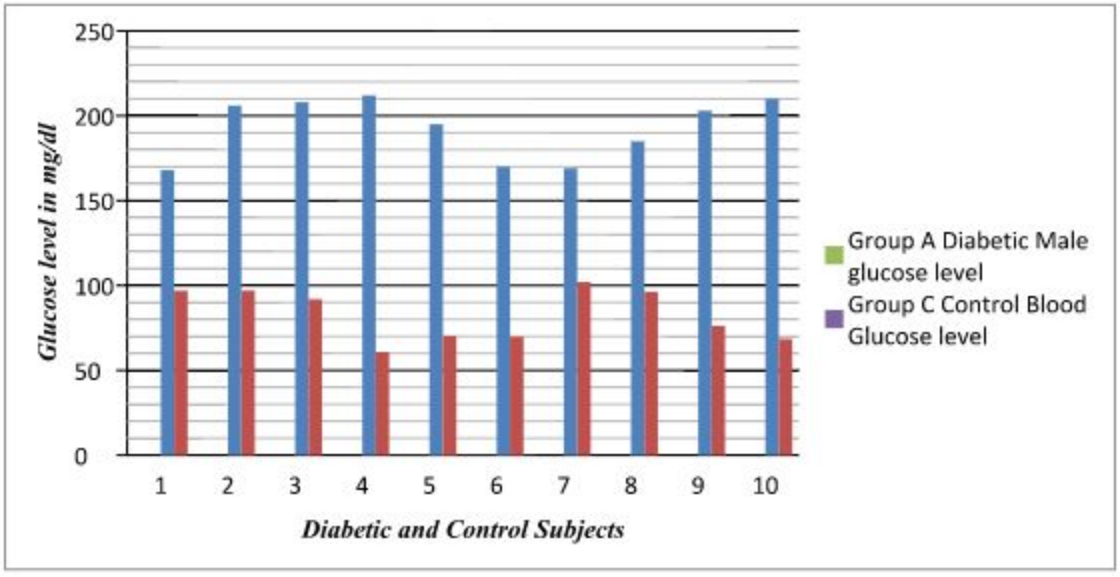


Graph 4: Comparison of ADA levels in group A&B

Open Access Journal
International Journal of Medical Research and Pharmaceutical Sciences
Volume 4 (Issue 4): April 2017 ISSN: 2394-9414
DOI- 10.5281/zenodo.546200 Impact Factor- 3.109



Graph 5:Comparison of ADA level in group B & C



Graph 6: Comparison of glucose level in group A & C