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ESTIMATION OF ADA LEVELS IN TYPE-II DIABETES MELLITUS PATIENTS IN WEST GODAVARI DISTRICT, COASTAL ANDHRA PRADESH

D.S.R.S. Prakash, S.Murali Mohan and B.Preethi Chandrakala
Department of Biotechnology, Adikavi Nannaya University, Rajahmundry, Andhra Pradesh, India.
Department of Microbiology, Rajiv Gandhi Institute of Management and Science, Kakinada, Andhra Pradesh, India

Abstract:

Diabetes mellitus is a group of metabolic disorders of carbohydrate metabolism in which glucose is underused, producing hyperglycemia. Diabetic patients are prone to opportunistic infection, thus serum ADA levels in these patients is very important as a screening test for Tuberculosis and autoimmune diseases. Thus, the present study was conducted to estimate the Serum ADA activity, glycated Haemoglobin (HbA1c), fasting and postprandial glucose level in patients with T2DM and to correlate the serum level of ADA with glycated Hemoglobin (HbA1c), fasting and postprandial glucose level in T2DM.

Keywords: Adenosine deaminase; Blood glucose/metabolism; Diabetes mellitus type2, Hemoglobin A1c protein human of East Godavari District , Coastal Andhra Pradesh.

INTRODUCTION:

In 2000, according to the world health organization, at least 171 million people worldwide suffer from diabetes. Its incidence is increasing rapidly, and it is estimated that by the year 2030, this number will double. Diabetes mellitus occurs throughout the world, but is more common (especially type-II) in the more developed countries. The greatest increase in prevalence is, however, expected to occur in Asia and Africa, where most patients will likely to be found by 2030. The increase in incidence of diabetes in developing countries follows the trend of Urbanization and lifestyle changes, perhaps most importantly a "Western-style" diet. This has suggested an environmental (i.e.dietary)effect, but there is little understanding of the mechanism(s) at present, though there is much speculation, some of it most compellingly presented. According to the American Diabetes Association, approximately 18.3% (8.6 million) of Americans age 60 and older have diabetes. Diabetes mellitus prevalence increases with age and the number of older persons with diabetes are expected to grow as the elderly population increases in number.

The National Health and Nutrition Examination Survey (NHANES III) demonstrated that, in the population over 65 years old, 18% to 20% have diabetes, with 40% having either diabetes or its precursor form tolerance. Indigenous populations in first world countries have a higher prevalence and increasing incidence of diabetes than their corresponding non- indigenous populations.

Type-I Diabetes mellitus:

Type –1 diabetes mellitus is characterized but loss of the insulin producing beta cells of the islets of Langerhans in the pancreas, leading to a deficiency of insulin. The main cause of the beta cell loss is a T-cell mediate autoimmune attack. There is no known preventative measure that can be taken against type -I diabetes, which comprises up to 10% of diabetes mellitus cause in North America and Europe (through this varies by geographical location)Most effected people are otherwise healthy and of weight when onset occurs. Sensitivity and responsiveness to insulin are usually normal, especially in the early stages. Type-1 diabetes can affect children or adults but was traditionally termed 'juvenile diabetes" because it represents a majority of cases of diabetes affecting children.

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Type -II diabetes mellitus:

Type 2 diabetes mellitus is charectarized differently due to insulin resistance or reduced insulin sensitivity, combined with reduced insulin secretion. The defective responsiveness of body tissues to insulin almost certainly involves the insulin receptor in cell membranes. In the early stage the predominant abnormality is reduced insulin sensitivity, characterized by elevated levels of insulin in the blood. At the stage hyperglycemia can be reversed by a variety of measures and medications that improve insulin sensitivity or reduce production by the liver.

As the diabetes progresses the impairment of insulin secretion worsens, and therapeutic replacement of insulin often becomes necessary. Accordingly to one study, overweight patients treated with metformin compared with diet alone, had relative risk reduction of 32% for any diabetes endpoint,42% for diabetes related death and 36% for all cause mortality and stroke. Oral medication may eventually fail due to further impairment of beta cell insulin secretion. At this point, insulin therapy is necessary to maintain normal or near normal glucose levels.

Gestational diabetes:

Gestational diabetes mellitus (GDM) resembles type 2 diabetes in several respects, involving a combination of relatively inadequate insulin secretion and responsiveness. It comes in about 2% -5% of all pregnancies and may improve or disappear after delivery. Gestational diabetes is fully treatable but requires careful medical supervision throughout the pregnancy. About 20%-50% of affected women develop type 2 diabetes later in life.

Even thought it may be transient, untreated gestational diabetes can damage the health of the fetus or mother. Risks to the baby include macrosomia (high birthweight), congental cardiac and central nervous system anomalies and skeletal muscle malformations. Induction may be indicated with decreased placental function. A cesarean section may be performed if there is marked fetal distress or an increased risk of injury associated with macrosomia, such as shoulder dystocia.

Signs and symptoms :

The classical triad of diabetes symptoms is polyuria, polydipsia and polyphagia, which are respectively frequent urination; increased thirst and consequent increased fluid intake; and increased appetite, symptoms may develop quite rapidly (weeks or months)in type 1 diabetes , particularly in children . However, in type 2 diabetes the symptoms develop much more slowly and may be subtle or completely absent. Type 1 diabetes may also cause a rapid yet significant weight loss (despite normal or even increased eating) and irreducible fatigue. All of these symptoms expect weight loss can also manifest in type 2 diabetes in patients whose diabetes is poorly controlled.

ADENOSINE DEAMINASE (ADA):

Adenosine deaminase is an essential zinc metallo enzyme of purine recycling or salvage path way for nutrition and reproduction. It catalyses the irreversible deamination of adenosine and reproduction. It Catayses the irreversible deamination of adenosine and deoxyonosine respectively. This ubiquitous enzyme has been found in a wide variety of microorganisms plants and invertebrates in addition it is present in all mammalian cells that play a central role in the differentiation and maturation of the lymphoid system.

Adenosine + H2O ADA Inosine + NH3

One form of the enzymes appears particulate with a molecular weight greater than 20000000. Other three forms of the enzymes are soluble and inter convertible with apparent molecular weight of

1. Small	36,000
2. Intermediate	114,000
3. Large	298,000

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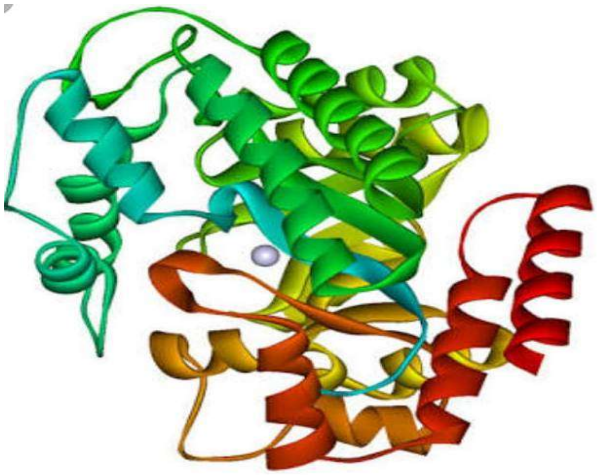
The small form of the enzyme predominates in tissue preparation, exhibiting larged enzyme specific activity and has no detectable conversion activity. The large form of ADA predominates in tissue extracts exhibiting lower enzymes specific and abundant conversion activity.

PROPERTIES OF ADA

Adenosine deaminase activity is present in all human tissue extracts. Higher specific activity is found in gastrointestinal and splenic tissue.

The large form of ADA activity predominates in those tissue extracts exhibiting lower enzyme activity. Ex: Lung, Kidney. The smaller molecular form is the main species in tissue extracts exhibiting higher enzyme activity. Ex: Stomach, Spleen. The cofactor zinc is located in the active sides in which there is a deep pocket at the "C" terminus of the beta barrel. One molecule of zinc per enzyme molecule is coordinated to three Histidine (15, 17, 24) molecules as well as Aspartate (295). The features of the catalytic mechanism of enzymes such as carbonic anhydrase, Thermolysin and Carboxy peptidase A, that also involves the addition of water to carbon atom.



ISO ENZYMES

Human adenosine deaminase consists of three iso enzymes
ADA1 , ADA1+cp, ADA2
Human ADA exists in at least in three molecular forms .
ADA1, is a monomeric protein with molecular mass of ~35KDa (gene assignment, chromosome 20) ADA1 is most abundant in the spleen, lymphocytes, monocytes and neutrophils .
ADA1+cp(molecular mass ~ 280KDa) is composed of two ADA1 molecule connected via, combining protein (CP – binding protein) gene assignment, chromosomes 2 and 6. ADA 1+cp is dominant ADA from is liver, ling, muscle pancreas, and kidney tissue shows only ADA 1+CP.
ADA2 appears to be coded by a separate gene locus of unknown chromosomal position. ADA2 could be detected only in monocytes 60.
ADA shows not only polymorphism but also deficiency. ADA deficiency is cause of one form of severe combined immuno deficiency symdrome (SCID) in which there is dysfunction of the 'B' and 'T' lymphocytes and impaired cellular immunity and decreased production of immunoglobulin 20.
In all sera with increased ADA. The ADA2 forms predominate. The greatest ADA activity is found in lymphocytes and monocytes. ADA2 is detected only in monocytes this indicates that ADA2 is an enzyme unique to monocytes/

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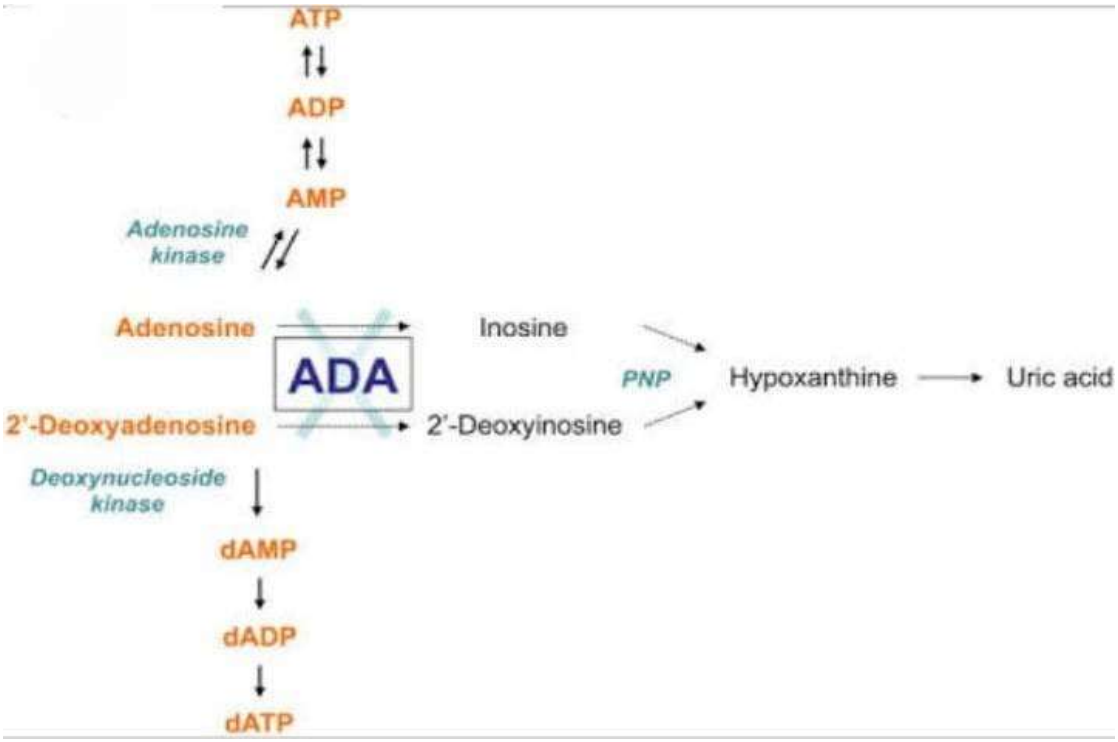
macrophage cell linage. Increased serum ADA has been seen in patients who had Hepatitis, infectious mono nucleosis, tuberculosis, pneumonia, rheumatoid arthritis, acute lymphoblast lukemia28.
Enzyme storability- the enzyme is stable in serum for at least 24 hours at 250 C seven days at 40C and three months at -200C.



RANDOM BLOOD SUGAR (RBS):

A random blood glucose test is used to diagnose diabetes. The test measures the level of glucose (a type of sugar) in your blood. If your blood glucose level is 200 mg/dL or higher and you have the classic symptoms of high blood sugar (excessive thirst, urination at night, blurred vision and, in some cases, weight loss) your doctor may diagnose you with diabetes. If you do not have any symptoms of high blood sugar.

The reference values for a "normal"random glucose test in an average adult are 79–160 mg/dl (4.4–8.9 mmol/l), between 160–200 mg/dl (8.9–11.1 mmol/l) is considered pre-diabetes, and > 200 mg/dl is considered diabetes according to ADA guidelines

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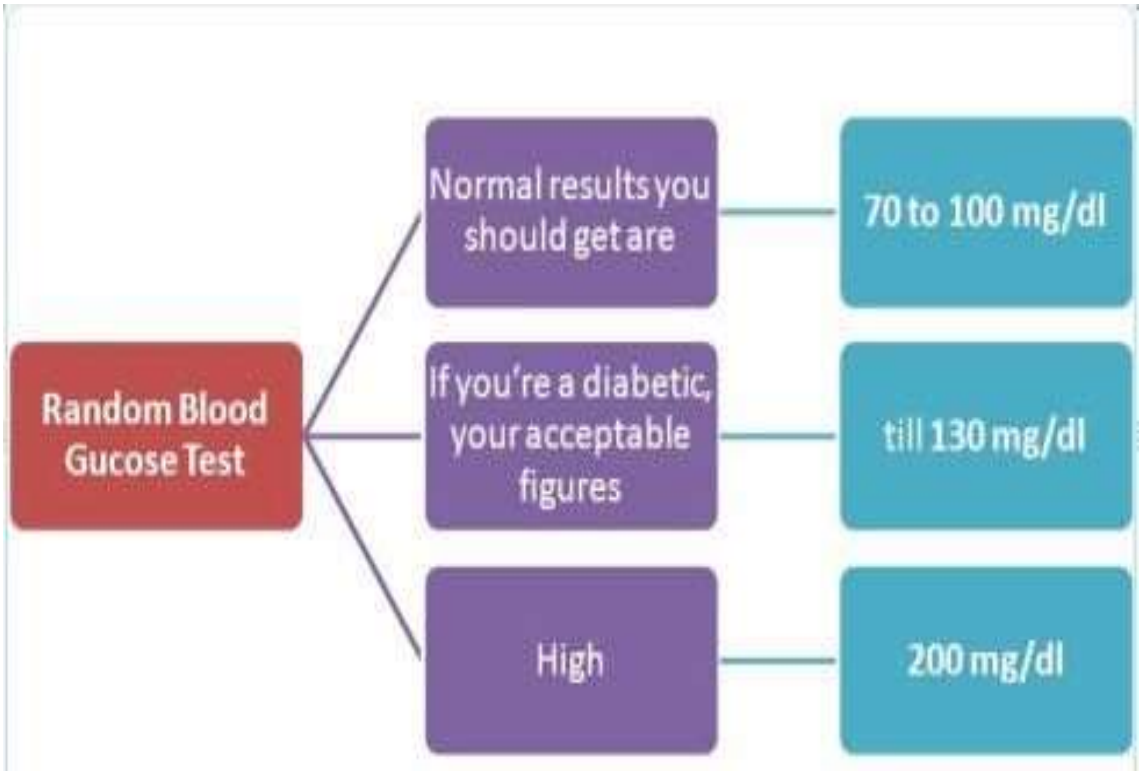

MATERIALS AND METHODS:

The present study was done on patients suffering with Type-II Diabetes mellitus& Normal persons aged between 45 to 65 irrespective of sex. In the present study randomly selected, 30 patients with type-2 diabetic patients with an age ranged from 45 to 65 years along with 30 healthy controls were recruited from the patients attending to OPD at GGH Kakinada.

A total of 30 T2DM patients and controls were recruited for the study. Estimation of fasting plasma glucose (FPG), postprandial plasma glucose (PPG), HbA1c and fasting lipid profile was done. Serum ADA level was estimated by Colorimetric method. Statistical analysis of data was performed using the SPSS version 15.

RESULTS AND DISCUSSION:

Category	No. of cases	Category	No. of Cases	Percentage
Control	30	Males	14	46.60%
Diabetis	30	Females	16	53.30%
Total	60	Total	30	100%

PARAMETERS	CASES MEAN±SD	CONTROLS MEAN±SD	CASES SEM	CONTROLS SEM	P - VALUE
RBS	217.70±39.50	90.47±9.21	7.21	1.68	<0.0001
ADA	79.73±10.21	20.43±6.11	1.86	1.12	<0.0001

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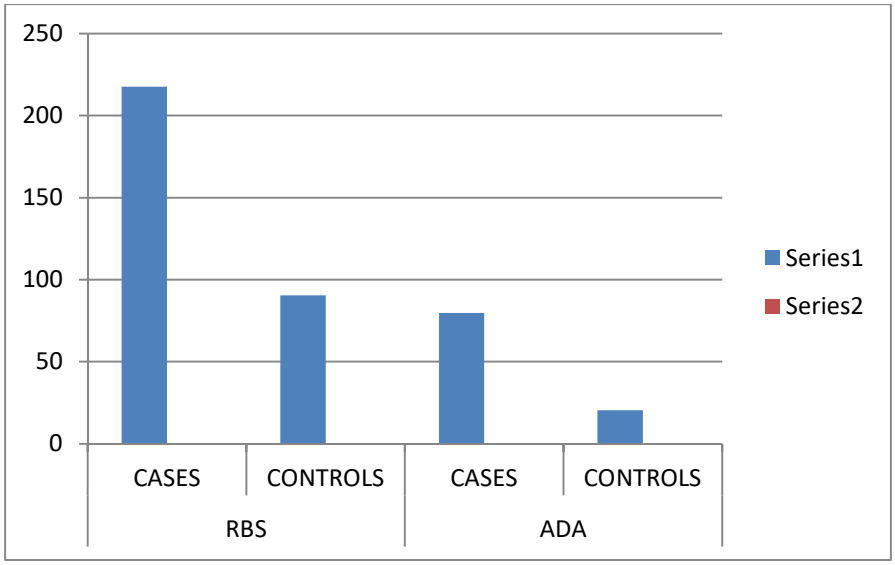
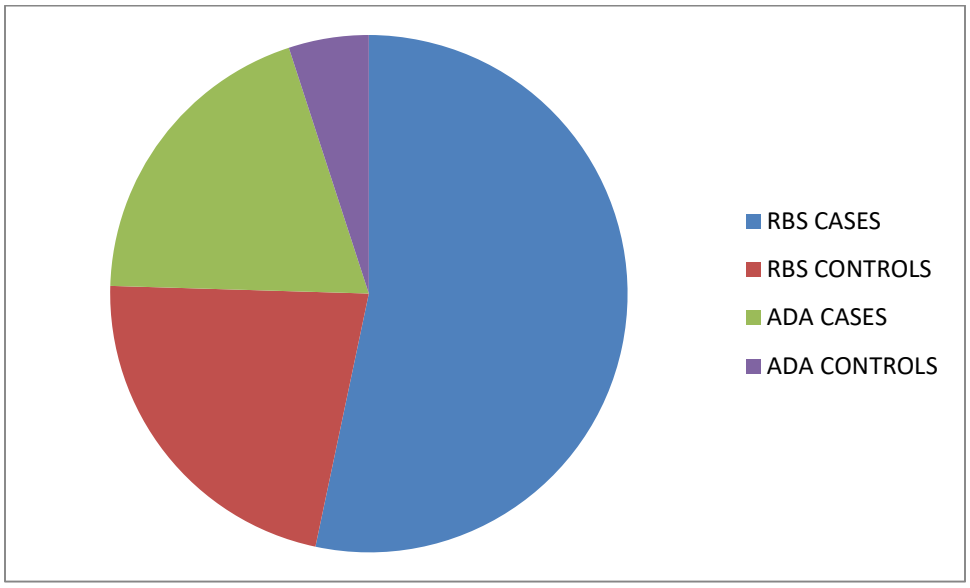
STATISTICAL DATA





A total numbers of 60 subjects were taken for the study which compaired of 30 Diabetes Mellitus Type-II as cases and 30 controls with age limit 45 to 65 irrespective of sex.

The patients suffering with Diabetes Mellitus uncontrolled Type-II Diabetes mellitus there is increased levels of ADA, which represents the reduces glucose uptake into cells and insulin resistance and also play an important role in predicting the glycemic and immunological status in these patients.

CONCLUION:

The mean ± SD of RBS levels in Diabetes mellitus is 217.70±39.50which are increased when compared to controls90.47±9.21. The mean ± SD of ADA levels in Diabetes mellitus is79.73±10.21which are increased when

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compared to controls20.43±6.11.The RBS levels are significantly increased in Diabetes mellitus when compared with controls. The ADA levels are increased in Diabetes mellitus when compared with controls.

Reference:

1. Chang FY, Shaio MF. Decreased cell-mediated immunityin patients with non-insulin-dependent diabetes mellitus.Diabetes Res Clin Pract1995; 28: 137-46.
2. Frankie B, Abbas E. Activated T-lymphocytes in type2diabetes: Implications from in vitrostudies. Curr DrugTargets 2003; 4: 493-503
3. Vader Weyden MB, Kelly WN. Human adenosinedeaminase: distribution and properties. J Biol Chem 1976;251: 5448-56.
4. Baghanha MF, Pego A, Lima MA et al. Serum and pleuraladenosinedeaminasecorrelation with lymphocytpopulations. Chest 1990; 87: 605-10.
5. Hovi T, Smyth JF, Allison AC, Williams SC. Role of adenosinedeaminase in lymphocyte proliferation. Clin Exp Immunol1976; 23: 395-403.
6. Sullivan JL, Oxborne WRA, Wedgewood RJ. Adenosinedeaminase activity inlymphocytes. Br J Haematol1977; 37:157-8.
7. Kurtul N, Pence S, Akarsu E et al. Adenosine deaminaseactivity in the serum of type 2 diabetic patients. Acta Medica(Hradec Kralove)2004; 47 (1): 33-5.
8. Hoshino T, Yamada K, Masuoka K et al. Elevated adenosinedeaminase activity in the serum of patients with diabetesmellitus. Diabetes Res Clin Pract1994; 25: 97-102
9. Kurtul N, Pence S, Akarsu E et al. Adenosine deaminaseactivity in the serum of type 2 diabetic patients. Acta Medica(Hradec Kralove) 2004; 47 (1): 33-5.
10. The expert committee on the diagnosis and classificationof diabetes mellitus. Report of the expert committee onthe diagnosis and classification of diabetes mellitus.Diabetes Care 2001; 23: S5-20.
11. World health organization.Definition, diagnosis and classification of diabetes mellitus and its complications.Geneva: World health organization; 1999.
12. Shiva prakash, S.Chennaiah, YSR Murthy,E.Anjaiah, S.Ananda Rao, C.Suresh.Altered Adenosine Deaminase activity in the Type 2 Diabetes Mellitus. JIACM 2006; 7(2): 114-7.
13. Kirkpatrick, C.H.R.R.Rich and J.E.Bennett.1971.chronic mucocutaneous candidiasis : model building of cellular immunity. Ann.Intern.Med.74:955-978.
14. Thornton, G.F.19171. Infections and diabetes. Med.Clin.North Am. 55:931-938.
15. C.hang FY, Shaio MF. Decreased cell-mediated immunity in patients with non-insulin dependent diabetes Mellitus. Diabetes Res Clin Pract 1995; May;28(2):137-46.
16. Nancie J. MacIver,1Ryan D. Michalek,2andJeffrey C. Rathmel. Metbolic Regulation of T Lymphocytes. Annaual Review of Immunology Vol.31: 259-283.
17. Shariq I. Sherwani,Haseeb A. Khan,Aishah Ekhzaimy,Afshan Masood,andMeena K. Sakharkar. Significance of HbA1c Test in Diagnosis and Prognosis of Diabetic Patients .Biomarkinsights 2016; 11:95-104.
18. Stentz FB1, Kitabchi AE, Activated T lymphocytes in Type 2 diabetes: implications from in vitro studies.2003 Aug;4(6):493-503.
19. Vanessa Sauer, Immacolota Brigida, Nicolo Carriglio, Alessandro Aiuti.Auto immune dysregulation and Purine Metabolismin
20. Adenosine Deaminase deficiency.Aisha Frontiers in Immunology.2012;3:265:1-19
21. American Diabetes Association. 'Diagnosis and classification of diabetes mellitus', Diabetes Care 2014;37:S81-S90.
22. Olokoba AB, Obateru OA, Olokoba LB. Type 2 diabetes mellitus: a review of current trends. Oman Medical Journal 2012;27:269-273.
23. "Diabetes can be controlled in 80 percent of Cases in India". IANS. news.biharprabha.com. Retrieved 6 February 2014.
24. Mehta SR, Kashyap CA, Das CS. Diabetes mellitus in India: The Modern Scourge.MJAFI 2009;65:50-54.

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25. Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan V, Das AK et al. High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. Diabetologia 2001;44:1094-101.
26. Longo DL, Kasper DL, Jameson JL, Fauci AS, Hauser SL, Loscalzo J et al Chapter 344 Harrison's principles of internal medicine. 17thed. New York: McGraw-Hill; 2012. (ebook).
27. Tomas Dolezal. Adenosine Deaminase: Review of Physiological roles. [Review article]. 2001; University of South Bohemia, Czech Republic.
28. Stina Johannson. Metabolic roles of Adenosine. Thesis 2007; Karolinska Institute.
29. Vergauwen L, Hespel P, Richter EA. Adenosine receptors mediate synergistic stimulation of glucose uptake and transport by insulin and by contractions in rat skeletal muscle. The Journal of Clinical Investigation. 1994;93(3):974–981.
30. John N.Fain, Paul W. Weiser. Effects of adenosine deaminase on cyclic adenosine monophosphate accumulation, lipolysis, and glucose metabolism of fat cells. The Journal of Biological Chemistry 1975; 250(3): 1027-1034.
31. Olokoba AB, Obateru OA, Olokoba LB. Type 2 diabetes mellitus: a review of current trends. Oman Medical Journal 2012;27:269-273.
32. "Diabetes can be controlled in 80 percent of Cases in India". IANS. news. biharprabha.com. Retrieved 6 February 2014.Mehta SR, Kashyap CA, Das CS. Diabetes mellitus in India: The Modern Scourge. MJAFI 2009;65:50-54.
33. Frankie B, Abbas E. Activated T-lymphocytes in type2 diabetes: Implications from in vitro studies. Curr Drug Targets 2003; 4: 493-503.
34. Vader Weyden MB, Kelly WN. Human adenosine deaminase: distribution and properties. J Biol Chem 1976; 251: 5448-56.
35. Baghanha MF, Pego A, Lima MA et al. Serum and pleural adenosine deaminase correlation with lymphocyte populations. Chest 1990; 87: 605-10.
36. Hovi T, Smyth JF, Allison AC, Williams SC. Role of adenosine deaminase in lymphocyte proliferation. Clin Exp Immunol 1976; 23: 395-403.
37. Sullivan JL, Oxborne WRA, Wedgewood RJ. Adenosine deaminase activity in lymphocytes. Br J Haematol 1977; 37: 157-8.
38. Kurtul N, Pence S, Akarsu E et al. Adenosine deaminase activity in the serum of type 2 diabetic patients. Acta Medica (Hradec Kralove) 2004; 47 (1): 33-5.
39. Hoshino T, Yamada K, Masuoka K et al. Elevated adenosine deaminase activity in the serum of patients with diabetes mellitus. Diabetes Res Clin Pract 1994; 25: 97-102.
40. Kurtul N, Pence S, Akarsu E et al. Adenosine deaminase activity in the serum of type 2 diabetic patients. Acta Medica (Hradec Kralove) 2004; 47 (1): 33-5.
41. Bergmayer H.V. – "Methods of Enzymatic Analysis",A.P., N.Y. 1974, Page 1196.
42. Gabby, K H et al. – J. Clin. End. Met. 44:859,1977.