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Abstract

The purpose of the present study entitled "Effect of Juvenile Diabetes on Intelligence of Adolescents" was to determine whether type 1 diabetes significantly interferes with the intelligence of Adolescents of age group 11 to 15. It was hypothesized that Adolescents of age group 11 to 15 with type 1 diabetes would demonstrate deficits in intelligence when compared with normal adolescent control subjects. The present study is descriptive in nature in which two groups were selected namely Juvenile Diabetic group and Normal group comprises of normal adolescent of same age group. For the study, total n=44 adolescents affected with Juvenile Diabetes were selected and compared with normal adolescent control of same age group in terms of Intelligence. For collection of data, standardized test was used. The effect of Juvenile Diabetes on intelligence was studied in terms of comparison of scores of Juvenile diabetic and Normal students on standardized test. The results showed that normal adolescent group performed better than juvenile diabetic group on Intelligence test which indicated that juvenile diabetes affects the intelligence of students.

Keywords : Juvenile Diabetes, intelligence, cognitive performance, SES

Education plays an important role in the progress of an individual's mind and country. Ignorance, poverty and many diseases are major speed-breakers in the swift developing individual and can be overcome to quite a good extent through education. Education tames the astray mind, nurturing its capabilities. There are many factors which impede the purpose of education by directly or indirectly creating hurdles in the process of education. According to the Pennsylvania State Education Association's (PSEA) opinion "Student Achievement is More than Academic" There is considerable evidence to suggest that student low achievement is a symptom of deeper issues related to student health and well-being. In other words, policymakers may need to consider the idea that the root cause of academic achievement problems may not be in the academic content or in instruction only but there may be certain other factors which impede the purpose of education. The issues suggested below are just a few of the many indicators of child health and well-being that affect student learning like:

Physical Health : It includes many diseases like Juvenile diabetes, Asthma, Child obesity, Cystic fibrosis, Malnutrition, Developmental disabilities, including attention-deficit/hyperactivity disorder (ADHD) and the autism spectrum disorders, Cerebral palsy, Dental Health etc.

Mental Health :

Every year, more than one in five children between the ages of 9 and 17 experience the signs and symptoms of a psychiatric disorder; but only 20 percent of children and youth who need mental health services actually receive them.

As many as one in eight adolescents struggle with clinical depression. About 1,900 will commit suicide every year, and for every child who commits suicide, as many as 25 others have tried.

Diabetes : Diabetes or Juvenile diabetes is one of the major health issues among adults and around 4 to 5% of world's population is suffering with this disease. In India there are approximately one million juvenile diabetic children who cover around 3-4% of total population of children in country. Juvenile diabetes is major curse in the academic impairment associated with Child's long absenteeism correlates with lower scores on reading, spelling, and mathematics measures. It is basically "A disease in which the body cannot produce insulin or cannot use insulin to its full potential. It is characterized by high blood glucose levels". The prevalence of diabetes is increasing most rapidly (150 per cent over next 15 year).

"Diabetes mellitus" of any type develops when the body cannot produce as much insulin as it needs, resulting in high blood glucose levels (Gale 2005). Diabetes used to be considered one disease. Then it was divided into two main types called "juvenile" and "adult onset." These were later renamed "insulin dependent diabetes mellitus (IDDM)" and "non-insulin dependent diabetes mellitus (NIDDM)." Now they are called "type 1" and "type 2." It is the commonest forms of primary Diabetes Mellitus. Juvenile Diabetes is Type 1 category of diabetes, developing in individuals of young age. This division is important both clinically in assessing the need for treatment and also in understanding the causes of diabetes which are entirely different in the two groups.



There are some other forms of diabetes also like Mitochondrial Diabetes, Insulin Resistant Diabetes, Mixed Types of Diabetes etc.

Complications from any type of diabetes may include neuropathy (nerve damage), retinopathy (eye damage), nephropathy (kidney damage), and premature death. These may occur even with good glucose control (Narendran et al. 2005). Taking insulin can treat the disease, but is not a cure.

Type 1 diabetes : Type 1 diabetes or Insulin-dependent diabetes mellitus (IDDM), formerly called juvenile diabetes, is an autoimmune disease where the body's own immune system destroys the insulin-producing beta cells in the pancreas. People with type 1 usually have certain auto antibodies that may appear years before the disease develops, even in utero. These auto antibodies are used as markers of the disease, but do not necessarily cause the beta cell destruction.

A number of genes have been identified that are associated with the risk of developing type 1 diabetes. Some people, then, have a higher genetic risk than others, in other words, are more genetically susceptible. The genetic component of type 1 diabetes, however, is "neither sufficient nor necessary" (Vehik et al. 2008). That is, there is some environmental component to the disease: someone with high genetic risk might never develop it, while someone with low genetic risk might. More than 85% of the people who do develop type 1 diabetes do not have a parent or sibling with the disease (Larsson et al. 2004). Among monozygotic identical twins only about one-third of the pairs are concordant for diabetes in contrast to the situation in Type 2 diabetes where almost all pairs are concordant.

Type 1 has been divided into type 1A and type 1B, where type 1A has an autoimmune cause, and type 1B is "idiopathic" diabetes, that is, has no known cause. People diagnosed with type 1B show signs of type 1 but have no evidence of autoimmunity (American Diabetes Association, 2011). The younger the diagnosis, the higher the chance of auto antibodies being positive. Those who tested negative for antibodies had a higher body mass index, and may have a non-immune form of diabetes (perhaps different from either type 1A or type 2) (Wang et al. 2010).

The presence in a non-diabetic individual of three or more antibodies (islet cell antibodies, anti-GAD (glutamic acid decarboxylase) antibodies, anti-IA (insulin auto antibodies) indicates an 88% chance of developing diabetes within 10 years.

The risk of developing Type 1 Diabetes for an individual with affected relative is represented below in Table 1

Table 1
The Risk of Developing Type 1 Diabetes for an Individual with Affected Relative

Relative with Type 1 diabetes	Risk to individual (%)
Sibling	8
Mother	2-3
Father	5-6
Both parents	30

Effect of Juvenile Diabetes on Brain and Cognitive Functions:

The new findings suggest that rising blood sugar levels, a precursor of diabetes, are responsible in part for the lapses in memory. If the amount of glucose supplied by the blood falls, the brain is one of the first organs affected. Prolonged, severe hypoglycemia can produce lasting damage of a wide range. This can include impairment of cognitive function, motor control, or even consciousness. There have been increasing concerns that recurrent hypoglycemia could affect cognitive function. There is no doubt that profound and prolonged hypoglycemia can cause catastrophic cerebral damage as occurs in young children from a variety of causes. Patients with Type 1 diabetes may be at even greater risk, due to certain other factors. Results suggest that severe hypoglycemia is a risk factor for learning due to deficits in auditory-verbal functioning Hannonen R, Tupola S, Ahonen T, Riikonen R. (2003)

Cognitive Domains Potentially Affected in Children with Diabetes : The findings of previous studies in this area can be taken to indicate that : IQ scores of children with diabetes may be adversely affected by early onset of disease, Performance on tests requiring intact neuro-cognitive function, including measures of IQ, can be negatively affected by acute hypoglycemia and perhaps also acute hyperglycemia. Tamara Hershey et al.(2005). Children, who spend the majority of their day at school assimilating information, could be seriously compromised if they regularly experienced episodes of hypoglycemia during class time. There is some evidence that suggests that children may be particularly susceptible to even mild episodes of hypoglycemia.

Souto Sari A. R, Clarissa S. Holmes et al. (2004) observed that pediatric Type 1 diabetes can result in verbal memory difficulties. Ann E. Gold, Ian J. Deary, Kenneth M. MacLeod, Brian M. Frier (1995) carried out a study that examines whether IQ level exerts a differential effect on the impairment of cognitive performance induced during acute hypoglycemia. No overall effect of IQ on deterioration in cognitive performance could be ascertained, although univariate analysis of variance revealed an IQ effect on two of the test: The average IQ group deteriorated significantly less than the higher IQ group during hypoglycemia In conclusion, individuals with a higher IQ did not appear to be protected from the adverse effects of acute hypoglycemia on cognitive function.

Present Study : The present study entitled "Effect of Juvenile Diabetes on Intelligence of Adolescents" belongs to the area of Interdisciplinary research.

Rationale of the Study : India has the largest concentration of diabetic patients in the world. A widespread lack of information, education and awareness is the root cause for this epidemic growth.

The prevalence of diabetes is increasing most rapidly. In 1984, only five per cent of adults living in the towns and



cities of India had diabetes, but by 2011, 10-15 per cent of adults in urban areas were affected by diabetes. In fact, more than seven per cent Indians have diabetes; this is at par with Australia and more than UK. Additionally, the average age of onset of diabetes in Indians is a decade earlier than other races. Many emerging cases are in their late 20s and are predicted to reach nine per cent by 2030. Whereas the number of people with diabetes in India was 50.8 million in 2010 and is predicted to reach 87 million by 2030.

In developed world, almost 5 - 15% of all diabetics are Juvenile Diabetic. Although the prevalence of Juvenile Diabetes, type-1 diabetes mellitus, in India is less than one percent, the morbidity (the rate of incidence of a disease) and mortality (Death rate) is a huge burden on childhood. Many times Juvenile Diabetes goes undiagnosed leading to mortality and so education of general public, school children, parents and school teachers regarding obesity, healthy lifestyle, balanced nutrition, and physical activity is very important.

Many researches have been done in the educational field to see the effect of different factors on cognitive performance. But there is a lack of researches concerning chronic childhood diseases and their effect on intelligence and other cognitive performance and behavior of students. Very few researches are conducted to find out the effect of Juvenile Diabetes on cognitive performance of students.

Juvenile Diabetes is one of the most serious of all chronic childhood diseases, but due to lack of work done on its effect on educational achievement more and more work in this field is required. It has been proved from medical studies that severe and long lasting glucose level fluctuations effect the functioning of central and peripheral nervous system and hence the problems these children suffering from Juvenile Diabetes may face like memorizing, learning, retention, attention span and absence from school need to be studied. This can help them to know the causes, the possible effects, the precautions, the remedies and cures etc. It will also help the teachers to know about their academic and adjustment problems and to find out and apply some appropriate teaching strategies to help them bring out their inherent potential. The present study is a planned effort to find the effect of Juvenile Diabetes on intelligence of adolescents.

Objective of the Study : To study the effect of Juvenile Diabetes on Intelligence of adolescents.

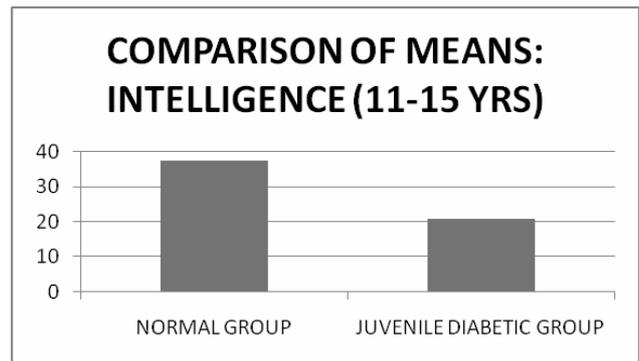
Hypothesis : Adolescents of age group 11 to 15 with type 1 diabetes would demonstrate deficits in intelligence when compared with normal adolescent control subjects.

Research Methodology : The present study is in the area of interdisciplinary research based on survey method. The purposive sampling technique, a type of non probability sample was used. The sample of juvenile diabetic adolescents was selected from "Dream trust organization Nagpur working for cause of juvenile diabetics. The non diabetic sample com-

prised of siblings and other adolescents of the same age group. A comparison was made between the juvenile diabetic and healthy group adolescents in terms of intelligence. The Intelligence Scores achieved by the students on Standardized Intelligence Tests are considered. The sample was divided into two groups. One group represented the normal healthy adolescents n=59 while the other group was having Juvenile Diabetic adolescents n=44. Intelligence Test by Prayag Mehta was applied to compare the intelligence of both the groups and t-test was applied to test the hypothesis.

Analysis and Interpretation of Data : The objective of the study was to find the effect of Juvenile Diabetes on intelligence of adolescents. For this purpose the juvenile diabetic group was compared with normal group for intelligence. Comparison was carried out using verbal intelligence tests developed by Prayag Mehta. The analysis and results are as under:

Effect of Juvenile Diabetes on Intelligence of Adolescents: For this purpose Intelligence Test by Dr. Prayag Mehta was administered and the results are represented graphically as below;



Graph showing comparison of means of Intelligence Scores

Figure 1

The mean values in the above graphs shows that the average scores on intelligence test by Prayag Mehta for the age group of 11 to 15 yrs achieved by normal group is 37.13 and the average scores on intelligence test by Prayag Mehta for the age group of 11 to 15 yrs achieved by Juvenile diabetic group is 20.45 i.e. Juvenile Diabetic group lacks behind in IQ scores for the same items for which the normal group is ahead. To compare mean intelligence score of both the group i.e. juvenile diabetic and normal adolescents' of age group 11 to 15 years t test was used. The results are presented below in table 2

Table 2
Mean, SD and t Value for Intelligence

S No.	Group (11-15 Yrs)	Number of Adolescents	Mean	S.D.	t Value
1	Normal	59	37.13	7.2	8.18*
2	Juvenile Diabetic	44	20.45	11.94	

*Significant at 0.01 level

The values in the above table shows that the t value came out to be 8.18 which is highly significant at .01 level of significance .It indicates that the mean value of intelligence scores of juvenile diabetic group differ significantly from normal group. It can be concluded that the difference is due to effect of Juvenile Diabetes and chance factors can not be the reason for the observed difference.

Thus the hypothesis Adolescents of age group 11 to15 with type 1diabetes would demonstrate deficits in intelligence when compared with sibling or adolescent control subjects is accepted.

Findings : There is significant difference between the performance of juvenile diabetic adolescents and normal adolescents in terms of intelligence. The normal adolescents performed better than juvenile diabetic adolescents.

Discussion : The results indicate that Juvenile Diabetic has a significant effect on intelligence of the affected adolescents. There can be many probable reasons for this effect. Brain is the main organ responsible for reasoning, logic, mathematical operations. Brain receives the energy for its normal functioning from the sugar in blood. As blood sugar levels fluctuate severely in Juvenile Diabetics it can be expected that these fluctuations in blood sugar level will affect the normal functioning of brain by altering the amount the sugar received by brain. Episodes of hypoglycemia and hyperglycemia, coma, seizures, can also be the probable cause for the effect on intelligence. Poor metabolic control can also lead to fluctuations in blood sugar levels, thus affecting the functioning of brain. Various psychological and behavioral problems also add to this like adhering to insulin regimens, family stress. The lack of proper teaching strategies adopted by teachers can also be considered as one of the cause of this effect.

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