Automatic Diagnosis of Diabetes by Expert System

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Abstract

All species of the world undergo diseases and disorders it is necessary to treat it effectively and efficiently. In this concept today, various steps have been taken for discovering or identifying disease like Diabetes and disorders in various species. Diseases and disorders occur due to improper communication within cells networked together which response on metabolic reactivity. Taking this aspect into consideration narration have been made in this paper for automating diseases identification for human, subspecies of Homo sapiens considered to be greatest of the ape family. This would help developers of applications, techniques and tools in the area of diseases for better identification and treating.

Keywords: Diabetes insipidus, Gestational, Insulin, Kussmaul breathing, Polyuria etc.

1. Introduction

Diseases are considered as medical condition that causes abnormal condition in biological systems that prejudice bodily functions with specific signs and symptoms. The main reason behind this is, due to absence of or less in autoimmune responses to diseases. At cells level diseases cause due to non proper signaling within the cells. In specific to human species diseases are any abnormal conditions in the system like pain, injuries, infections, etc. Various types of diseases and disorders avail in various human systems like infectious diseases, syndrome, disorders etc. Diseases are also considered to be infectious where transmission may occur through one or more of diverse pathways including physical contact with infected individuals [7]. These infecting agents may also be transmitted through liquids, food, body fluids, contaminated substance and airborne inhalation. Various treatments are available for treating and preventing diseases and disorders. In this paper narration about diseases in human and significant of automatics diseases diagnosis's in humans. Since in specific
humans are considered to be more valued of the whole biological systems in the world concentration has been made to this species. Humans belong to the species of Homo sapiens of the greatest ape family considered to be the only surviving members of the genus homo. They are highly brained with reasoning and problem solving capabilities. In this species of human diabetes disease is considered for analysis. Since, this is the topmost disease that causes more health problem like gradually affect the heart, kidney etc.

2. Case Study

Most cases of diabetes mellitus fall into the three broad categories of type 1, type 2, and gestational diabetes. A few other types are described. The term *diabetes*, without qualification, usually refers to diabetes mellitus, which roughly translates to excessive sweet urine (known as "glycosuria"). Several rare conditions are also named diabetes. The most common of these is diabetes insipidus in which large which large amounts of urine are produced (polyuria), which is not sweet (insipidus meaning "without taste" in Latin). The term "type 1 diabetes" has replaced several former terms, including childhood-onset diabetes, juvenile diabetes, and insulin-dependent diabetes mellitus (IDDM). Likewise, the term "type 2 diabetes" has replaced

several former terms, including adult-onset diabetes, obesity-related diabetes, and non-insulin-dependent diabetes mellitus (NIDDM). Beyond these two types, there is no agreed-upon standard nomenclature. Various sources have defined "type 3 diabetes" as: gestational diabetes,[6] insulin-resistant type 1 diabetes (or "double diabetes"), type 2 diabetes which has progressed to require injected insulin, and latent autoimmune diabetes of adults (or LADA or "type 1.5" diabetes)[7]

2.1 Type 1 diabetes

Type 1 diabetes mellitus is characterized by loss of the insulin-producing beta cells of the islets of Langerhans in the pancreas leading to insulin deficiency. This type of diabetes can be further classified as immune-mediated or idiopathic. The majority of type 1 diabetes is of the immune-mediated nature, where beta cell loss is a T-cell mediated autoimmune attack.[2] There is no known preventive measure against type 1 diabetes, which causes approximately 10% of diabetes mellitus cases in North America and Europe. Most affected people are otherwise healthy and of a healthy 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 the diabetes cases in children.

2.2 Type 2 diabetes

Type 2 diabetes mellitus is characterized by insulin resistance which may be combined with relatively reduced insulin secretion. The defective responsiveness of body tissues to insulin is believed to involve the insulin receptor. However, the specific defects are not known. Diabetes mellitus due to a known defect are classified separately. Type 2 diabetes is the most common type.

In the early stage of type 2 diabetes, the predominant abnormality is reduced insulin sensitivity. At this stage hyperglycemia can be reversed by a variety of measures and medications that improve insulin sensitivity or reduce glucose production by the liver. As the disease progresses, the impairment of insulin secretion occurs, and therapeutic replacement of insulin may sometimes become necessary in certain patients.[*citation needed*]

2.3 Gestational diabetes

Gestational diabetes mellitus (GDM) resembles type 2 diabetes in several respects, involving a combination of relatively inadequate insulin secretion and responsiveness. It occurs 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.

2.4 Other types

Pre-diabetes indicates a condition that occurs when a person's blood glucose levels are higher than normal but not high enough for a diagnosis of type 2 diabetes. Many people destined to develop type 2 diabetes spend many years in a state of pre-diabetes which has been termed "America's largest healthcare epidemic."[9]:10–11

Signs and symptoms

Figure 1. The most significant symptoms of diabetes.

The classical symptoms of DM are polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger).[11] Symptoms may develop quite rapidly (weeks or months) in type 1 diabetes, particularly in children. However, in type 2 diabetes symptoms usually 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 mental fatigue. All of these symptoms except weight loss can also manifest in type 2 diabetes in patients whose diabetes is poorly

controlled, although unexplained weight loss may be experienced at the onset of the disease. Final diagnosis is made by measuring the blood glucose concentration. When the glucose concentration in the blood is raised beyond its renal threshold (about 10 mmol/L, although this may be altered in certain conditions, such as pregnancy), reabsorption of glucose in the proximal renal tubuli is incomplete, and part of the glucose remains in the urine (glycosuria). This increases the osmotic pressure of the urine and inhibits reabsorption of water by the kidney, resulting in increased urine production (polyuria) and increased fluid loss. Lost blood volume will be replaced osmotically from water held in body cells and other body compartments, causing dehydration and increased thirst. Prolonged high blood glucose causes glucose absorption, which leads to changes in the shape of the lenses of the eyes, resulting in vision changes; sustained sensible glucose control usually returns the lens to its original shape. Blurred vision is a common complaint leading to a diabetes diagnosis; type 1 should always be suspected in cases of rapid vision change, whereas with type 2 change is generally more gradual, but should still be suspected. Patients (usually with type 1 diabetes) may also initially present with diabetic ketoacidosis (DKA), an extreme state of metabolic dysregulation characterized by the smell of acetone on the patient's breath; a rapid, deep breathing known as Kussmaul breathing; polyuria; nausea; vomiting and abdominal pain; and any of many altered states of consciousness or arousal (such as hostility and mania or, equally, confusion and lethargy). In severe DKA, coma may follow, progressing to death. Diabetic ketoacidosis is a medical emergency and requires immediate hospitalization. A rarer but equally severe possibility is hyperosmolar nonketotic state, which is more common in type 2 diabetes and is mainly the result of dehydration due to loss of body water..

3. Pathophysiology

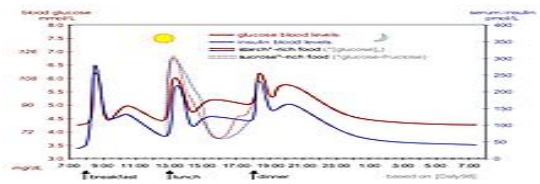

Figure 2. Variation of Blood Sugar & Insulin

The fluctuation of blood sugar (red) and the sugar-lowering hormone insulin (blue) in humans during the course of a day with three meals. One of the effects of a sugar-rich vs a starch-rich meal is highlighted.

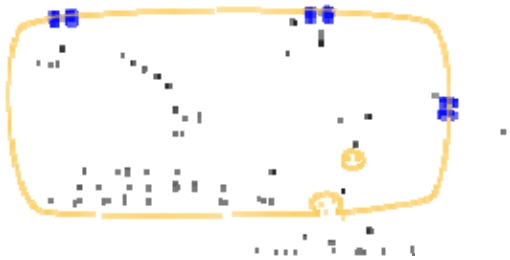

Figure 3. Release of Blood Sugar & Insulin

Mechanism of insulin release in normal pancreatic beta cells. Insulin production is more or less constant within the beta cells, irrespective of blood glucose levels. It is stored within vacuoles pending release, via exocytosis, which is primarily triggered by food, chiefly food containing absorbable glucose. The chief trigger is a rise in blood glucose levels after eating. Humans are capable of digesting some carbohydrates, in particular those most common in food; starch, and some disaccharides such as sucrose, are converted within a few hours to simpler forms most notably the monosaccharide glucose, the principal carbohydrate energy source used by the body. The most significant exceptions are fructose, most disaccharides (except sucrose and in some people lactose), and all more complex polysaccharides, with the outstanding exception of starch. The rest are passed on for processing by gut flora largely in the colon. Insulin is released into the blood by beta cells (β-cells), found in the Islets of Langerhans in the pancreas, in response to rising levels of blood glucose, typically after eating. Insulin is used by about two-thirds of the body's cells to absorb glucose from the blood for use as fuel, for conversion to other needed molecules, or for storage.

4. Diagnosis

Table 1. WHO Diabetes criteria(1999)

Condition	2 hour	Fasting

	glucose	**glucose**
	mmol/l(mg/dl)	mmol/l(mg/dl)
Normal	<7.8 (<140)	<6.1 (<110)
Impaired fasting glycaemia	<7.8 (<140)	≥ 6.1(≥110) & <7.0(<126)
Impaired glucose tolerance	≥7.8 (≥140)	<7.0 (<126)
Diabetes mellitus	≥11.1 (≥200)	≥7.0 (≥126)

Diabetes mellitus is characterized by recurrent or persistent hyperglycemia, and is diagnosed by demonstrating any one of the following:[10]

- Fasting plasma glucose level at or above 7.0 mmol/L (126 mg/dL).
- Plasma glucose at or above 11.1 mmol/L (200 mg/dL) two hours after a 75 g oral glucose load as in a glucose tolerance test.
- Symptoms of hyperglycemia and casual plasma glucose at or above 11.1 mmol/L (200 mg/dL).
- Glycated hemoglobin (hemoglobin A1C) at or above 6.5. (This criterion was recommended by the American Diabetes Association in 2010; it has yet to be adopted by the WHO.)[28]

5. Epidemiology

Figure 4. Prevalence of diabetes worldwide in 2000 (per 1000 inhabitants) World average was 2.8%.

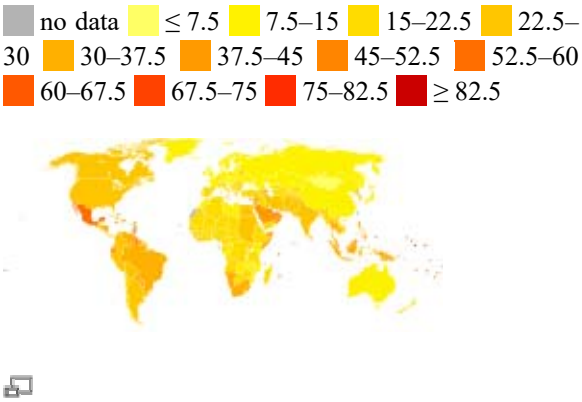

Figure 5. Disability-adjusted life year for diabetes mellitus per 100,000 inhabitants in 2002

In 2000, according to the World Health Organization, at least 171 million people worldwide suffer from diabetes, or 2.8% of the population.[4] Its incidence is increasing rapidly, and it is estimated that by 2030, this number will almost double.[4] Diabetes mellitus occurs throughout the world, but is more common (especially type 2) in the more developed countries. The greatest increase in prevalence is, however, expected to occur in Asia and Africa, where most patients will probably be found by 2030.[4] 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.[4]

6. Automatic Diagnosis of Diabetes

In this section, narrations about significance of automating diagnosis of human diseases have been made. For the automatic disease diagnoses various analyses has to be taken into consideration. In specific to humans suspecting Diabetes in the

systems is based on signs and symptoms. Automating diabetes recognition by suspecting based on mutation detection in human genomes along with different determining factor like
Age. S1, S2, S3, S4 & S5
Pregnancy status S1, S2, S3, S4 & S5
Chronically ill S1, S2, S3, S4 & S5
Where S1= 1-20%, S2= 17-40%, S3= 35-60%, S4= 55-80%, S5= 75-100 & symptoms that would be helpful in early treatment. Different agents are used in the system to identify each sign and symptoms and by the interoperability of agents in the system diagnosis can be done and also treatment can be suggested by the system.

7. Conclusion

The main aim behind this narration of automating diagnosing of diseases in human system is to treat diabetes disease effectively and efficiently. This is also helpful in diseased related researches and in new drug discovery. This would benefit not only researchers but also to the society for the mankind.

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