DESDIAB - Diagnostic an Expert System for Diabetes

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ABSTRACT

Health information plays a crucial role in our society, and the demand for reliable medical knowledge has skyrocketed in recent years. To meet this pressing need, innovative expert systems have been developed for various diseases, offering invaluable knowledge and support for diagnosis and treatment. Among these is "DESDIAB-Diagnostic an Expert System for Diabetes," designed specifically to tackle one of the most prevalent diseases, known for its serious health complications. This groundbreaking system aids in the diagnosis of all diabetes types by analyzing a wide range of symptoms, empowering patients and healthcare providers alike. DESDIAB is not just a tool; it's a transformative resource that enables users to take control of their diabetes management and its potential complications. While primarily aimed at physicians, healthcare managers, and professionals, it also extends its wealth of information to students, researchers, and the general public. By bridging the technology gap, DESDIAB ensures that everyone can access essential health information, fostering informed decision-making and improving health outcomes for all. Embrace the future of diabetes care with DESDIAB—where knowledge meets empowerment!

Keywords

Expert System, Diabetes, Knowledge Base, Inference Engine, DESDIAB.

1. INTRODUCTION

Health information is one of the most important requirements of the society. The demands of information in medical field have considerably increased the responsibilities of physician's patients, scientists and laymen. The information requirements have become diversified due to the complicated nature of the various diseases and there is a need for awareness about medical information about these diseases in the society. One of the widely prevalent diseases which leads to many health complications is Diabetes. There are number of different diabetic and the most common are Type 1 and Type 2. [1] Diabetes can affect nearly every organ system in the body and is thereby widely recognized as one of the leading causes of death and disability worldwide. According to International Diabetes Federation (IDF) 10th edition 2021, the estimated number of individuals affected with diabetes is affects an estimated 537 million adults worldwide between the age of 20 to 79 (10.5% of all adults in this age range). By 2030, 643 million people will have diabetes globally, increasing to 783 million by 2045. [2] Unfortunately, most of the patients are not well aware of the symptoms of this disorder of diabetes and its complications. This could be due to their ignorance and lack of awareness about the disorder. These patients in many cases are not aware of this disease and how to control it. In this situation, the role of information professionals has become more complicated since they have to equipped themselves with the specialized knowledge and skill to provide value added information products to satisfy the specific needs of the target users.

In view of this, the objective of this research was to design and developed a "DESDIAB-Diagnostic an Expert System for Diabetes" for diagnosis of all types of diabetes and its complications to identify their disorder, using the sign and symptoms. These expert systems can be used to improve the quality of healthcare in many ways. [3] This could act as a support system for physicians and as a knowledge base for patients. It will provide valuable added information with regards to epidemiology, symptoms, diagnosis, treatment, prevention and control of diabetes. [4] The expert system includes not only tailor-made database but also knowledge base systems which will facilitate in decision-making and problem solving and reading purpose, it can be highly helpful for the who are information required. [5] In addition, some of these patients do not access to the physicians during necessary times. Therefore, such a system can provide necessary information about the indications, diagnosis and primary treatment advices to the diabetic's patients.

2. DEFINITION AND DESCRIPTION OF DIABETES MELLITUS

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels. [6]

2.1 Type 1 Diabetes

This form of diabetes, which accounts for only 5–10% of those with diabetes, previously encompassed by the term's insulin-dependent diabetes, Type 1 Diabetes, or juvenile-onset diabetes. Type 1 diabetes is a chronic inflammatory disease caused by a selective destruction of the insulin- producing β-cells in the islets of Langerhans. The condition is associated with the appearance of humoral and cellular islet autoimmunity, and a defective immunoregulation. [7]

2.2 Type 2 Diabetes

Type 2 Diabetes Mellitus (T2DM), one of the most common metabolic disorders, is caused by a combination of two primary factors: defective insulin secretion by pancreatic β-cells and the inability of insulin-sensitive tissues to respond appropriately to insulin. [8] Type 2 diabetes is much more common and accounts for around 90% of all diabetes cases worldwide. It occurs most frequently in adults, but is being noted increasingly in adolescents as well. [9] For the diabetic patient's treatment must not only be effective and safe but also improve the quality of life. The several novel medications are in development, but the greatest need is for agents that enhance insulin sensitivity, halt

the progressive pancreatic β-cell failure that is characteristic of T2DM and prevent or reverse the microvascular complications. [10]

2.3 Gestational Diabetes Mellitus (GDM)

Gestational diabetes mellitus (GDM) represents glucose levels in the high end of the population distribution during pregnancy. GDM carries a small but potentially important risk of adverse perinatal outcomes and a longer-term risk of obesity and glucose intolerance in offspring. Mothers with GDM have an excess of hypertensive disorders during pregnancy and a high risk of diabetes mellitus thereafter. Diagnosing and treating GDM can reduce perinatal complications, but only a small fraction of pregnancies benefit. Nutritional management is the cornerstone of treatment; insulin, glyburide and metformin can be used to intensify treatment. Fetal measurements compliment maternal glucose measurements in identifying pregnancies that need such intensification. [11].

3. DEFINITION OF THE TERM EXPERT SYSTEM

A computer decision support system with an explicit knowledge base and separate reasoned program that user used to give advice or interpret data, often patient data. [12] An expert system is a computer program that represents and reasons with knowledge of some specialist subject with a view of solving problems or giving advice. [13] In other words, an expert system is a computer program designed to model the problem-solving ability of a human expert. The concept of an expert system is also referred to by various other names such as decision support system, smart system, knowledge-based system etc. These different names reflect differences in the systems. For instance, a decision support system is usually intended to support an expert, whereas many expert systems were intended to replace the expert, at least for a sub-set of the expert's tasks. The term "knowledge-based system" reflects the hostility, which was aroused in the professionals by the concept of attempting to replace a human expert with software. [14] Stern stated it as Expert System as it would help field service technicians diagnose problems. The technician's personal ability could range from average to excellent but the expert system ensured that service quality was uniformly high. Tasks that require employees to make consistent decisions and remain alert over long periods of time, often under difficult circumstances, also lend themselves to expert system. [15]

4. EXPERT SYSTEMS IN MEDICINE

Several studies have explored the use of expert systems for the diagnosis and management of diabetes. These systems leverage patient data, clinical guidelines, and expert knowledge to provide recommendations for treatment and monitoring. The Expert system DENDRAL project was one of the first large-scale programs to embody the strategy of using detailed, task-specific knowledge about a problem domain as a source of heuristics, and to seek generality through automating the acquisition of such knowledge. [16] Tawfik and Mohammad et al., says major expert systems in the field of medicine have been expressed are PUFF: Pulmonary Disease Diagnosis, VM :Monitoring of patients need to intensive care, ABEL: Diagnosis of acidic materials and electrolytes, AI/COAG: Blood disease diagnosis, AI/RHEUM :Rheumatic disease diagnosis, CADUCEUS: Internal Medicine Disease diagnosis, ANNA: Monitoring and Treatment Analysis, BLUEBOX: Depression Diagnosis and Treatment, MYCIN Microbial disease diagnosis and treatment, ONCOCIN Treatment and management of patients chemotherapy, ATTENDING : Anaesthesia management education, GUIDON : Microbial disease education. [17] Keles and Yavuz have developed an expert system called as an Ex-DBC Expert System for Diagnosis of Breast Cancer. [18] Garcia, introduced an intelligent system, ESDIABETES to help diabetes people to monitor and to control the blood glucose level. In the first phase of the ESDIABETES, they presented a small prototype in CLIPS 6.0. [19] Fuzzy logic and an ontology system to build a patient-centered treatment decision support system which can infer the individualization HbA1c target and recommend anti-diabetic drugs for patients with T2DM which also serve as a guide for specialty doctors. [20] DIABOT An- Expert system for in management of Diabetes. [21] Knowledge-based systems (KBS) have emerged as valuable tools in the field of healthcare, aiding clinicians in diagnosing and treating lung cancer. [22] Belief Rule Base Expert System (BRBES) for Non -small cell Lung cancer (NSCLC) it provides a decision-making platform to physicians and help patient to get better treatment in advance. [23] DExS is a Diagnosis expert system, it helps a great deal in identifying those diseases and describing methods of treatment to be carried out taking into account the user capability in order to deal and interact with expert system easily and clearly, these expert system uses inference rules and plays an important role that will provide certain methods of diagnosis for treatment. [24] Campos-Delgado et al. in 2006 developed a Mamdani-type fuzzy-based system to present a blood glucose controller for type-1 diabetes patients under multiple daily insulin injections regimen. [25] Jha developed a knowledge-based expert System which integrated natural treatment methods in diabetes management. The methods consisted of massage, acupuncture, herbal/proper nutrition and gems. [26] CaDDES is the Cattle disease detection is a useful software for designing an expert system application program, which is able to provide an accurate diagnosis of the likelihood of cattle suffering from disease and how to treat it. [27] The CaDDES, a web application was developed using PHP, HTML, JavaScript, and MySQL computer programming languages. A questionnaire tool was developed and used for collecting the scores for symptoms or signs of 13 cattle diseases for diagnosed. [28] DESDIAB, based on the CaDDES model, uses signs and symptoms to self-identify diabetes patients to create a decision support system and knowledge base.

5. COMPONENTS OF AN EXPERT SYSTEM

The components of the expert system show in Figure 1, consists of Expert Editor, Knowledge-Base, Inference Engine, Current problem information, User Interface, User, Solution and Advice.

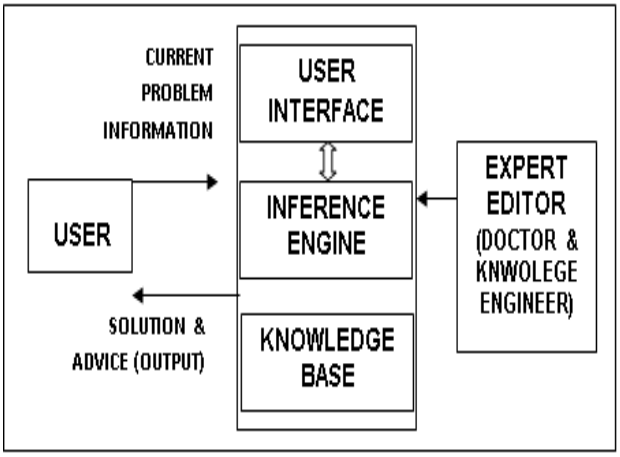


Fig 1: Components of an Expert System

5.1 Expert Editor: It is the component that allows the creator of the program or the "Human Expert" to enter information into the knowledge base. The information has to be fed into the system in a specified format.

5.2 Knowledge Base: It is the Brain of an Expert System in which the information is gathered on all facts and knowledge that human expert can provide. The knowledge base consists of certain objects and the relationship that exists among the objects.

5.3 Inference Engine: It contains the logical programming to examine the information provided by the user as well as the facts and rules specified within the knowledge base. It evaluates the current problem.

5.4 Problem Information Components: It is the area that gathers the data on changing conditions in the problem.

5.5 User Interface component: It serves the following multiple purposes:

- Gathers data from the user to be entered into the current problem information through various questions.
- Explains the reasoning of the Expert (Knowledge Base).
- Presents the solution for the current problem.

5.6 User: It is an individual who has a problem and requires the Expert System to help him to solve the problem.

5.7 Solution and Advice: It is the final component of an Expert System where a result has been generated from the knowledge base and the solution will be provided to the user with the help of user interface.

6. PROPOSED EXPERT SYSTEM

To address the limitations of current approaches, we propose the design of a Diagnostic an Expert System for Diabetes. DESDIAB will integrate patient data, medical knowledge, and machine learning algorithms to provide accurate and timely diagnosis of diabetes, as well as personalized recommendations for treatment and self-management.

7. LIMITATIONS OF THE EXPERT SYSTEM

- The Expert systems are not capable of originating new knowledge.
- Incomplete data or rules will lead to wrong decisions.
- It cannot replace the judgments, which requires deep knowledge and wisdom and the effectiveness depends on the knowledge included in the system. The performance is also constrained by the hardware
- and software designing of Expert System beta Version -1.

8. TOOLS USED TO DESIGN EXPERT SYSTEM

Expert System has been developed by using the Visual Basic 6 as the front-end screen. The tables have been created using Microsoft Access used as a back end and help line has been created using Microsoft front page. The data collected from the printed sources has been utilized for creating the knowledge base of Expert System for Doctors of Dr. Mohan's Diabetes Specialties Centre, Gopalapuram, Chennai. [29]

9. SCOPE AND LIMITATIONS OF THE STUDY

The symptoms were selected based on the recommendations of subject-matter specialists in the field of diabetes. In the Table-1 shows the Twenty-Three (23) symptoms, including habits were included. Table-2, Shows the Fourteen (14) Major complication have been included in the knowledge base of the Expert System.

Table 1 & 2 Symptoms and its Complication

Table 1	
No.	**List of Symptoms**
1	Abrupt onset
2	Weight loss
3	Weight Gain
4	Increasing Thirst/Urination
5	Weakness/Body Pain
6	Nervousness/ Sweating Trembling
7	Dry Skin / Fatigue/Drowsiness
8	Illness/ Hunger
9	Blurred / Decreased Vision
10	Visual disturbance
11	Pregnancy
12	Nauseas / Vomiting/Bladder
13	Difficult /Decreeing - Urination
14	Poor Wound Heal / Fungal Nail
15	Stress / Chest Pain
16	Swelling
17	Blood Pressure
18	Abdominal Pain
19	Maldigestion
20	Numbness / Pain (Leg/Hand/Body)
21	Smoking / Drinking
22	Obese (BMI>25)
23	Loss of Hair – Legs

Table - 2	
No.	**List of Complication**
1	Type 1 Diabetes
2	Type 2 Diabetes
3	Diabetic Retinopathy
4	Diabetic Neuropathy
5	Diabetic Nephropathy
6	Diabetic Cardiovascular
7	Obesity
8	FCPD
9	Hypoglycaemia
10	Hyperglycaemia
11	Gestation Diabetes
12	Diabetic Foot
13	Diabetic Ketoacidosis
14	Stroke

10. IMPLEMENTATION AND RESULTS SCREEN

Figure 2 is an output of the DESDIAB software of home page of explain the user interaction with the expert system design page. Its shows the Radio Buttons of Present and Absent of Symptoms, complication screen, Calculate, Cancel, Index, Help, Exit, Buttons.

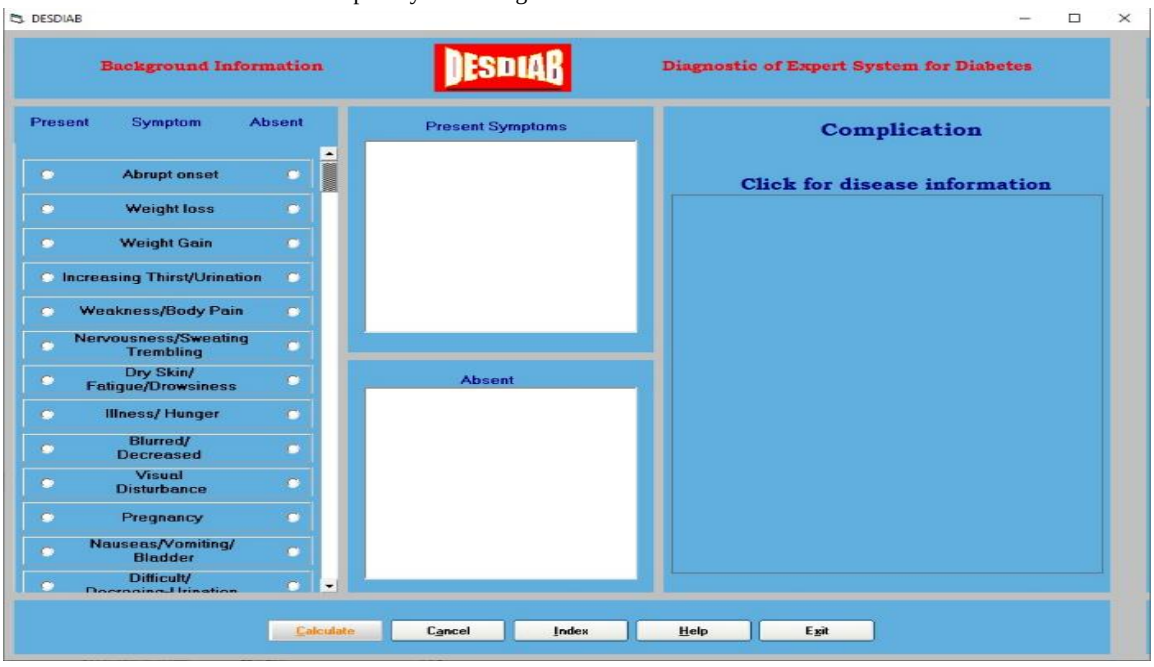


Fig 2: Home Screen for the DESIDAB Expert System

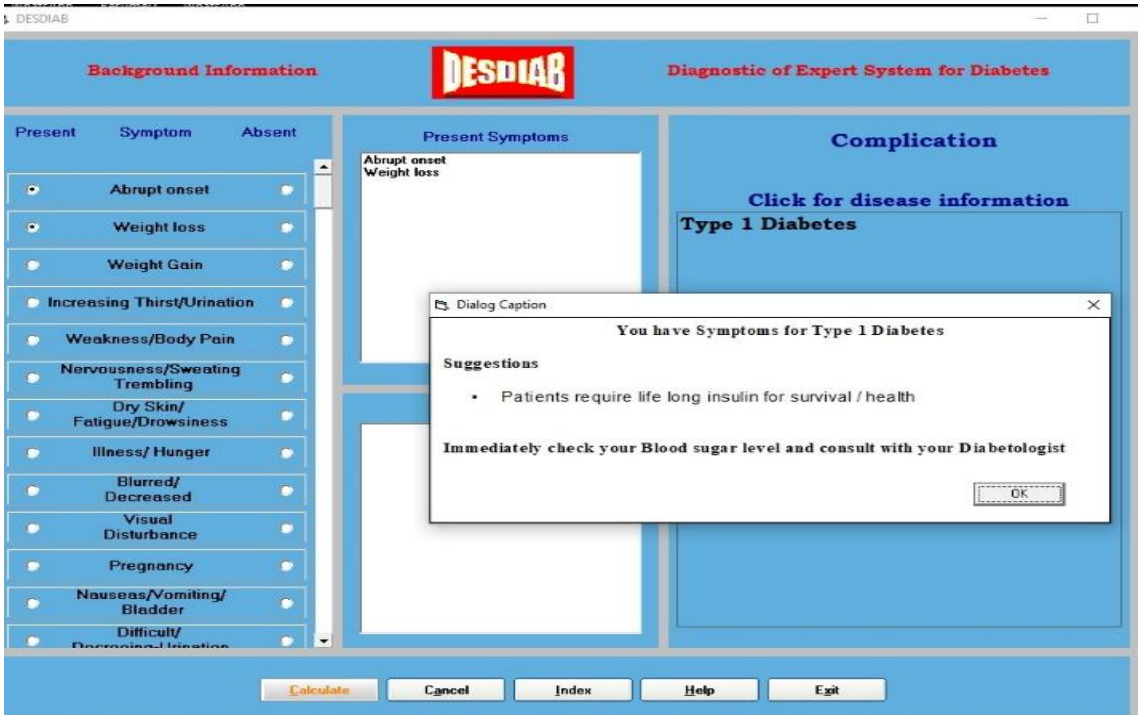


Fig 3 : Symptoms of Type 1 Diabetes Selection

Figure 3: Indicates the selection of radio button options by the user its indicate the symptoms of disease. The two buttons namely '**Abrupt onset**' and '**Weight loss**' were selected which is shown in the 'Present symptoms panel'. If the user clicks the "**Calculate"** button, the system will display the required information shown in the Dialog caption and gives the Suggestions (or) Advice to the user, as shown in the picture. Further the system has clearly indicated the information to user has 'Symptoms for Type 1 Diabetes'. Fig 4: shows the output result screen of Type 1 Diabetes with Hyperlinks information brief study tool.

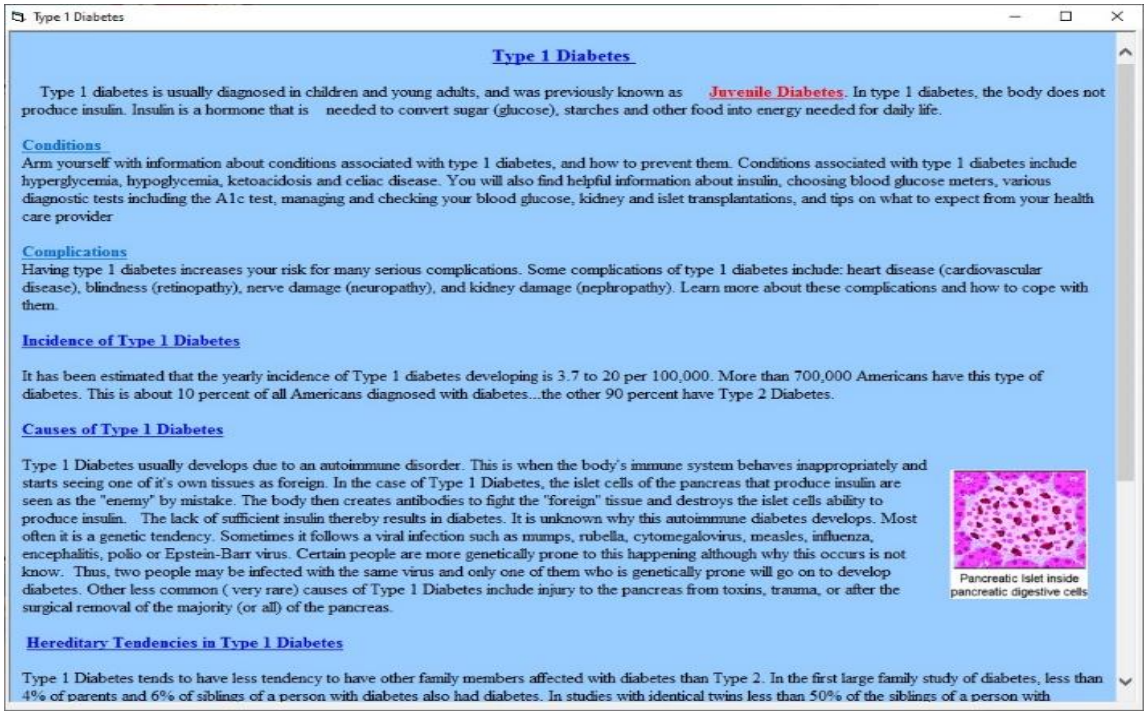


Fig 4: Result screen information on Type 1 Diabetes Selection

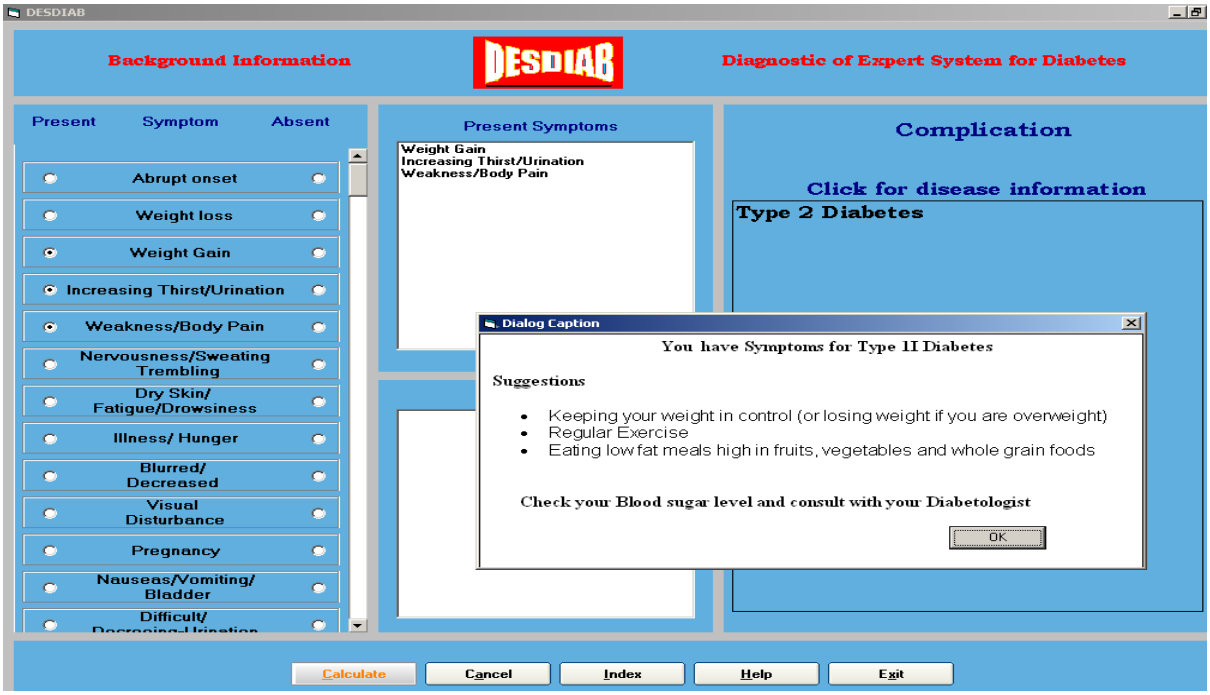


Figure 5 Symptoms of Type II Diabetes Selection

Figure 5: Shows that user selected the radio button options for the symptoms such as weight Gain and Increasing Thirst (or) Thirst (or) Urination (or) Weakness which are reflected in the present symptoms panel. If the user clicks the Calculate button the system will display the required information show in the dialog caption and gives the suggestion (or) advice to the user. Further, the system has clearly indicated that the user has "Symptoms for the Type 2 diabetes"

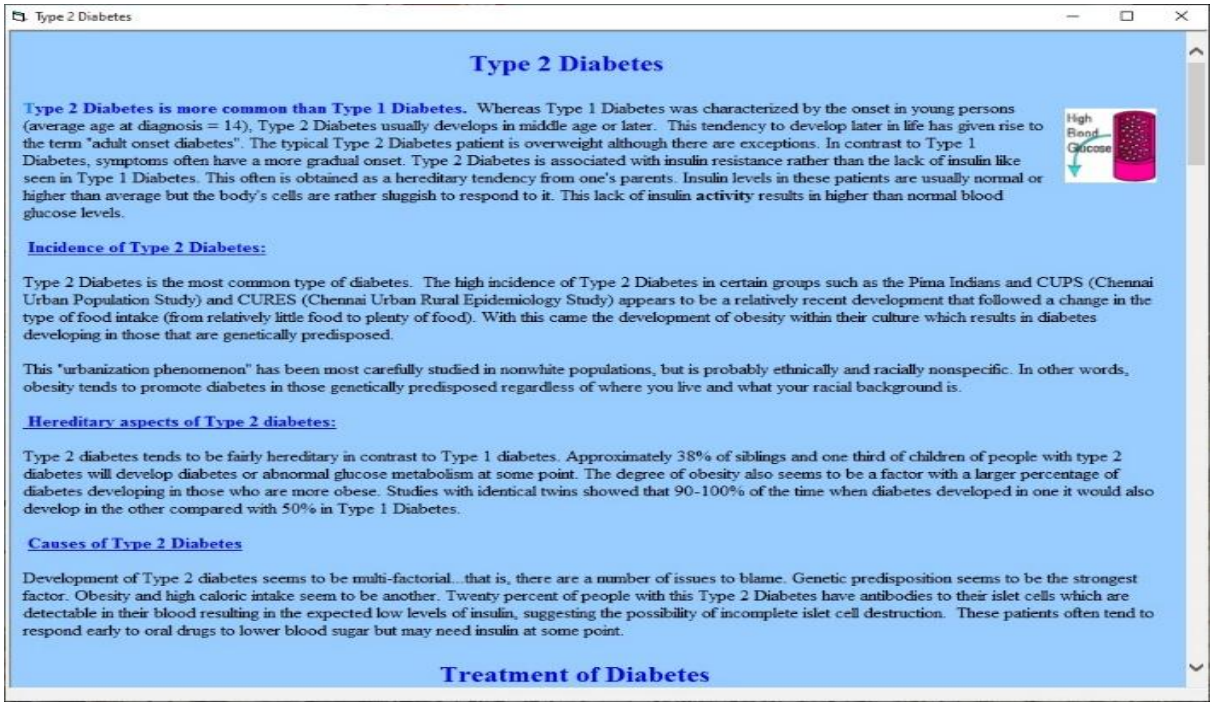
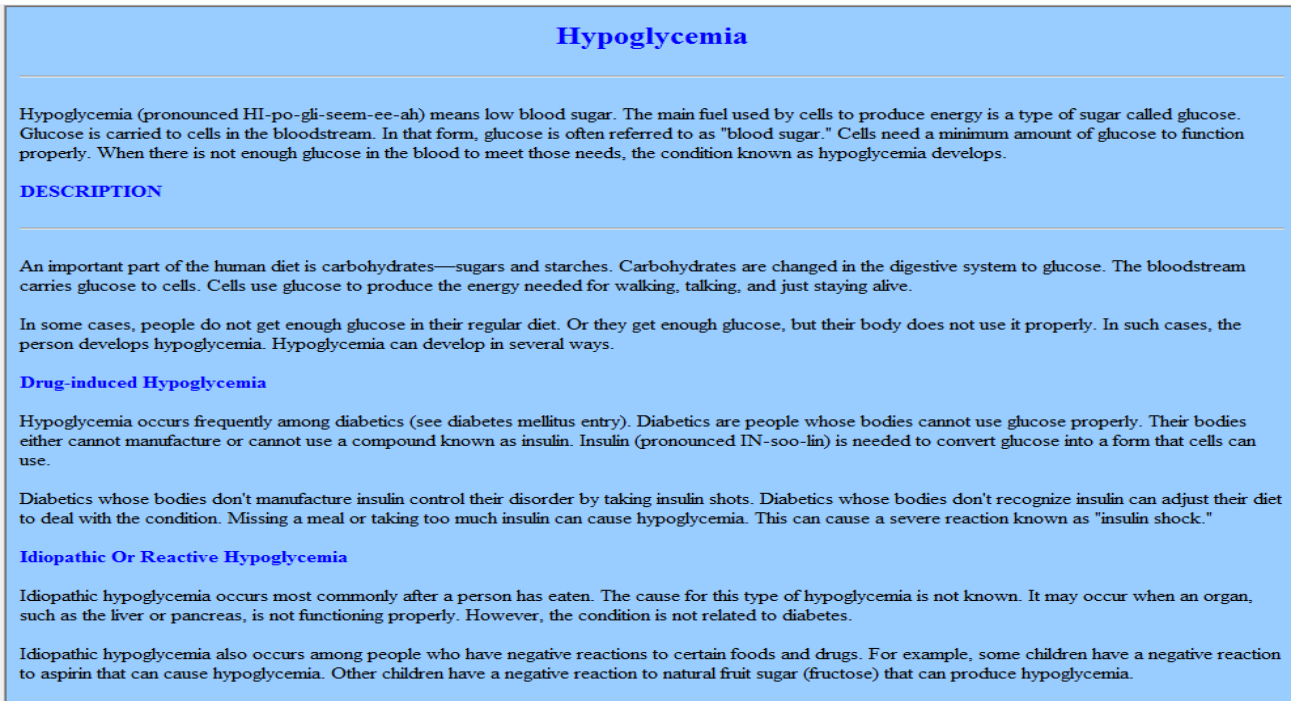


Fig 6: Results of Type 2 Diabetes

Presents more information about the type 2 diabetes and various hyperlinks available in the knowledge base system. Figure 7 : show that user selected the Radio Button Options for the symptoms "Increasing Thirst/urination and Weakness Body and Nervousness/Sweating/Trembling and dry skin / Fating /Drowsiness and illness/Hunger', which are reflected in the present symptoms panel. If the user clicks the Calculation button the system will display the required information show in the dialog caption and gives the suggestion or advice to the user check your sugar level. Further the system has clearly indicated that the user has "Symptoms for Hyperglycemia".

Fig 7: Symptoms for Hypoglycemia

If the user activates the "diseases Information" option, which is a hyperlink, and it will retrieve further information about the hyperglycemia as shown in the Figure No.8.



Hypoglycemia

Hypoglycemia (pronounced HI-po-gli-seem-ee-ah) means low blood sugar. The main fuel used by cells to produce energy is a type of sugar called glucose. Glucose is carried to cells in the bloodstream. In that form, glucose is often referred to as "blood sugar." Cells need a minimum amount of glucose to function properly. When there is not enough glucose in the blood to meet those needs, the condition known as hypoglycemia develops.

DESCRIPTION

An important part of the human diet is carbohydrates—sugars and starches. Carbohydrates are changed in the digestive system to glucose. The bloodstream carries glucose to cells. Cells use glucose to produce the energy needed for walking, talking, and just staying alive.

In some cases, people do not get enough glucose in their regular diet. Or they get enough glucose, but their body does not use it properly. In such cases, the person develops hypoglycemia. Hypoglycemia can develop in several ways.

Drug-induced Hypoglycemia

Hypoglycemia occurs frequently among diabetics (see diabetes mellitus entry). Diabetics are people whose bodies cannot use glucose properly. Their bodies either cannot manufacture or cannot use a compound known as insulin. Insulin (pronounced IN-soo-lin) is needed to convert glucose into a form that cells can use.

Diabetics whose bodies don't manufacture insulin control their disorder by taking insulin shots. Diabetics whose bodies don't recognize insulin can adjust their diet to deal with the condition. Missing a meal or taking too much insulin can cause hypoglycemia. This can cause a severe reaction known as "insulin shock."

Idiopathic Or Reactive Hypoglycemia

Idiopathic hypoglycemia occurs most commonly after a person has eaten. The cause for this type of hypoglycemia is not known. It may occur when an organ, such as the liver or pancreas, is not functioning properly. However, the condition is not related to diabetes.

Idiopathic hypoglycemia also occurs among people who have negative reactions to certain foods and drugs. For example, some children have a negative reaction to aspirin that can cause hypoglycemia. Other children have a negative reaction to natural fruit sugar (fructose) that can produce hypoglycemia.

Fig 8: Hypoglycemia with Hyperlinks information

Figure 9: show that user selected the Radio Button Options for the symptoms "Increasing Thirst/urination and weakness Body and Weight Loss', which are reflected in the present symptoms panel. If patients have higher sugar level. If the user clicks the Calculation button the system will display the Hyperglycemia Information as show in the dialog caption and gives the suggestion to the user.

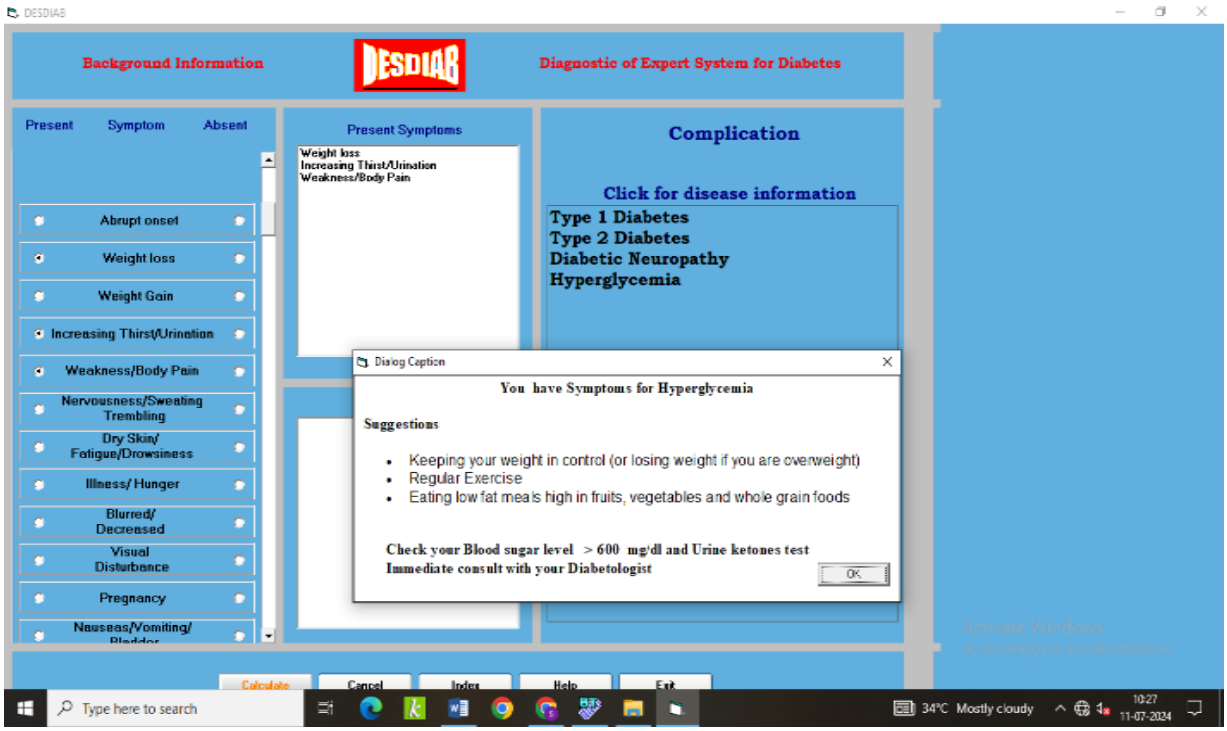
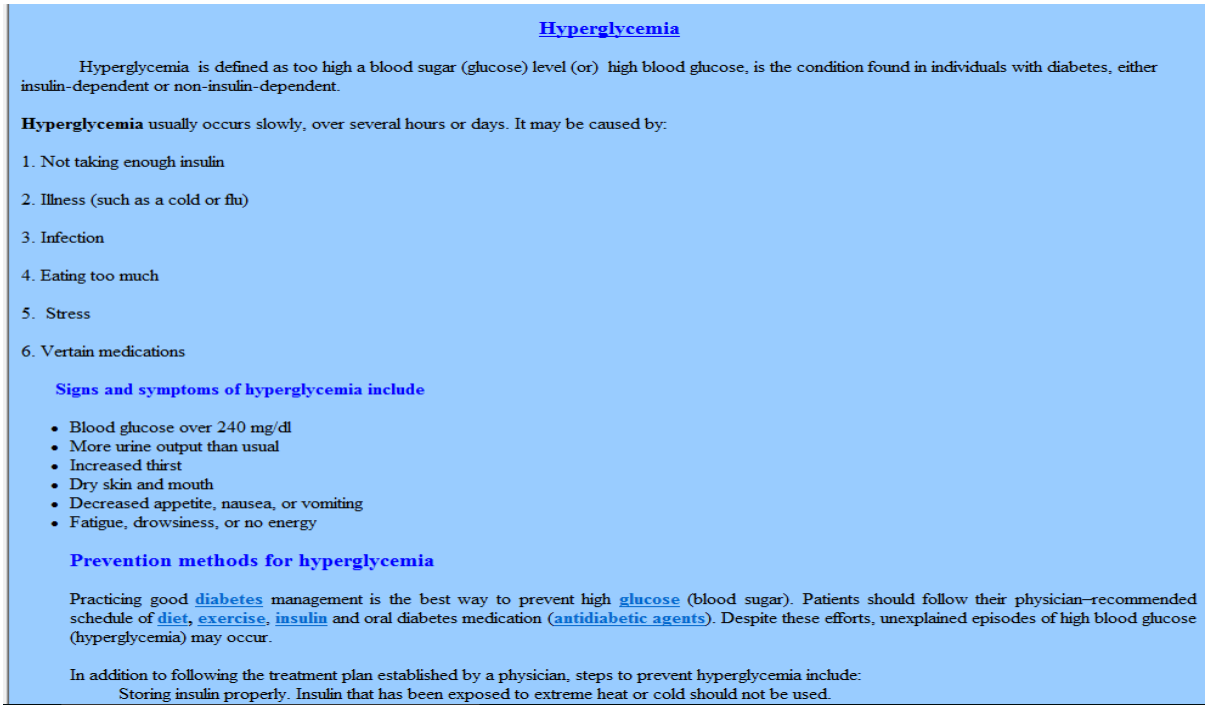


Fig 9: Symptoms for Hyperglycemia

If, user wants more details about hyperglycemia the user should Click for disease information option show in figure 10.



Hyperglycemia

Hyperglycemia is defined as too high a blood sugar (glucose) level (or) high blood glucose, is the condition found in individuals with diabetes, either insulin-dependent or non-insulin-dependent.

Hyperglycemia usually occurs slowly, over several hours or days. It may be caused by:

1. Not taking enough insulin
2. Illness (such as a cold or flu)
3. Infection
4. Eating too much
5. Stress
6. Vertain medications

Signs and symptoms of hyperglycemia include

- Blood glucose over 240 mg/dl
- More urine output than usual
- Increased thirst
- Dry skin and mouth
- Decreased appetite, nausea, or vomiting
- Fatigue, drowsiness, or no energy

Prevention methods for hyperglycemia

Practicing good diabetes management is the best way to prevent high glucose (blood sugar). Patients should follow their physician–recommended schedule of diet, exercise, insulin and oral diabetes medication (antidiabetic agents). Despite these efforts, unexplained episodes of high blood glucose (hyperglycemia) may occur.

In addition to following the treatment plan established by a physician, steps to prevent hyperglycemia include:
Storing insulin properly. Insulin that has been exposed to extreme heat or cold should not be used.

Fig 10: Showing Result on Hyperglycemia information.

Figure 11. Indicate that the user selected the Radio Options of the symptoms Increasing Thirst/ Urination/ Weakness and visual Disturbance or Blurred /Decreasing Vision, which are reflected in the present symptoms panel. If the clicks the Calculate buttons the system will display the required information show in the dialog caption and gives the Suggestion (or) Advice the user. Further the system has clearly indicated that the user has "Symptoms for Type II and Diabetic Retinopathy

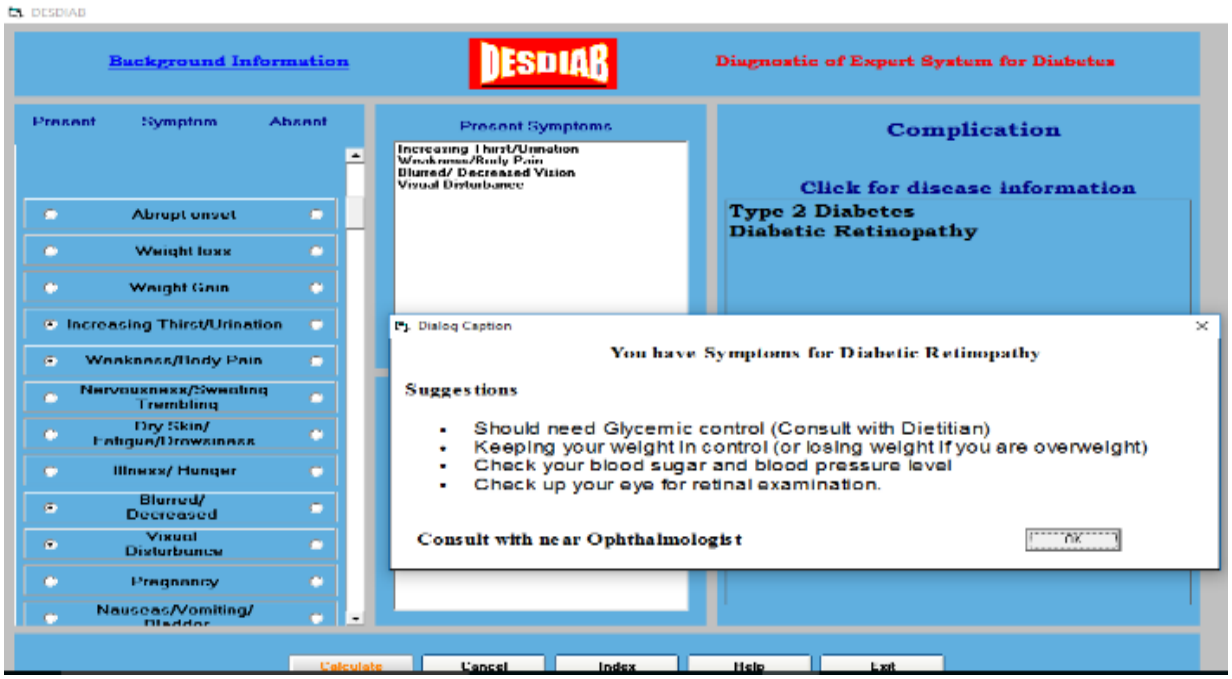
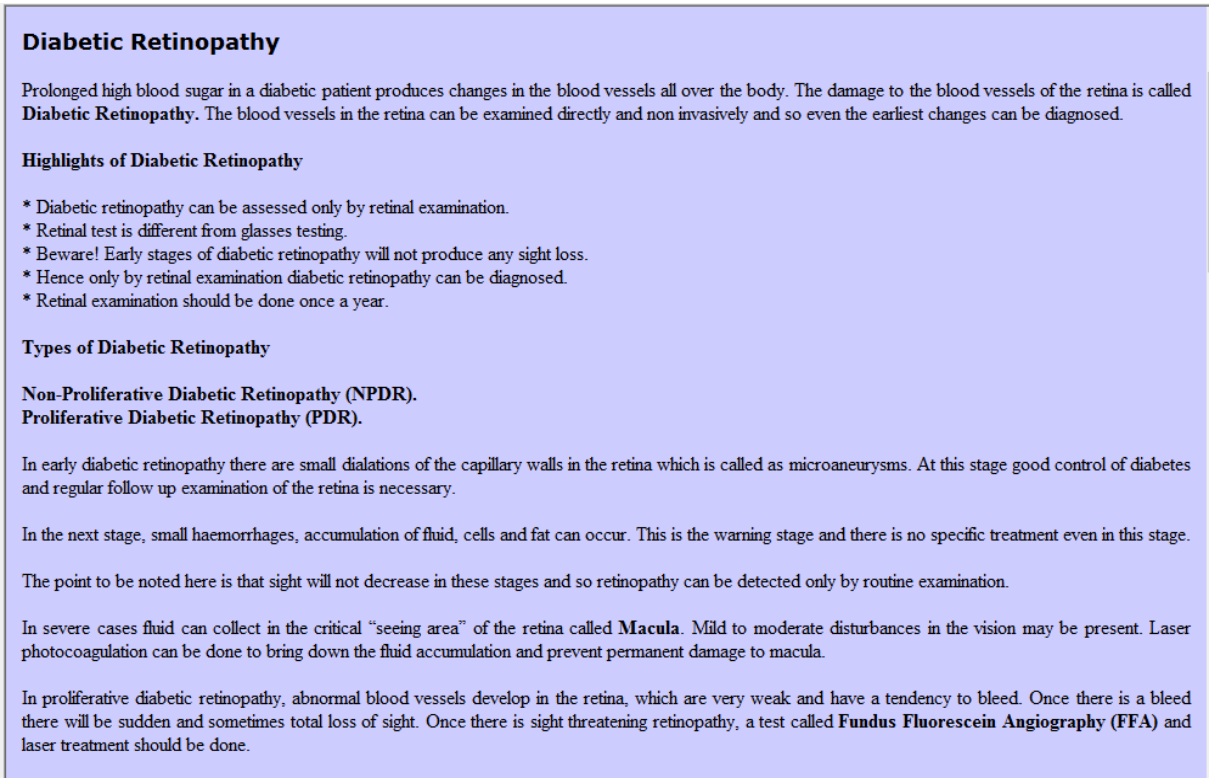


Fig 11: Symptoms for Diabetic Retinopathy

If the User activate the Disease Information", option, which is hyperlinks and it will retrieve further information about the Diabetic Retinopathy as show in the Display 11.



Diabetic Retinopathy

Prolonged high blood sugar in a diabetic patient produces changes in the blood vessels all over the body. The damage to the blood vessels of the retina is called **Diabetic Retinopathy.** The blood vessels in the retina can be examined directly and non invasively and so even the earliest changes can be diagnosed.

Highlights of Diabetic Retinopathy

* Diabetic retinopathy can be assessed only by retinal examination.
* Retinal test is different from glasses testing.
* Beware! Early stages of diabetic retinopathy will not produce any sight loss.
* Hence only by retinal examination diabetic retinopathy can be diagnosed.
* Retinal examination should be done once a year.

Types of Diabetic Retinopathy

Non-Proliferative Diabetic Retinopathy (NPDR).
Proliferative Diabetic Retinopathy (PDR).

In early diabetic retinopathy there are small dialations of the capillary walls in the retina which is called as microaneurysms. At this stage good control of diabetes and regular follow up examination of the retina is necessary.

In the next stage, small haemorrhages, accumulation of fluid, cells and fat can occur. This is the warning stage and there is no specific treatment even in this stage.

The point to be noted here is that sight will not decrease in these stages and so retinopathy can be detected only by routine examination.

In severe cases fluid can collect in the critical "seeing area" of the retina called **Macula**. Mild to moderate disturbances in the vision may be present. Laser photocoagulation can be done to bring down the fluid accumulation and prevent permanent damage to macula.

In proliferative diabetic retinopathy, abnormal blood vessels develop in the retina, which are very weak and have a tendency to bleed. Once there is a bleed there will be sudden and sometimes total loss of sight. Once there is sight threatening retinopathy, a test called **Fundus Fluorescein Angiography (FFA)** and laser treatment should be done.

Figure 11: Diabetic Retinopathy with hyperlinks

Figure 11: The Symptoms Increasing Urination/thirst and pregnant were by the user selected which are reflected the present symptoms panel. If the user clicks the calculate button the system will display the required information shown in the Dialog caption and gives the Suggestions (or) advice the user. Further the system has clearly show that the user has "Symptoms for Gestational diabetic Mellitus".

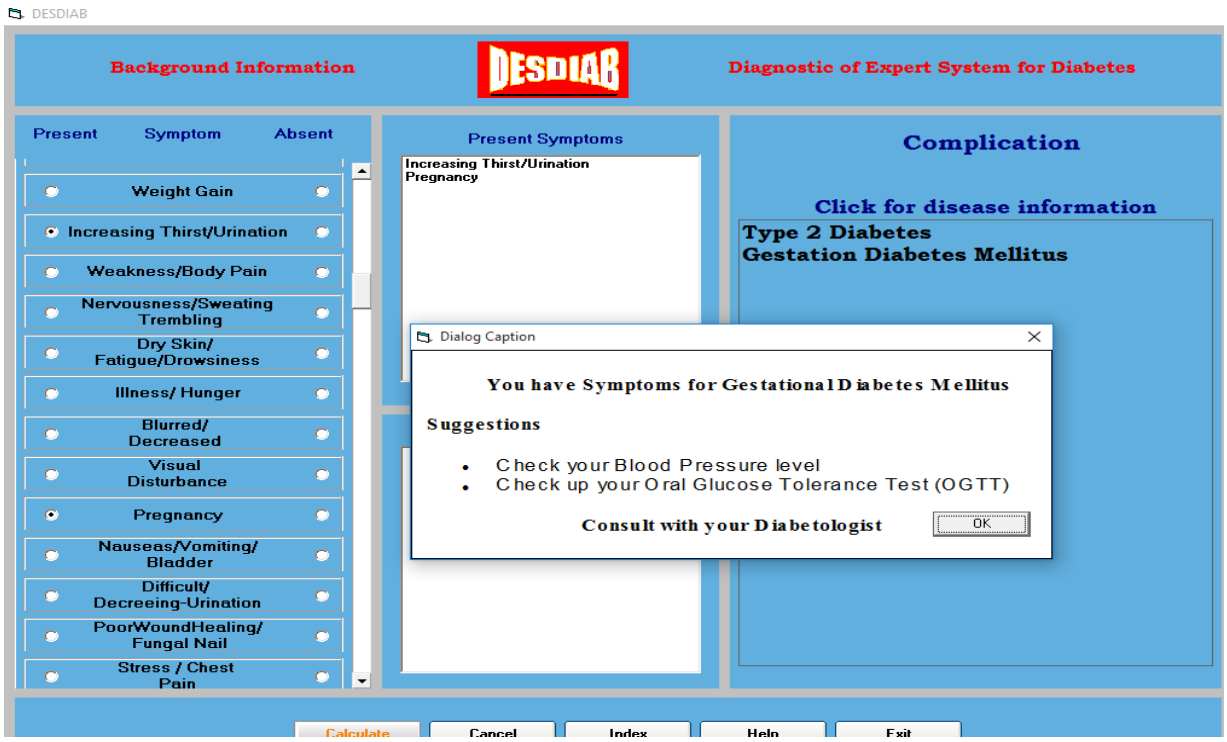


Fig 11: Symptoms for Gestational Diabetic Mellitus.

Figure 12 : If the user activates the "Disease Information" option which is hyperlinks and it will retrieve further information about the Gestational Diabetic Mellitus. Shows more information about the Gestational Diabetic Mellitus from the knowledge base system with Hyperlinks.

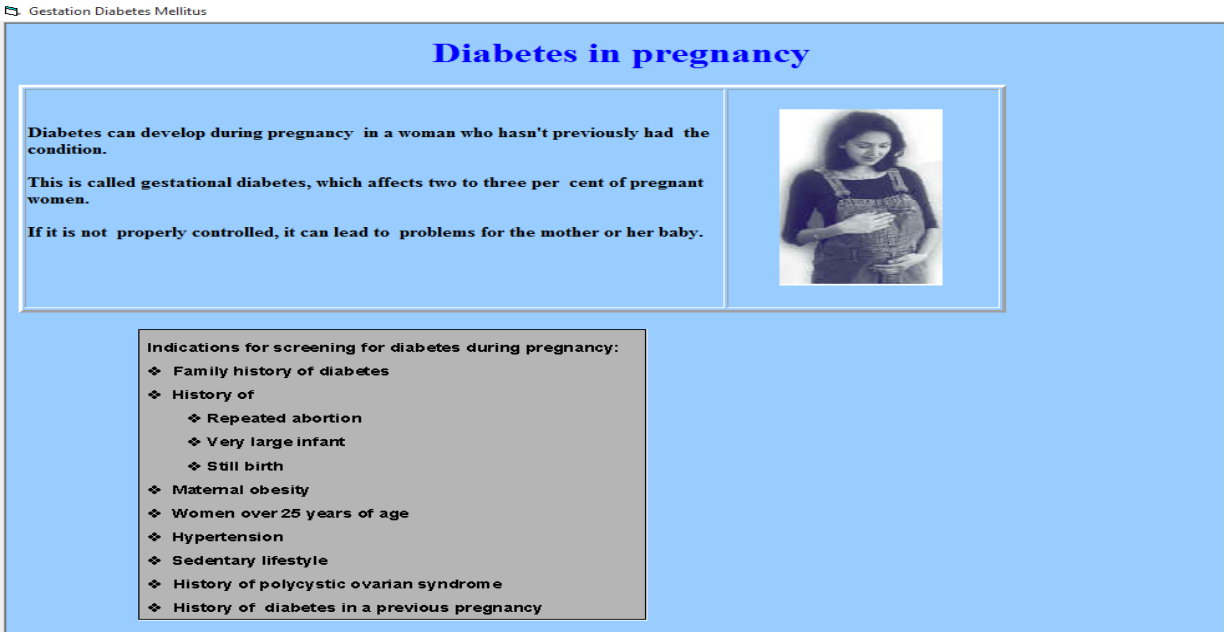


Fig 12: Gestational Diabetic Mellitus with Hyperlinks

Figure 15: Shows the Body Mass Index screen as ASIAN and Metric standard which is designed using Microsoft Front Page for knowledge Base Creation Design the Body Mass Index and Calculating Screen. Obesity is the major risk factor for diabetes. If the user has more than 23 of BMI value, it may lead to serious complications such as cardiovascular disease (CVD), Stroke. diabetes as per the Standard of Handbook of Diabetes Mellitus published by Dr.Mohan's Diabetes Specialities Centre

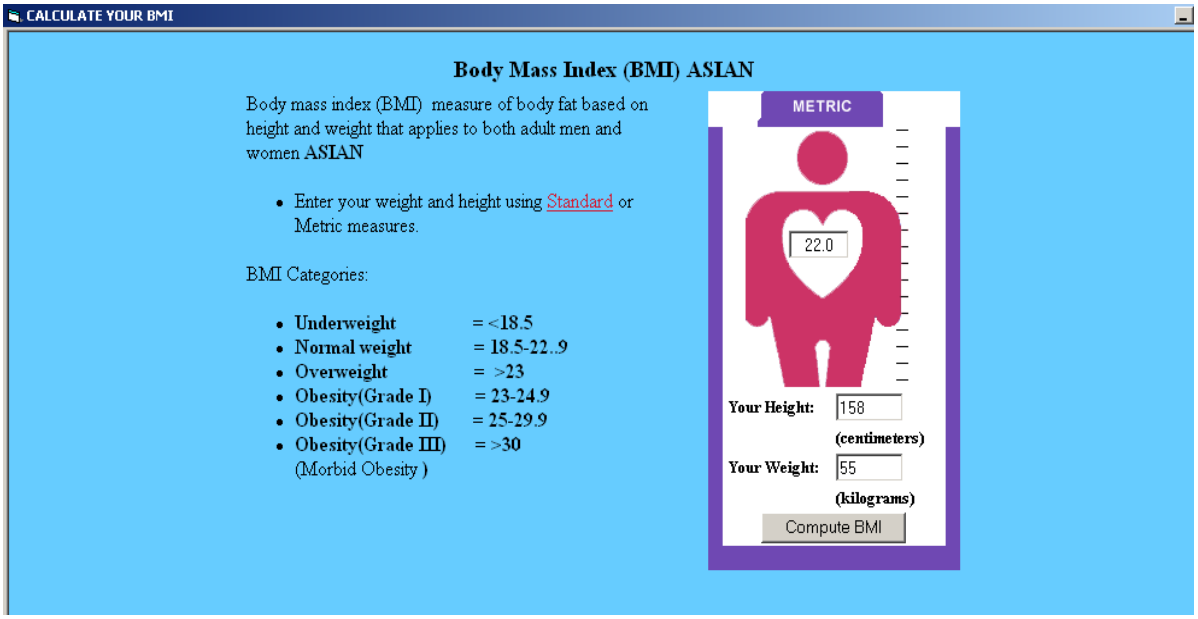
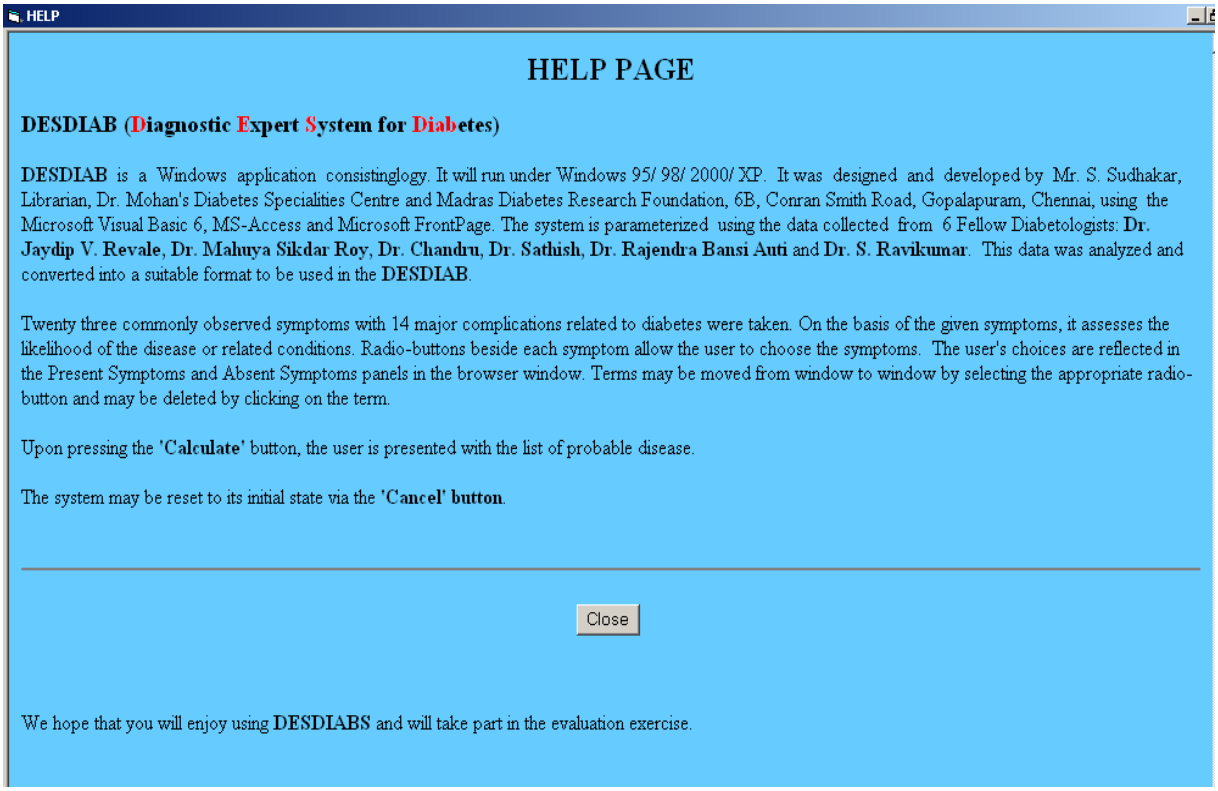


Fig 15 : Body Mass Index Calculation Screen

Figure 16: shows that index links an option that lets the user to browse each topic available in DESDIAB Knowledge base for diabetes and related complications. This Index Button in one of the major options and forms the main page of the Expert System. These links serve as a tool for searching or understanding the whole knowledge base of the system.

Fig 16: Index Button Screen

Figure 17, This help button Screen option allows the user to access help manual, which guides the user to browse the Diagnostic Expert System for Diabetes (DESDIAB).



11. CONCLUSION

The primary aim of our research was to develop version 1.0 of DESDIAB-Diagnostic an Expert System for Diabetes. This groundbreaking tool is designed to empower both individuals and healthcare professionals with essential information about diabetes. The system covers key areas such as epidemiology, clinical signs, diagnosis, treatment, prevention and control, causes, and potential complications associated with the disease. By facilitating the early identification and prediction of diabetes, the DESDIAB expert system lays the foundation for improved management and prevention strategies. It serves as an invaluable resource for physicians, healthcare managers, professionals, patients, and anyone eager to understand the symptoms and implications of diabetes. This innovative expert system closes the critical knowledge gap between healthcare providers and patients, enabling informed decision-making and encouraging a proactive approach to diabetes care. Embrace the future of diabetes management and empower yourself or your practice with DESDIAB. It's more than just information and knowledge base; it's a pathway to better health outcomes. Overall, this expert system is beneficial for everyone, and future enhancements will continue to add valuable features.

12. ACKNOWLEDGMENTS

This project titled "DESDIAB an Diagnostic Expert System for Diabetes," was presented to Annamali University in 2007 as part of the Master of Philosophy in Library and Information Science program. It was supported by Dr. Mohan's Diabetes Specialities Centre and Madras Diabetes Research Centre at Chennai. This Open-source program (DESDIAB) is free to download for windows and can be found at https://github.com/sudhakarcvs/desdiab

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