

BLOOD GLUCOSE MEASUREMENT BY COMPUTER ⁺

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Abstract

The measurement and display of blood glucose level are investigated practically by using interfacing card with computer in the present work. The analysis involves the variation in blood glucose level. The results on interfacing card are compared with blood glucose test meter type "ONE TOUCHTM BASICTM plus blood glucose meter ".As a result for the same person blood glucose level is approximately equal by using interfacing card or blood glucose test meter . in the present work we use "thermo sensor"

المستخلص

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قياس وعرض مستوى السكري بالدم تم تحقيقه عمليا باستخدام دوائر الموائمة مع الحاسبة في العمل الحاضر . التحليل يتضمن التغيير في نسبة السكري .تم مقارنة النتائج باستخدام دوائر الموائمة مع مقياس نسبة السكري بالدم نوع "ONE TOUCHTM BASICTM . Plus Blood Glucose Meter" اظهرت النتائج بان معدل النبضات لنفس الشخص ظهرت تقريبا متساوية باستخدام دوائر الموائمة او مقياس السكري بالدم . استخدم في العمل الحاضر المتحسس الحراري لقياس نسبة السكري .

Introduction

Accurate measurement of blood glucose is essential in the diagnosis of long-term management of diabetes. Glucose is the main circulating carbohydrate in the body. In normal fasting individuals, the concentration of glucose in blood is very tightly regulated – usually between 80 and 90 mg / 100mL, during the first hour or so following a meal. The hormone insulin, which is normally produced by beta cell in the pancreas, promotes glucose transport in skeletal muscle and adipose tissue. In those suffering from diabetes mellitus. Insulin-regulated uptake is compromised, and blood glucose can reach concentrations ranging from 300 to 700 mg / 100ml (hyperglycemia). [1, 2]

Glucose Levels Determination

Accurate determination of glucose levels in body fluids, such as blood, urine, and cerebrospinal fluid , is a major aid in diagnosing diabetes and improving the

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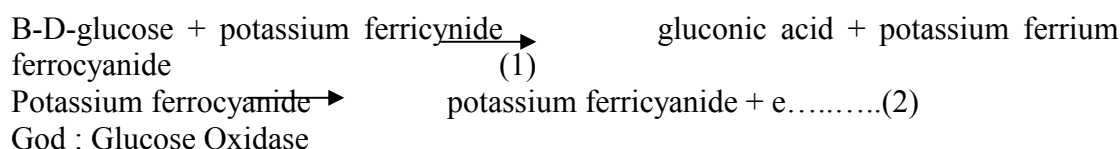
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treatment of this disease . Blood glucose levels rise and fall several times a day, So it is difficult to maintain normoglycemia by means of an " open-loop" insulin delivery approach . One solution to this problem would be to "close the loop" by using a self – adapting insulin device with a glucose – controlled biosensor that could continuously sense the need for insulin and dispense it at the correct rate and time. Unfortunately present – day glucose sensors cannot meet this stringent requirement.[3,4]

Thermo Sensor

The blood sample is drawn in to the test strip through capillary action. Glucose in the sample which reacts with glucose oxidase and potassium ferricyanide in the strip, producing potassium ferrocyanide. Potassium ferrocyanide is produces in proportion to the glucose concentration of the blood sample. Oxidation of the potassium ferrocyanide produces an eletrical current which is then converted by the meter to display the glucose concentration. The two reactions are illustrated in the equation (1) and (2).[1,5]



Glucose Levels

There are a number of common causes for glucose levels to increase or decrease. These include:[6]

- Food – time eaten, type and amount of carbohydrate (eg: bread, pasta, cereals, vegetables, fruit and milk).
- Exercise or physical activity. • Illness and pain.
- Diabetes medication. • Alcohol.
- Emotional stress. • Other medications.
- Testing

Hardware Connection

The interfacing card as shown in Fig (1) designed by the researchers. It contains the buffering mother board in order to protect the last when high current passes. Decoding circuit used to encode the address number. Control signal used to determine which signal can be suitable for input port or out put port. The signal received from the patient blood drop outstrip spot goes directly through thermo sensor to OP-AMP stage in order to amplify sensor signal so that the analoge to digital converter (A/D stage) can change the analoge sensor signal to 8-bit digital signal, that enable it to connect on PC data port. At last the interfacing process becomes completed. As indicated in the block diagram of interfacing card as shown in Fig (1).

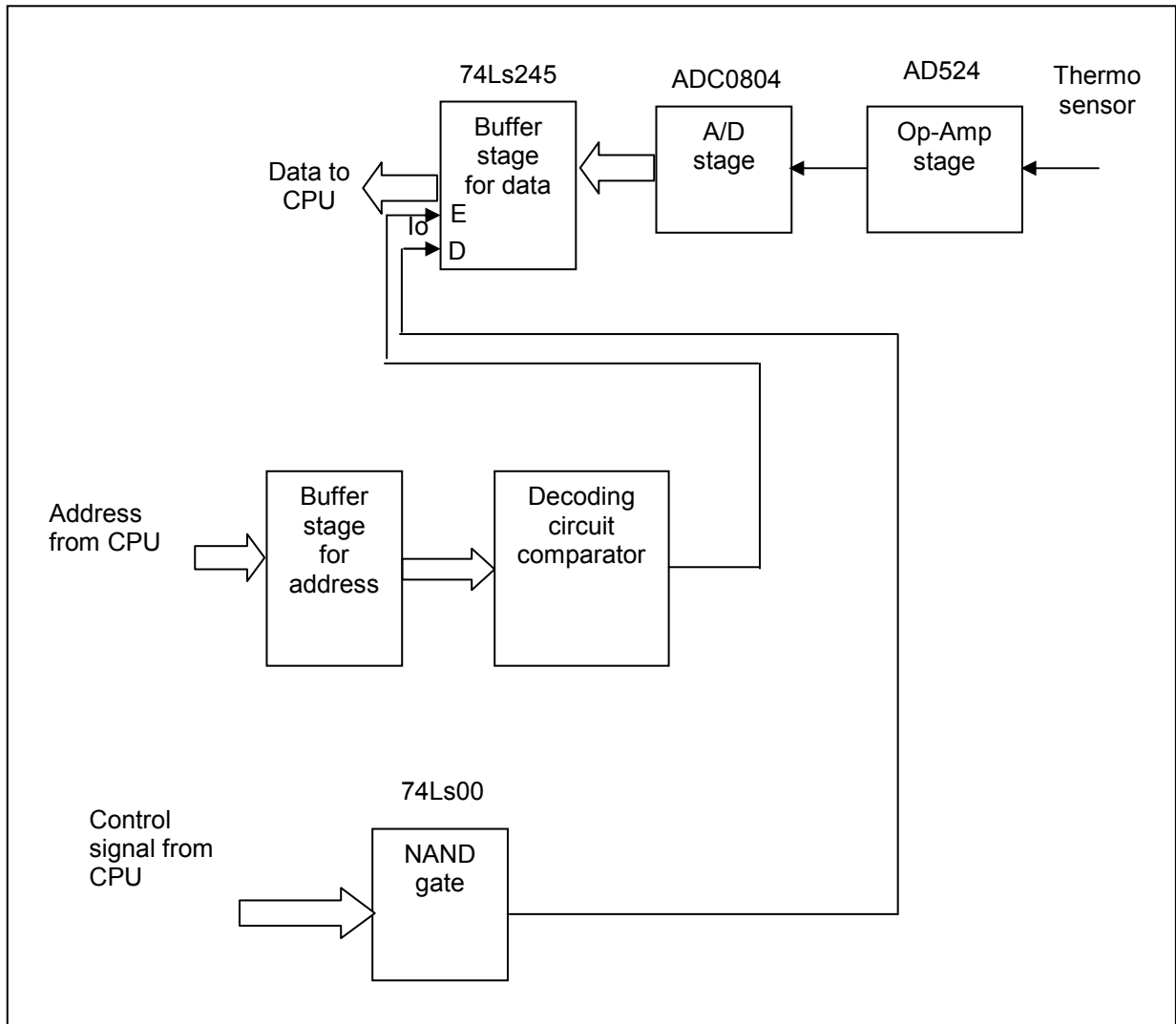


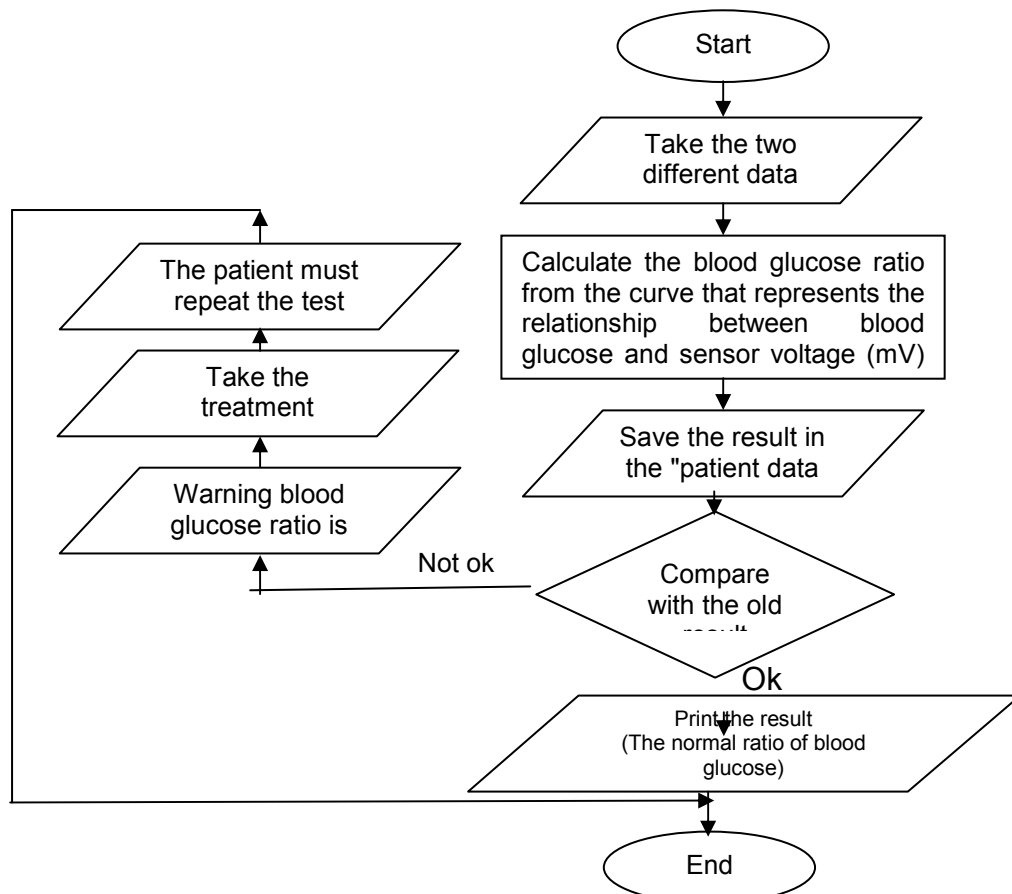
Fig (1) Block Diagram of Interfacing Card.

Software

To make interfacing circuit complete , need to write program in a correct way to be able through it receiving or sending the information and this may be achieved by the upon which is designed .

This flow chart is designed by the researchers depending on common methods that is used for testing blood glucose level.

The card is designated by the address [0300H]. Fig.(2) shows the flow chart for the steps for measuring the level of blood glucose .



Fig(2) Flow chart for measuring the ratio of blood glucose.

Results and Discussion

In fact, after visiting the hospital we notice that the blood glucose test made on three patients because there are three general cases for this test.

In this research, we depend on these three cases therefore we take three patients.

In this research, the blood glucose of three patients were measured for two days, 24 hour in a day as shown in tables (1) , (2) and (3).

Fig.(4) , Fig.(5) and Fig.(6) shows the relation between the blood glucose with time for one patient for two days .

Table (1) Blood glucose level for the first patient for two days.

Time	First day Glucose(mmol/dl)	Second day Glucose(mmol/dl)
8 am	81	75

2 pm	81	85
8 am	85	80

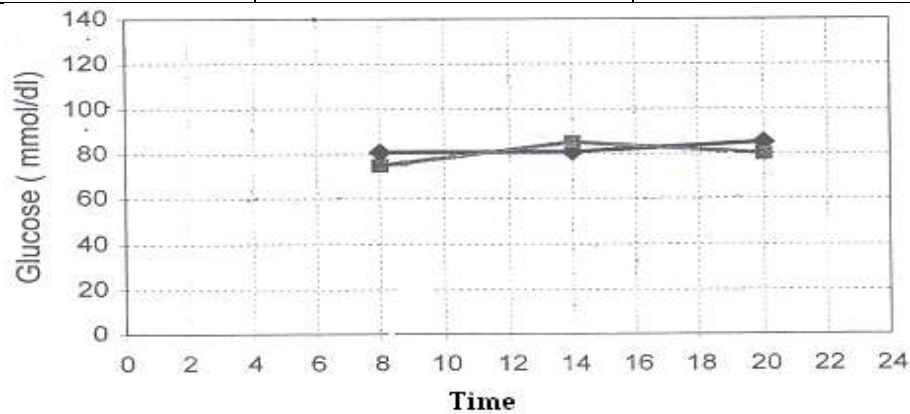


Fig (4) shows the relation between the blood glucose with time for first patient for two days.

Table (2) Blood glucose level for the second patient for two days

Time	First day Glucose(mmol/dl)	Second day Glucose(mmol/dl)
8 am	113	100
2 pm	83	80
8 am	90	85

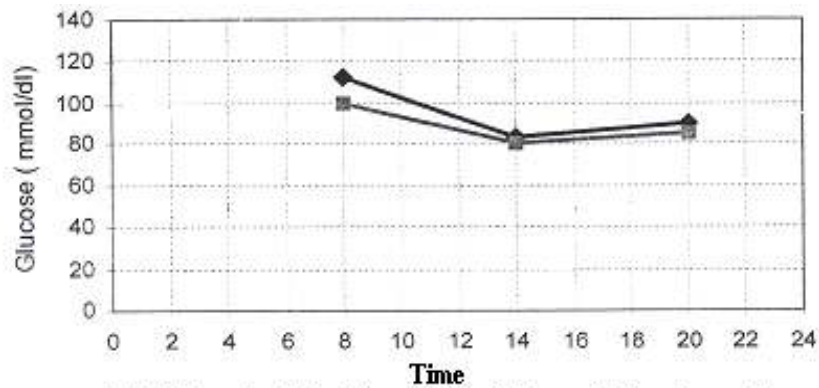


Fig (5) shows the relation between the blood glucose with time for second patient for two days.

Table (3) Blood glucose level for the third patient for two days.

Time	First day Glucose(mmol/dl)	Second day Glucose(mmol/dl)
8 am	82	80
2 pm	76	85
8 am	80	80

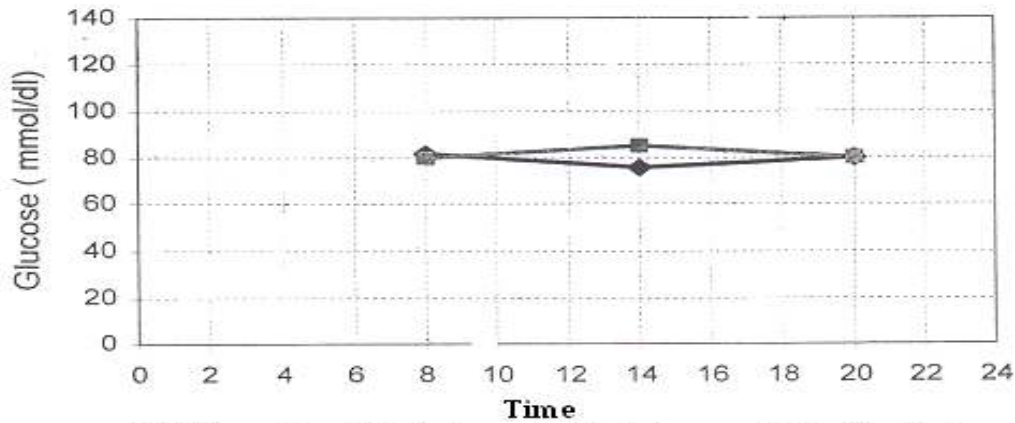


Fig (6) shows the relation between the blood glucose with time for third patient for two days.

From Fig (4), The curves obtained , shows that the patient is healthy over the results are most accurate and easy to measure from blood tester.

From Fig (5), we can conclude that the level of glucose in the blood of the patient was not stable.

From Fig (6), it seems that the patient is more healthy.

The third patient concedes more healthy because the consequences of changes in blood glucose level are very small.[7]

Conclusions

The result we got from computer is approximately same as of the original device, so the operation of connecting the blood glucose thermo sensor with computer by interfacing card so useful to make a data base for the patient who have diabetes.

Since this way provide the ability of saving many numbers of readings in one day or many days and it can be viewed at any time.

So it can be very useful in hospitals and laboratories to keep looking after the state of the patient.

Approximately same curves were obtained when this test was repeated on other three patients.

The third patient was more healthy because the blood glucose level at the beginning of the first day test approximately the same as blood glucose level at the end of the second day (80 mmol/dl).

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