

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Sudan University of Science and Technology

College of Engineering

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**NON INVASIVE BLOOD GLUCOSE
MEASUREMENT**

**A research submitted in partial fulfillment for the requirements of the degree
of B.Sc. (Honors) in Biomedical Engineering**

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Abbreviations

PA	Photo-Acoustic
PZT	Lead Zirconate Titanate
NI	Non-Invasive
IR	Infra Red
LCD	Liquid Crystal Display
A/D	Analog-to-Digital

ABSTRACT:

Determination of blood glucose level is a frequently occurring procedure in diabetes care. As the most common method involves collecting blood drops for chemical analysis, it is invasive and liable to afflict a degree of pain and cause a skin injury. To eliminate these disadvantages, this project focuses on pulsed photoacoustic techniques, which have potential ability in non-invasive blood glucose measurement. Found that there is a relationship between output voltage of transducer and blood glucose concentration . This study presents a new simple, low cost and safe method to reduce any discomfort due to measurement procedures produced by old invasive methods.

المستخلص :

ان عملية قياس مستوى سكر الجلوكوز في الدم عملية متكررة لدى مرضى السكري و لأن معظم طرق القياس تتطلب أخذ عينات دم و تحليلها كيميائياً . و هذا ما يعرف بالطريقة المباشرة والتي عادة ما تكون مؤلمة و قد تصاحبها بعض الاصابات . هذه الدراسة تستخدم الخاصية الضوئية الصوتية لقياس الجلوكوز بطريقة غير مباشرة . وجد ان هنالك علاقة طردية خطية بين مطال الاشارة الصوتية المتولدة و تركيز الجلوكوز في الدم . هذه الدراسة تستخدم طريقة آمنة و منخفضة التكلفة دون التسبب بأي اذى أو ضيق للمريض .

CHAPTER ONE

INTRODUCTION

1.1 General view:

Diabetes mellitus is a serious disease that affects not only the patient's internal organs, circulation system and eyesight, but also his entire life [1]. The first step in diabetes care is to monitor the patient's blood glucose level 24 hours a day. Knowing the glucose level assists in determining the right diet and medical treatment. Over the years, scientists have been trying to find noninvasive ways for people with diabetes to measure their blood glucose. Most methods of monitoring blood glucose require a blood sample, usually obtained by using an automatic lancing device on a finger. Some meters use a blood sample from a less sensitive area, such as the upper arm, forearm, or thigh. Other devices use a beam of light instead of a lancet to pierce the skin. In this project the technique of laser photo-acoustic (PA) spectroscopy has been used in trace detection due to the high sensitivity it offers.

1.2 Statement of the problem:

Since there is no cure available for diabetic at present, diabetic patients must adhere strictly to a proper diet, exercise and medication. The key process that control all above activities is frequent measurement of blood glucose which may cause increase in skin permeability [4] that affect the concentration of tissue analytes if performed invasively. A non-invasive method is a necessary. Therefore this project deals with a new method.

1.3 Objectives:

1.3.1 General objectives:

Survey the methods of non-invasive glucose measurement. Study in the photo acoustic property used to measure the coefficient of thermal expansion, velocity, and specific heat, which have a relationship with a concentration of glucose.

1.3.2 Specific objectives:

The objective of this study is to provide a diabetic with a device with:

1. Minimum pain & Minimum discomfort.
2. Reliable measurements.
3. Portable and easy to use.
4. Affordable.

1.4 Project layout:

The research had been divided into **six** chapters. Chapter one is an introduction including the general view of the project, statement of the problem, and objectives. While chapter two include Literature reviews and chapter three contains theoretical background of photo acoustic and use it in non-invasive glucose measurement. Circuit design, simulation and implementation are found in chapter four. Chapter five shows the results obtained and discussion. Chapter six deals with conclusion and future recommendations.