

Diagnosis of diabetes mellitus in serum of pregnant women by using UV spectroscopy technique

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Abstract:

Spectroscopy techniques can be effectively employed as a diagnostic tool in clinical chemistry. It can also be an alternate method in clinical analysis. The study of serum through such techniques can be used not only for understanding the biological nature of the disease, but also for the diagnosis of the disease [1]. In the present work, UV-Vis spectroscopic technique which is used to study the spectral differences in the serum of normal and diabetes blood samples of pregnant women in each trimester. It is found that this technique is efficient in the 1st and 3rd trimester where there is not efficient in the 2nd trimester.

Keywords: diabetes, pregnant women, serum, UV-VIS spectroscopic.

تشخيص داء السكري في الدم للنساء الحوامل باستخدام تقنية مطياف الأشعة فوق البنفسجية

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الخلاصة:

تقنيات المطياف هي احدى التقنيات التشخيصية في الكيمياء السريرية كما وتعتبر طريقة بديلة للتحليلات المرضية. ان دراسة مصل الدم باستخدام المطياف تستعمل لفهم الطبيعة البيولوجية للمرض وكذلك لتشخيص المرض نفسه. في هذه الدراسة تم استخدام مطياف الأشعة فوق البنفسجية-الضوء المرئي لدراسة اختلافات الطيف في مصل الدم الطبيعي والمصاب بالسكر للنساء الحوامل في كل ثلث من الحمل ووجد ان هذه التقنية كفوءة لقياس نسبة السكر في الثلث الأول والثالث ولكنها غير كفوءة في الثلث الثاني من الحمل.

الكلمات المفتاحية: داء السكري، الدم، النساء الحوامل، مطياف الاشعة فوق البنفسجية.

1.Introduction:

In recent past, UV-Visible spectroscopic methods efficiently have been used in the field of Medical science for qualitative analysis of biological samples such as blood plasma and serum or tissues[2]. Implementation of this technique are: reduces time, resources and cuts cost. emerging also as a potential diagnostic tool in the medical and pharmacological fields to provide information about the different chemical and morphological structures for healthy and pathological tissues. It has received quite a lot of attention not only for understanding the biological nature of the disease, but also for the diagnosis of the disease in recent years[3].

The application of UV spectroscopy for the study of biomedical compounds has increased tremendously in recent years [2].The term diabetes mellitus describes a metabolic disorder of multiple etiology characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, and insulin action or both[4]. Pregnancy is a complex metabolic state that involves dramatic alterations in the hormonal milieu, increases in estrogen, progesterone, prolactin, cortisol, human chorionic gonadotropin, placental growth hormone and human placental lactogen The aim of diabetic management is to normalize blood glucose level[5].

Gestational Diabetes Mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. The definition applies regardlessly whether insulin or only diet modification are used for treatment or whether the condition persists after pregnancy[6]. It does not exclude the possibility that unrecognized glucose intolerance may have antedated or begun concomitantly with the pregnancy. GDM complicates ~4% of all pregnancies in the U.S.(united states), resulting in ~135,000 cases annually. The prevalence may range

from 1 to 14% of pregnancies, depending on the population studied. GDM represents nearly 90% of all pregnancies complicated by diabetes[7].

Deterioration of glucose tolerance occurs normally during pregnancy, particularly in the 3rd trimester[6]. Diabetes mellitus is a chronic illness, in which the body is exposed to continual high levels of blood glucose, a condition known as hyperglycemia[8]. Glucose is a simple sugar and an important source of energy, especially for the brain. Pregnancy involves complex hormonal interactions, which cause profound physiologic changes. Some changes are more evident than others[6]. The changes that occur are the result of increasing maternal and fetal requirements for the growth of the fetus and the preparation of the mother for delivery. An increase in the secretion of female sex hormones, estrogen by 10-fold and progesterone by 30-fold, is important for the normal progression of pregnancy. Increased hormonal secretion and fetal growth induce several systemic, as well as local physiologic and physical changes in a pregnant woman [6].

2.Materials and methods :

Blood samples were collected from fasting normal and diabetic pregnant women in each month of each trimester from al-Forat and al-Zahraa hospital at Al Najaf al Ashraf governorate. Each blood sample was allowed to coagulate naturally without adding anticoagulant agents for about half hour. Firstly we take drop of blood to measure blood sugar by RIFLO (manual tool for measure blood sugar) and record data. The serum was separated from every sample and centrifuged at speed of 1200 round per minutes (rpm) in REMI electric centrifuge for 5min.then take 1cc of serum to calculate blood sugar in bio chemestric analysis by adding 0.1 ml of glucose then the mixture was lifted for 10

min then the blood sugar concentration was recorded by spectrophotometer.

Then remained serum was diluted by deionized water with ratio 1:30 and its spectrum was registered a grased of double beam Shemadzo UV-Vis spectroscopy. The spectra were recorded in the absorbance wavelength region 200-350 nm In this instrument the UV light region is scanned normally over the range 200-400 nm and the visible portion is from 400-600 nm. Over a short period of time the spectrometer automatically scans component of wavelength.

Samples were measured by absorbance wavelength ranged The serum 210-279 corresponding to total protein and tryptophan respectively[2]. Serum are slightly from this study, different from that of other.

3.Clinical significance:

Blood, contains an abundance of protein and nucleic acid molecules that reflects physiological status. and possess a high potential to revolutionize the first generation of diagnostic.[9] Pregnancy is a complex metabolic state that involves dramatic alterations in the hormonal milieu, increases in estrogen, progesterone, prolactin, cortisol, human chorionic gonadotropin, placental growth hormone and human placental lactogen[5] . The aim of diabetic management is to normalize blood glucose level. Therefore measurements of glucose are made more frequently to regulate the treatment of the patient more accurately. In the first weeks of pregnancy, are increase in the estrogen and progesterone level which lead pancreatic beta cell hypertrophy and insulin excretion alters maternal carbohydrate metabolism.

Plasma cellulose which responses to similar carbohydrate loads are higher in pregnant women than non pregnant women[10]. The changes in serum pattern

in normal and diabetic pregnant women in each trimester have been compared.

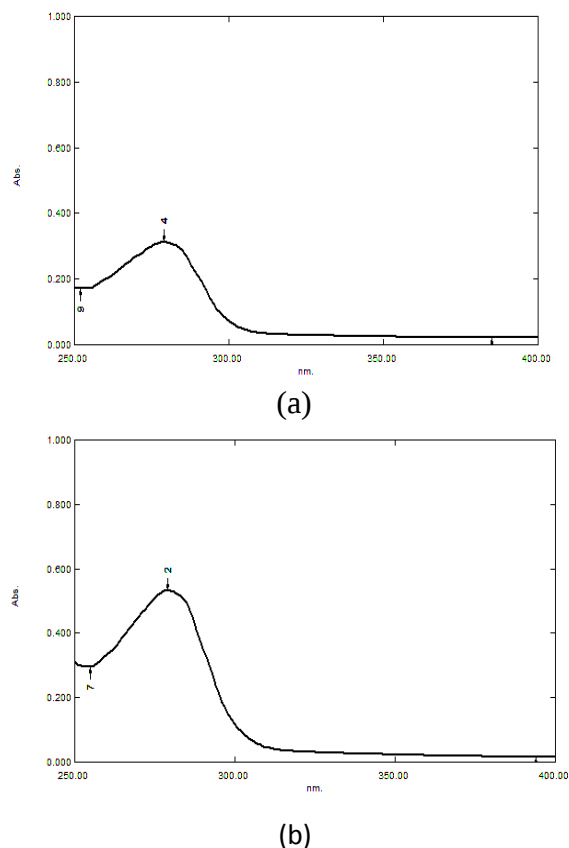


Figure 1: Change in serum pattern in (a) normal and (b) diabetic pregnant women in the 1st trimester.

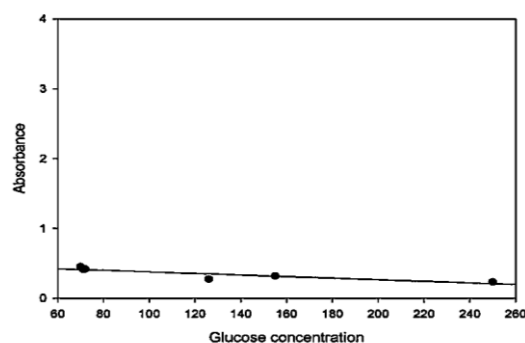


Figure2: Comparison of normal and diabetic pregnant women in the 1st trimester.

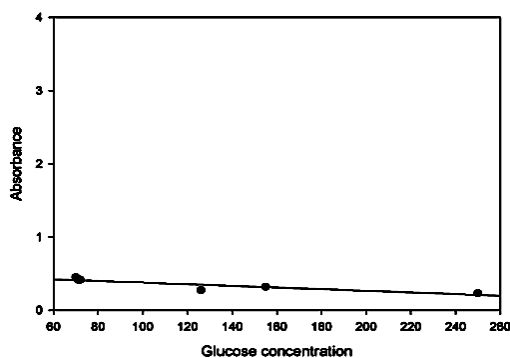


Figure3: Comparison of normal and diabetic pregnant women in the 2nd trimester.

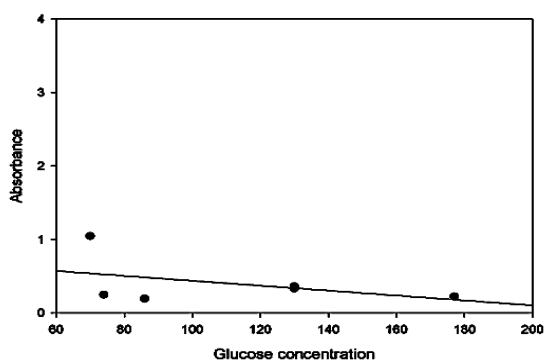


Figure 4: Comparison of normal and diabetic pregnant women in 3rd trimester.

4.Results and discussion:

It has been reported that the absorption spectra of the diseased blood show marked changes from that of normal blood which is the evidence for the manifestation of disease. The overlay UV-Visible spectrum of the healthy and diabetic serum is presented in (Figure 1) peak are observed at wavelength 279 nm due UV-Visible overlay spectrum of healthy and diabetic serum of pregnant women at 1st trimester to constituents of serum. The amid chains of the proteins present in the blood absorbs strongly glucose at 279 nm. As shown in (Figure 2) there are good relation between normal and disease samples.

In pregnant women at 2nd trimester to constituents of serum. The amide chains of the proteins present in the blood absorbs strongly glucose at 279 nm [2]. there is no relation (as shown in Figure 3) between the normal and disease samples because there is increase hormones in this trimester more

than others in each normal and diseased samples.

In Figure 4, due to UV-Visible overlay spectrum of healthy and diabetic serum in pregnant women at 3rd trimester to constituents of serum. The amide chains of the proteins present in the blood absorbs strongly glucose at 279 nm.

5.Conclusion:

In this study, it has been demonstrated that the study of UV- Vis spectra of serum samples may be used to differentiate between the healthy and diabetes subjects. It can be observed that in the case of diabetes samples, the absorbance for the various fundamental modes of absorbance of the vital regions is lesser than that for the normal samples. Further this is also confirmed by a clear discrimination between healthy and diabetes serum samples with scatter plots drawn in the three important spectral regions namely lipid, amide and glucose spectral regions.

There will be a linear relationship between the protein content and the maximum absorption spectrum in the UV region. Due to the fact that the protein absorbance band at 279 nm determines the characteristic spectrum of the blood plasma and the absorption maximum strongly depends on the blood plasma protein concentration. The present study suggests that the spectro photometric analysis of the blood Serum is a useful tool for determination of diseases in human body at this trimester ,while there is no relation of the normal and diseased samples at 2nd trimester. There will be a linear relationship between the protein content and the maximum absorption spectrum in the UV region in the normal and diseased samples of 3rd trimester. The result were compared with the standard curves established for normal and diabetes pregnant in the same month of pregnancy which gave us the difference in the concentration.

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