

The impact of fasting blood glucose on plasma creatinine and urea levels in individuals with type 2 diabetes, both male and female

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Abstract: When diabetes reaches an advanced stage, it affects the liver's functioning, as well as the patient's blood levels of creatinine and urea. The Diabetic Center in EL-Beyda City served as the site of this research project. There were two sets of participants, totaling one hundred. The first group, known as the control group, consisted of 50 people (30 males and 20 women). There were fifty people in the second group, which was called the patient group (28 males and 22 women). These people had blood samples taken, and conventional procedures were used to calculate the amounts of sugar, urea, and creatinine in their fasting blood. Statistical analysis was done on these tests' outcomes. The average age of the control subjects was 48 ± 9.0 , while the average age of the diabetic patients was 53 ± 9.3 years. The average blood sugar concentration among male patients was significantly lower compared to female patients. Furthermore, urea and creatinine concentrations in the plasma were considerably lower in female patients than in male patients. This implies that there are gender differences in the effects of type 2 diabetes on renal function. The study's inclusion keywords are creatinine, urea, and type 2 diabetes. The blood glucose, urea, and creatinine levels in type 2 diabetic patients were difference between both gender

Key words: Fasting blood glucose, creatinine, urea levels, type 2 diabetes

تأثير جلوكوز الدم الصائم على مستويات الكرياتينين واليوريا في بلازما الدم لدى الأفراد المصابين بداء السكري من النوع الثاني ذكراً وإناً
سالمين بوفروة

محاضر، فسيولوجي علم الحيوان، قسم علم الحيوان، كلية العلوم، جامعة عمر المختار، البيضاء، ليبيا

المستخلص: يؤثر مرض السكري في مراحله المتقدمة على وظائف الكبد، بما في ذلك تركيز اليوريا والكرياتينين في دم المرضى. أجريت هذه الدراسة البحثية في قسم السكري بمستشفى الثورة الواقع شمال مدينة البيضاء. شارك فيها مائة شخص وتم تقسيمهم إلى مجموعتين. المجموعة الأولى، والمعروفة باسم المجموعة الضابطة، تكونت من 50 شخصاً (30 رجلاً و20 امرأة). أما المجموعة الثانية، والتي يشار إليها بمجموعة المرضى، فقد تألفت من 50 شخصاً (28 رجلاً و22 امرأة). تم أخذ عينات الدم من هؤلاء الأفراد، وتم تحديد تركيز السكر واليوريا والكرياتينين في دمهم باستخدام الطرق القياسية. وتم إجراء تحليل إحصائي على نتائج هذه الاختبارات. كان متوسط عمر الأشخاص في المجموعة الضابطة 48 ± 9.0 ، في حين كان متوسط عمر مرضى السكري 53 ± 9.3 سنة. كان متوسط تركيز السكر في الدم لدى المرضى الذكور أقل بشكل ملحوظ مقارنة بالمرضى الإناث. بالإضافة إلى ذلك، كان تركيز الكرياتينين واليوريا في الدم لدى المرضى الإناث أقل بشكل ملحوظ مقارنة بالمرضى الذكور. وهذا يشير إلى أن تأثير مرض السكري من النوع 2 على وظائف الكلى يختلف بين الذكور والإناث. كانت مستويات الجلوكوز واليوريا والكرياتينين في الدم لدى مرضى السكري من النوع 2 متفاوتة في كل من الذكور والإناث.

الكلمات المفتاحية: هي مرض السكري من النوع 2، واليوريا، والكرياتينين.

Introduction:

The metabolic condition known as diabetes mellitus is characterized by elevated plasma glucose concentration. This is caused by a disturbance in the secretion of the insulin hormone a response by the cells of the body (Deshmukh *et al.*, 2015), which in turn leads to metabolic disturbances in the body (Khuwaja *et al.*, 2004; Shera *et al.*, 2004). Among these

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disturbances are dyslipidemia, hypertension, and visceral adiposity, which are the main causes of developing chronic kidney disease (Whaley-Connell *et al.*, 2009). Most individuals with late-stage diabetes have impaired kidney function (Remuzzi *et al.*, 2002). People affected by this condition have a disorder in the metabolic process, and the worsening of this condition can lead to death. Since renal filtration and reabsorption play a role in maintaining proper levels of urea and creatinine in the body, it is important to ensure their proper functioning (Triplitt, 2012). The primary metabolic byproduct of protein catabolism in humans that does not include nitrogen is urea (Triplitt, 2012), which explains its abnormal concentration in the late stages of the disease (Romagnani *et al.*, 2017). Glucose accumulates greatly in the blood, and the kidneys are unable to process it, leading to damage to the blood vessels of the kidneys (Hofsø *et al.*, 2009). High concentrations of creatinine and urea in the blood are due to a defect in glomerular filtration (Schutte *et al.*, 1981). The change in serum creatinine concentration is the most reliable indicator of changes in glomerular filtration rate compared to the serum urea concentration (Schwartz *et al.*, 1987). There have been many previous studies similar to our topic (Chutani and Pande, 2017; Jasem and Abdul-Razaq, 2023; Mishra *et al.*, 2015; Richard *et al.*, 2017) (Bamanikar *et al.*, 2016; Jasem and Abdul-Razaq, 2023; Wagle, 2010). Therefore, the aim of this research was to compare the impact of fasting blood glucose on serum creatinine and urea levels in individuals with type 2 diabetes, both male and female, at the Northeastern Libyan Diabetic Center in Al-Bayda City.

Materials and methods:

The diabetic population was the subject of the study at Al-Thawra Hospital. These individuals received comprehensive care in terms of nutrition and monitoring of blood sugar levels. The blood sugar concentration was analyzed during the fasting period and after eating on a daily basis. This study took place between March 2022 and August 2023. Fifty healthy sick people (25 males, 25 females) were compared to fifty sick people (28 males, 22 females). All of them were between 35 and 65 years old. After eight hours of fasting, a sample of the patient's blood is taken, then put into tubes containing EDTA, an anticoagulant. After that, the tubes are inserted into the central device to obtain the plasma. Special devices are used to determine the concentration of fasting sugar, creatinine, and urea.

Statistical analysis:

Minitab 17 software was used for statistical analysis. The difference between the two samples was displayed using a t-test analysis, with a significance threshold of $P < 0.05$ considered sufficient.

Results:

The number of volunteers in this study was 100 (Table 1). Out of the 100 volunteers, 50 people comprised the control group, 30 male and 20 female. The remaining 50 volunteers (28 males and 22 females) were in the diabetic group. The control group's average ages were 48 ± 9.0 years, while the patients' ages were 53 ± 9.3 years. Table 2 presents the results for males. Within the control group, the average levels of fasting blood glucose, blood urea and blood creatinine were 92.8 ± 3.2 mg/dL, 33 ± 1.4 mg/dL, and 1 ± 0.25 mg/dL, respectively. Within the group of diabetics, the average levels of blood urea and blood creatinine were 161.3 ± 7.2 mg/dL, 41.1 ± 3.2 mg/dL, and 2.59 ± 0.59 mg/dL, respectively. There was a noticeable increase in the levels of fasting blood urea and creatinine in diabetic patients compared to healthy individuals. Table 3 presents the results for females, in the control group, the average levels of blood urea and blood creatinine were 89.9 ± 4.0 mg/dL, 32 ± 1.3 mg/dL, and 1.69 ± 0.53 mg/dL, respectively. In the patient group, the average levels of fasting blood glucose, urea and creatinine were 160.9 ± 8.0 mg/dL, 53.7 ± 2.3 mg/dL, and 0.92 ± 0.075 mg/dL, respectively. Additionally, compared to healthy people, diabetes patients had higher fasting blood urea and creatinine levels

Table 1: Data for the control group and the patient group.

| parameters | control (n=50) | patients (n=50) |
|-------------------|----------------|-----------------|
| Male | 30 | n=28 |
| female | n=20 | n=22 |
| Age (30-65) years | 48 ± 9.0 | 53 ± 9.3 |

Table 2: Fasting blood glucose, urea, and creatinine levels in the control group and patients male group

| | control (n=50) Male (n=30) | patients (n=28) | P – value | Significant level |
|---------------------------|-------------------------------|--------------------|-----------|-------------------------|
| Fasting blood glucose | 92.8 ± 3.2 | 161.3 ± 7.2 | 0.000 | P < 0.05 Significant |
| Plasma urea (mg/dl) | 33 ± 1.4 | 41.1 ± 3.2 | 0.030 | P < 0.05 Significant |
| Plasma creatinine (mg/dl) | 1 ± 0.25 | 2.59 ± 0.59 | 0.021 | P < 0.05 Significant |

Table 3: Fasting blood glucose, urea, and creatinine levels in the control group and patient female group.

| | control (n=20) | Patients (n=22) | P – value | Significance level |
|-------------------------------|----------------|-----------------|-----------|----------------------|
| Fasting blood glucose (mg/dl) | 89.9 ± 4.0 | 160.9 ± 8.0 | 0.000 | (highly significant) |
| Plasma urea (mg/dl) | 32 ± 1.3 | 53.7 ± 2.3 | 0.175 | (non-significant) |
| Plasma creatinine (mg/dl) | 1.69 ± 0.53 | 0.92 ± 0.075 | 0.164 | (non- significant) |

Discussion:

In the current study, blood glucose levels were compared to blood urea and creatinine levels among people suffering from type 2 diabetes in Al Bayda. People with type 2 diabetes had noticeably higher levels, according to the findings. In male diabetic patients, blood levels of urea and creatinine significantly increased compared to unaffected controls. Male patients' levels of serum creatinine and urea rose considerably due to the negative impacts compared to the healthy control. The impact of these elevated glucose levels on kidney function. Female patients' serum blood glucose levels were significantly different from those of healthy controls. Levels of creatinine and urea were not significantly different from those in healthy women controls. The use of drugs that lower blood levels of urea and creatinine may be the cause. The outcomes of this research were similar to those of the present data (Bamanikar *et al.*, 2016; Mishra *et al.*, 2015; Richard *et al.*, 2017; Wagle, 2010). In Umuahia, Ezema *et al.* (2023) and in China, Li *et al.* (2023) and Yin, *et al.* (2024) researchers reported on the blood glucose, urea, and creatinine levels in type 2 diabetic patients, both male and female. Neugartan *et al.* studied the influence of gender on the development of individuals who do not have diabetes. In 2000, a study on renal disease found that, compared to males, women with chronic renal disease of different causes exhibit impairment in renal function over time (Neugarten *et al.*, 2000). In another finding, Rossing *et al.* studied severe kidney disease in type 2 diabetics (Rossing *et al.*, 2004). According to this study, Type 2 diabetes is the most common cause of end-stage renal failure (Rossing *et al.*, 2004). Experimental evidence

suggests that inducing renal damage in rats is achieved by increasing blood levels of creatinine and serum urea (Anjaneyulu and Chopra, 2004). Elevated levels of serum urea and creatinine in type 2 diabetics are due to reduced renal filtering capacity (Ninomiya *et al.*, 2009). In a previous study, it was found that female patients over 40 years of age have a significant increase in this parameter (Wagle, 2010). This indicates that blood sugar levels are significantly higher in female patients older than 40 years compared to males. However, serum creatinine levels are significantly lower in females compared to males (Remuzzi *et al.*, 2002). Previous studies suggest that renal impairment in diabetic patients is caused by prolonged and inadequate glycemic management.

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