**Original Article**

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# Assessment of Serum Urea, Creatinine and Uric Acid in Sudanese Hypertensive Patients

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## ABSTRACT

**Background:** Hypertension is a major public health problem in developing counties such as Sudan, and it increases the risk of mortality. Biochemical renal parameters are necessarily tested routinely to check the renal efficiency of patients, as hypertension is a chronic disease and has many long-term complications, such as renal failure.

**Objective:** The present study aims to assess serum urea, creatinine and uric acid in Sudanese patients with hypertension.

**Patients and Methods:** This study is an analytical case control hospital-based study that was carried out in Wad Madani city, Gezira, from December 2019 to February 2020. A hundred subjects were enrolled in the study with 50 hypertensive patients as the case group and the other 50 subjects as the control group. The age and sex were matched in the study population. Serum urea, creatinine and uric acid were measured using a Biosystem 310 spectrophotometer. The data were analyzed using SPSS version 21.

**Results:** The mean ± SD of the serum urea, creatinine and uric acid of the case group were 17.42 ± 6.54 mg/dl, 0.83 ± 0.23 mg/dl and 6.02 ± 1.39 mg/dl, respectively. The mean ± SD of the serum urea, creatinine and uric acid of the control group were 17.44 ± 6.44 mg/dl, 0.87 ± 0.26 mg/dl and 5.14 ± 1.70 mg/dl, respectively. There was no significant difference between the patients and the control group. Serum creatinine was significantly higher in males than females (*p-value* = 0.004). There was a negative correlation between age and diastolic pressure (r = -0.417, $^{**}p = 0.003$) and a positive correlation between systolic and diastolic pressure (r = 0.292, $p = 0.039$). The serum urea was negatively and positively associated with diastolic pressure and age, respectively (r = 0.323, p = 0.022, r = 0.393, p = 0.005).

**Conclusion:** The study observed that age had a positive association with serum urea and serum uric acid but a negative one with diastolic pressure. Diastolic pressure had a positive correlation with systolic pressure and serum urea. No significant differences were found between THE serum parameters in the study population. The serum creatinine was significantly higher in males than females.

**Key words:** Hypertension, Creatinine, Urea, Uric Acid, Sudanese, Chronic kidney disease

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## INTRODUCTION

Hypertension is high blood pressure (BP), sometimes also called arterial hypertension. It is a chronic medical condition in which the BP in the arteries is elevated.[1] BP is measured and summarized by two measurements, systolic and diastolic pressure, depending on whether the heart muscle is contracting (systole) or relaxed between beats (diastole). The normal BP at rest is within the range of 100–140 mmHg systolic and 60–90 mmHg diastolic. A person is said to have high BP when the readings are often at or above 140/90 mmHg.[2] Hypertension is classified into primary hypertension and secondary hypertension. Primary hypertension refers to high BP with no obvious underlying medical cause.[3] It is the most common form of hypertension, accounting for 90–95% of all cases of hypertension. Secondary hypertension causes disorders affecting the kidneys, arteries, heart or endocrine system and accounts for the remaining 5–10% of cases.[4]

When people age, their BP increases, raising their likelihood of being hypertensive later in life.[5] Hypertension results from a complex interaction of genes and environmental factors, which include numerous common genetic variants that have minor effects on BP.[6] Several environmental factors also influence BP.[7] Reduced dietary salt consumption is a lifestyle factor that lowers BP.[8] Renal disease is the most common secondary cause of hypertension. Hypertension can also be caused by endocrine conditions such as Cushing's syndrome, hyperthyroidism, hypothyroidism, acromegaly, Conn's syndrome or hyperaldosteronism and pheochromocytoma. Other causes of secondary hypertension include obesity, sleep apnea, pregnancy, coarctation of the aorta, excessive licorice consumption and certain prescription medicines, herbal remedies and illegal drugs.[9] Hypertension is a leading cause of chronic kidney disease due to the deleterious effects that increased BP has on kidney vasculature; long-term, uncontrolled high BP can lead to high intraglomerular pressure, impairing glomerular filtration.[10] The relationship between kidney failure and high BP is cyclic, as CKD can contribute to or cause hypertension HTN.[11] Elevated BP can lead to damage of the blood vessels within the kidney, as well as throughout the body,[12] leading to failure of the kidney's ability to filter fluids and waste from the blood.[13] This can lead to an increase in fluid volume in the blood[14] and thus causes an increase in BP. Hypertension affects the vessels, brain and endocrine.[15] Renal damage is detected by a renal function test, which includes serum creatinine, blood urea, uric acid, glomerular filtration rate and electrolyte.[16] Creatine is primarily synthesized in the liver and then transported to the skeletal muscle for use in storing ATP.[17] It is a metabolic end-product of creatine that is released into the plasma, freely filtered through the glomerulus and also secreted but not absorbed by renal tubules.[18] Serum creatinine is predominantly determined by glomerular filtration rate (GFR). SCr is also influenced by non-renal factors that alter creatinine generation, such

as muscle mass, dietary creatine intake, liver function and elimination.[19] Urea is a relatively nontoxic substance produced by the liver from ammonia resulting from protein metabolism.[20] It is an indicator of renal disease, which can be caused by a rise in protein catabolism, impaired kidney function and increased dietary protein.[21,22] Uric acid is the primary waste product of purine metabolism, and only 6%–12% of the original filtered uric acid is finally excreted in the urine.[23] The objective of the current study is to assess the serum urea, creatinine and uric acid in Sudanese patients with hypertension.

## MATERIALS AND METHODS

An analytical case-control hospital-based study was carried out in Alshaheed center, Wad Madani city, Gezira, from December 2019 to February 2020. Quantitative methods were used to estimate the urea, creatinine and uric acid in hypertensive and healthy subjects in Gezira. A hundred subjects, where 50 patients with hypertension comprised the case group and 50 healthy subjects comprised the control group, were enrolled in this study. The age of the study population was matched and ranged between 26 and 75 years, and the mean age was 59.3 years. Patients with renal disease, cardiac disease, adrenal disorder or diabetes mellitus were excluded. Blood samples were collected randomly in lithium heparin containers from the study population after taking verbal consent. Then, the samples were mixed and centrifuged for 3 minutes, and later, the plasma was transferred into new plain containers. Data was collected using a structured questionnaire that included variables such as age, gender, treatment, systolic BP, diastolic BP and duration of the disease. Serum urea, creatinine and uric acid were measured using a Biosystem 310 spectrophotometer. Written consent from each patient was taken, and the overall study was approved by the ethical committee at Alneelain University, Faculty of Medical Laboratory Sciences. The precision and accuracy of the methods used in this study were checked each time using control material. The data of this study were analyzed using the statistical package for social study (SPSS) software (version 21). A student's t-test (presented as mean ± SD) and correlation test (R-value) were conducted. A *P*-value of less than 0.05 was considered statistically significant.

## RESULTS

One hundred subjects enrolled in this study, comprising 50 patients having hypertension who were under a certain type of therapy and 50 healthy subjects as the control group, with matched age and sex. Table 1 shows the descriptive data, including age, duration of disease and the type of BP. The age range in the case of both hypertensive and control groups was between 26 and 75 years, and their mean was 59.3 years. The lowest duration of the disease was one year and the highest duration was 30 years. The systolic pressure ranged between 101.0 and 171.0 mmHg, and the mean was 135.6 mmHg. The diastolic pressure ranged between 60.0 and 140mmHg and their mean was 85.4 mmHg. Figure 1 shows the distribution of gender in the study population, which was matched

(51% males and 49% females). Table 2 shows the serum parameters in the case group. The mean of serum urea, creatinine and uric acid were 15, 0.8, 5.6; 17, 0.7, 6.2; and 20, 0.9, 6, respectively, according to the duration of the disease: 1–5, 5–10, or >10 years. Table 3 shows the serum parameters in the study population. The mean ± SD of serum urea, creatinine and uric acid in the case group was 17.42 ± 6.54 mg/dl, 0.83 ± 0.23 mg/dl and 6.02 ± 1. 39 mg/dl, respectively. Meanwhile, the mean ± SD of serum urea, creatinine and uric acid in the control group was 17.44 ± 6.44 mg/dl, 0.87 ± 0.26 mg/dl, and 5.14 ± 1.70 mg/dl, respectively. There were no significant differences between these parameters in the case and control groups. Table 4 indicates the serum parameters in the study population according to gender. The serum creatinine significantly increased (*p-value* = 0.004) in males compared to females. Table 5 shows the correlation between the descriptive data and the serum parameters in the study population. There was a negative correlation between age and diastolic pressure (r = -0.417$^{**}$, $p$ = 0.003). A positive correlation between systolic and diastolic pressure was observed (r = 0.292, $p$ = 0. 039). Additionally, a negative correlation was noted between serum urea and diastolic pressure (r = -0.364$^{**}$, $p$ = 0.009). Figure 2 shows the correlation between age and serum urea. There was a positive correlation between the two (r = 0.323, p = 0.022). Figure 3 shows the correlation between age and serum uric acid, which was noted as positive (r = 0.393, p = 0.005). Figure 4 indicates no correlation between age and serum creatinine (r = 0.249, p = 0.082). Figure 5 shows that there was no correlation between duration and serum urea. (r = 0.129, p = 0.370). Figure 6 shows there was no correlation between duration and serum uric acid (r = 0.094, p=0.516). Figure 7 shows there was no correlation between duration and serum creatinine (r = -0.126, p = 0.384).

**Table 1:** Descriptive data in the study population.

| Variables | Minimum | Maximum | Mean | SD |
|---|---|---|---|---|
| **Age** | 26.0 | 75.0 | 59.3 | 10.59 |
| **Duration** | 1.00 | 30.0 | 6.46 | 6.56 |
| **Systolic** | 101.0 | 171.0 | 135.6 | 18.59 |
| **Diastolic** | 60.0 | 140.0 | 85.4 | 12.79 |

**Table 2:** Serum parameters (urea, creatinine and uric acid) in the case study according to the duration of disease

| Mean | Urea | Creatinine | Uric acid |
|---|---|---|---|
| 1–5 | 15 | 0.8 | 5.6 |
| 5–10 | 17 | 0.7 | 6.2 |
| ➢ 10 | 20 | 0.9 | 6 |

**Table 3:** Comparison of mean concentrations of (urea, creatinine and uric acid) in study populations and the control group.

| Serum parameters | Case (Mean ± SD) N = 50 | Control (Mean ± SD) N = 50 | *P-value* |
|---|---|---|---|
| Urea | 17.42 ± 6.54 | 17.44 ± 6.44 | 0.991 |
| Creatinine | 0.83 ± 0.23 | 0.87 ± 0.26 | 0.382 |
| Uric acid | 6.02 ± 1.39 | 5.14 ± 1.70 | 0.006 |

**Table 4:** Serum parameters (Urea, Creatinine, and Uric Acid) in the study populations according to gender.

| parameters | Male (Mean ± SD) | Female (Mean ± SD) | *P-value* |
|---|---|---|---|
| Urea | 16.56 ± 6.13 | 18.28 ± 6.94 | 0.358 |
| Creatinine | 0.92 ± 0.21 | 0.74 ± 0.22 | 0.004 |
| Uric acid | 6.14 ± 1.64 | 5.89 ± 1.09 | 0.534 |

**Table 5:** Correlation of descriptive data and serum parameters in the study population.

| Parameters | | Systolic | Diastolic |
|---|---|---|---|
| Age | R-value | -0.149 | -0.417** |
| | P-value | 0.303 | 0. 003 |
| Duration | R-value | 0.233 | -0.252 |
| | P-value | 0.103 | 0. 077 |
| Systolic | R-value | | 0.292* |
| | P-value | | 0.039 |
| Diastolic | R-value | 0.292* | |
| | P-value | 0.039 | |
| Urea | R-value | -0.215 | -0.364** |
| | P-value | 0.134 | 0.009 |
| Creatinine | R-value | -0.179 | -0.189 |
| | P-value | 0.213 | 0.188 |
| Uric acid | R-value | -0.131 | -0.238 |
| | P-value | 0.365 | 0.097 |

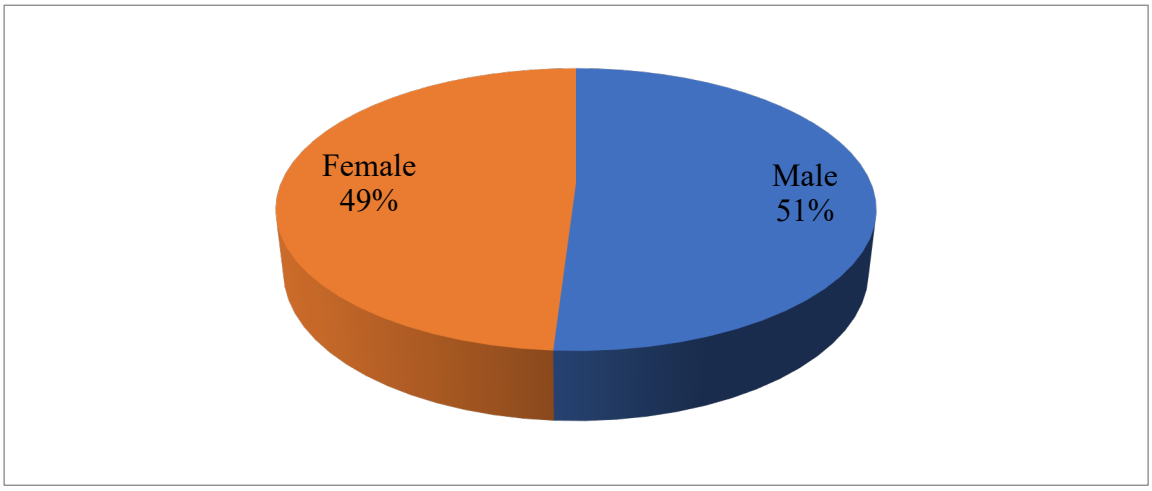


**Figure 1**: Distribution of gender in the study population

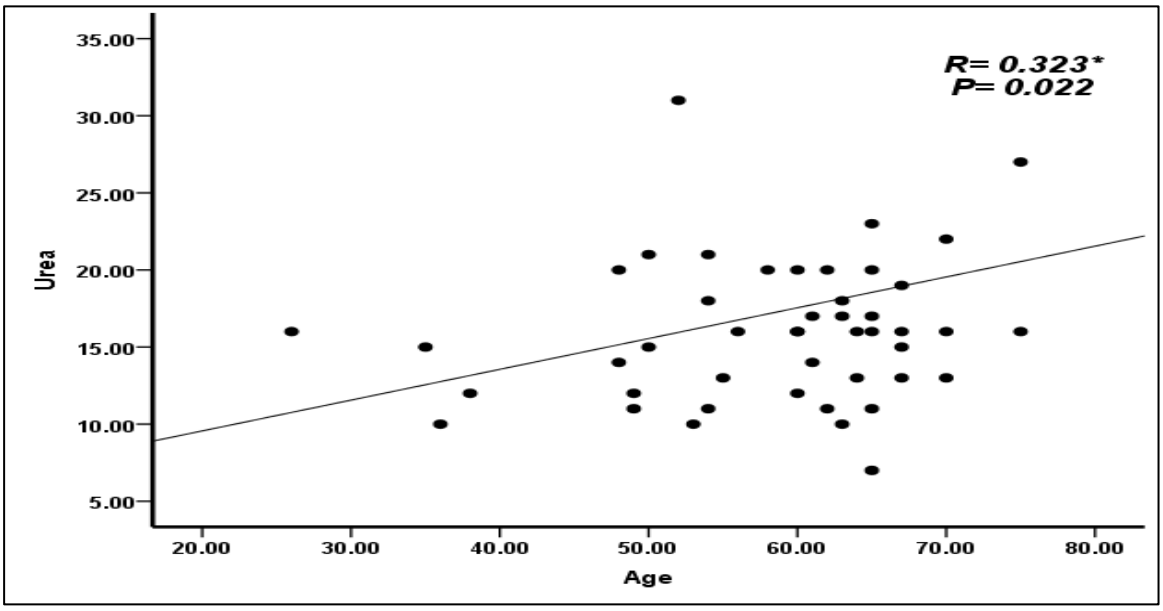


**Figure 2:** Correlation between age and serum urea

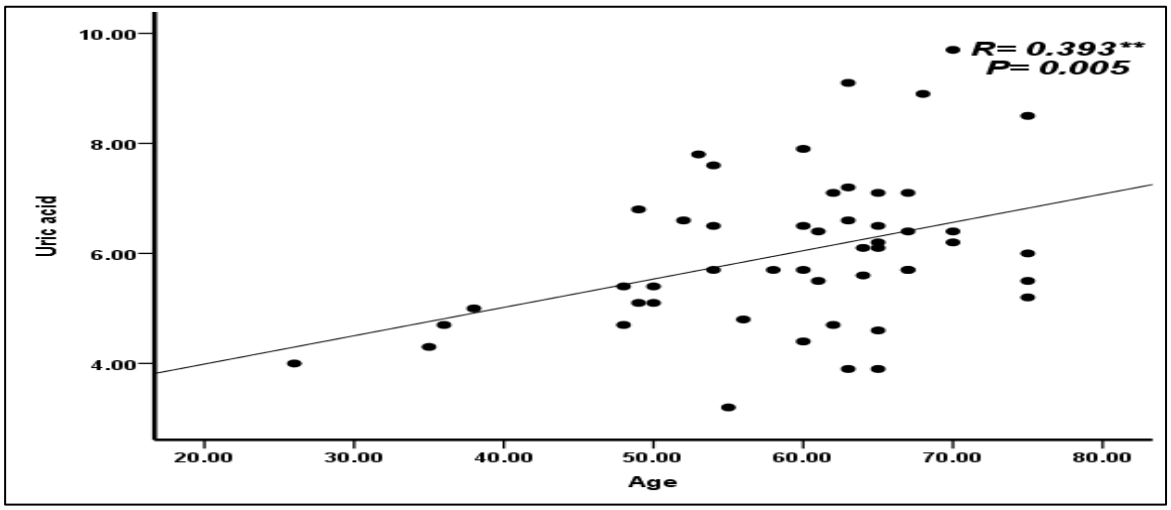


**Figure 3:** Correlation between age and serum uric acid

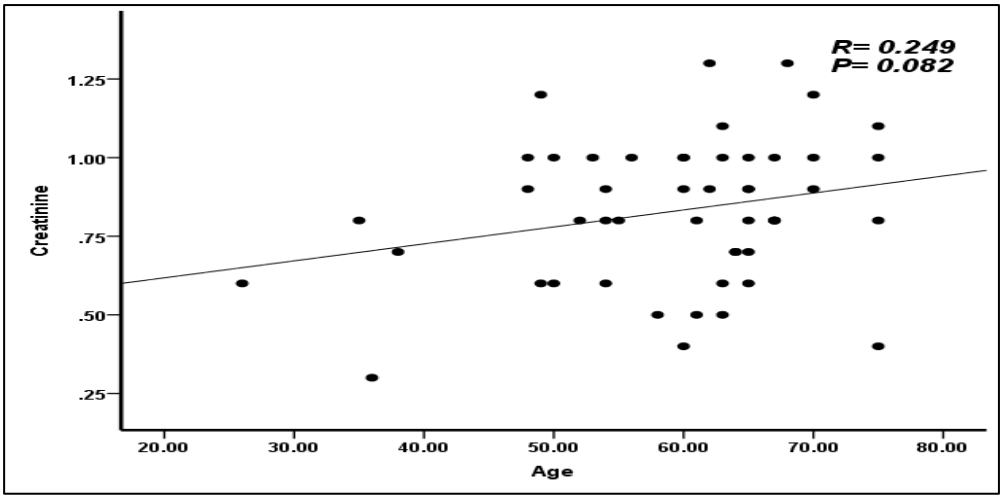


**Figure 4:** Correlation between age of patient and serum creatinine

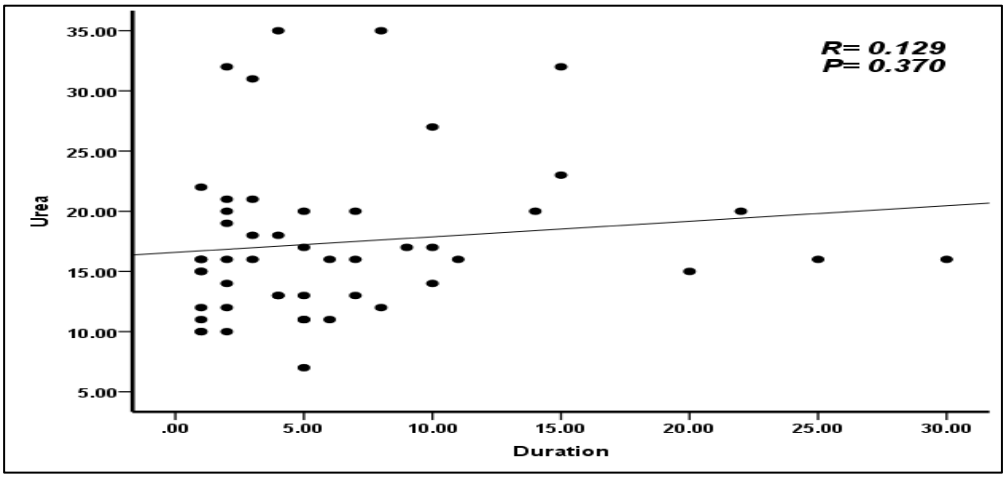


**Figure 5:** Correlation between duration of disease and serum urea

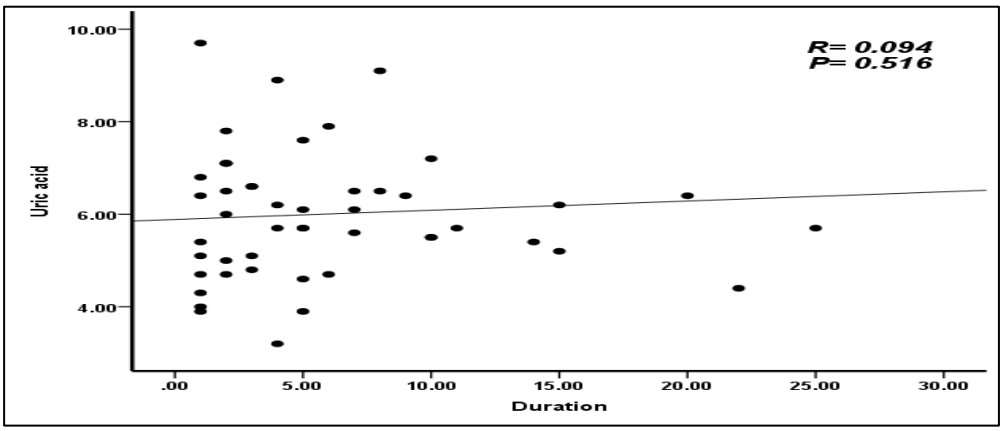


**Figure 6:** Correlation between duration of disease and serum uric acid

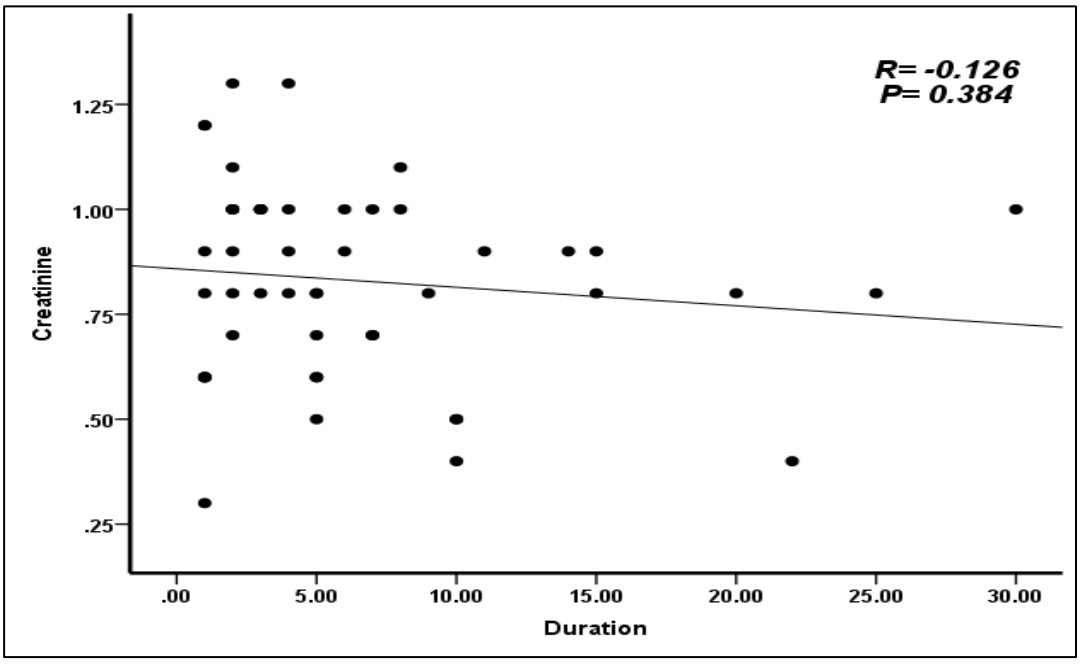


**Figure 7:** Correlation between duration of disease and serum creatinine

## DISSUASION

Chronic kidney disease is a major public health problem, and its prevalence is rising, particularly in the elderly population.[24] It is classified into stages according to the level of the GFR. Therefore, the estimation of the GFR is essential for the evaluation and screening of CKD, especially for groups at high risk, such as patients with hypertension.[25] The study population was age-matched and ranged between 26 to 75 years, and their mean was 59.3 years. The lowest duration of the disease was one year and the highest duration was 30.0 years. The systolic pressure ranged between 101.0 and 171.0 mmHg, and the mean was 135.6. The diastolic pressure ranged between 60.0 and 140 mmHg, and the mean 85.4. These findings were in agreement with a study by Oloruntoba A. Ekun *et al* in Nigeria.[26] Hypertensive patients were equal according to gender, with 51% males and 49% females. From the results, no significant differences in serum urea, creatinine and uric acid levels were noted between hypertensive patients (17.42 ± 6.54 mg/dl, 0.83 ± 0.23 mg/dl and 6.02 ± 1.39 mg/dl) and normotensive individuals (17.44 ± 6.44 mg/dl, 0.87 ± 0.26 mg/dl and 5.14 ± 1.70 mg/dl), respectively. These results were different from the study hypothesis, which assumed that the renal function test levels would be higher in hypertensive patients when compared with the normotensive individuals; these differences may be due to the patients' full commitment to hypertension treatment. In the current study, the mean of serum urea, creatinine and uric acid (15, 0.8, 5.6), (17,

0.7, 6.2), (20, 0.9, 6) were not significantly different according to the durations of the disease, which were 1–5, 5–10 and >10 years, respectively. The serum creatinine was significantly higher in males than in females, but there was no significant difference in serum urea and uric acid levels depending on the gender. These results agreed with the literature and reflected the effects of creatinine by muscle mass, as males have larger body muscles than females.[27] In this study, it was seen that diastolic pressure was positively correlated with systolic pressure ($r = 0.292$, $p = 0.039$), and negatively correlated with age ($r = -0.417^{**}$, $p = 0.003$) and serum urea ($r = -0.364^{**}$, $p = 0.009$) while it had no correlation with duration, creatinine and serum uric acid. The current study shows that ageing had a positive correlation with the serum urea level ($r = 0.323$, $p = 0.022$) and serum uric acid level ($r = 0.393$, $p = 0.005$), while it did not correlate with serum creatinine. Similar findings were reported in a study by Rasha Mustafa in Sudan,[28] where the duration of hypertension did not correlate with serum urea, serum uric acid or serum creatinine.

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**Conflict of Interests**
The authors declared no conflict of interests.

## CONCLUSIONS

The study observed that age was positively associated with serum urea and serum uric acid and negatively with diastolic pressure. Diastolic pressure had a positive correlation with systolic pressure and indicated a positive correlation with serum urea. No significant differences between the serum parameters in the study population were found. The serum creatinine was significantly higher in males compared to females.

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