ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Evaluation of Serum Uric Acid and Creatinine in Post-Menopausal Women Residing in Maiduguri Metropolitan Council (MMC) As a Risk Factor for Renal Failure

Lawrence Ocheme Akor., Fatima Zakari Abacha., Wadai Smith., Emeka Walter Ndubuisi., Nana Thliza Solomon and Barka Abbas Maladi

Department of Medical Laboratory Science, University Of Maiduguri, Maiduguri, Nigeria

DOI: https://doi.org/10.51244/IJRSI.2025.120800173

Received: 08 Aug 2025; Accepted: 15 Aug 2025; Published: 17 September 2025

ABSTRACT

Menopause is a turning point in the life of a woman where the woman faces hormonal changes that may predispose the individual to different health problems and renal dysfunction being one of them. This analysis did an assessment on the uric acid and creatinine concentrations in the serum of post-menopausal women living in Maiduguri Metropolitan Council (MMC) as a way of determining whether they can be used as early predictors of the risk of renal failure. A total of 215 volunteers were recruited, of which 165 were post-menopausal women and 50 were pre-menopausal controls of the same age group. Blood samples were taken and blood analyzed by regular enzyme and colorimetric methods. The findings showed that there were significantly higher levels of serum uric acid (427.10 ± 114.54µmol/L) and creatinine (118.43 ± 60.35µmol/L) in post-menopausal women than in the control group ($p < 0.05$). Further, there was a weak but significant positive correlation between serum uric acid and creatinine (r= 0 53) and each biomarker with the BMI. This is an indication that menopause can be a predisposing factor to kidney impairment because of the loss of protective effects that estrogen had on the kidney. It is recommended that renal biomarkers should be monitored regularly in women, especially post-menopausal and peri-menopausal women to detect the onset of chronic kidney disease and prevent it.

Keywords: Menopause, Post-menopausal women, chronic kidney disease (CKD), Biomarkers, Body mass index (BMI), Estrogen, uric acid, creatinine.

INTRODUCTION

Statement Of Problem

In recent years there has been an ever increase in research on women's health in post menopause. There is no confusion that biomedical research dominates the field. The series of complications that arises during the postmenopausal age includes flushes/sweating, fatigue, sleep disturbances, mood swings and joint/muscle pain (Perez et al., 2012). Joint and muscle pain are the most frequently encountered symptoms in post menopause. This symptom if not properly diagnosed, combines with other deteriorating factors such increase in uric acid and Creatinine which can eventually results in renal failure. Early diagnosis and treatment of this condition will prevent the occurrence of renal failure among postmenopausal women.

Aims and objectives of the study

Aims of the study

The aim of the study is to assess the level of uric acid and Creatinine among postmenopausal women residing in Maiduguri metropolitan council.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Objectives of the study

The objectives of the study are;

1. To determine the level of serum uric acid in postmenopausal subject.

2. To determine the level of serum Creatinine in postmenopausal subject.

3. To correlate the level of serum uric acid and Creatinine among postmenopausal subject and control.

4. To determine if any significant correlation exist between the level of creatinine and BMI in Post-Menopausal Women.

Significance of the study

The outcome from this research will be used to provide baseline information about the status of uric acid and Creatinine in postmenopausal women.

Research questions

The following research question would be addressed in the process of investigating the problem of the study;

1. What is the level of serum uric acid in postmenopausal subject?

2. What is the level of serum creatinine in postmenopausal subject?

3. Is there any significant correlation between the level of serum uric acid and Creatinine among postmenopausal subjects and normal control?

4. Is there any significant correlation between the level of creatinine and BMI in Post-Menopausal subject?

Scope of study

The study will be limited to only postmenopausal subjects residing in Maiduguri metropolitan council, Borno state.

LITERATURE REVIEW

Menopause occurs physiologically as a result of a decrease in the hormones progesterone and estrogen produced by the ovaries (Harlow et al., 2012). When a woman reaches menopause, also known as the climacteric, her menstrual periods cease permanently and she is no longer able to have children (Monterrosa-Castro et al., 2012). Typically, menopause starts between the ages of 49 and 52 (Takahashi et al., 2015). When a woman has gone one year without having her period, she is said to be postmenopausal (Sievert and Lynnette, 2024). It may be seen to have happened at the time of surgery in people who had their uterus removed but still had ovaries.

Usually, menopause is a normal change. Women who smoke tobacco may experience it early (Soares and Warren, 2009). While not normally required, hormone levels in the blood or urine can be used to confirm a diagnosis of menopause. Menopause and post-menopause symptoms can include painful intercourse, dry vaginal tissue, low energy, stiff joints, back pain, enlarged breasts, breast pain, heart palpitations, migraines, dizziness, rosacea, weight gain, heavy night sweats, and hot flashes (Hoffmann and Barbara, 2012).

The metabolic byproduct of purine metabolism is uric acid (Chaudhury et al., 2013). Uric acid levels are lower in women than in males while they are younger, but this gender difference disappears as women age, especially after menopause (Hak et al., 2010). Emerging evidence suggests hyperuricemia in post menopause was associated with increasing risk of the incidence and progression of chronic kidney disease (CKD) (Mallet et al., 2016).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

The breakdown of creatine and phosphocreatine in the muscle results in the production of creatinine, a non-protein nitrogenous (NPN) waste product (Salazar, 2014). The amino acids arginine, glycine, and methionine are transaminated to creatine it in the liver, pancreas, and kidneys (Lesley and Andrew, 2019). Muscle is where the majority of creatinine is created. Therefore, a patient's muscle mass, diet, age, gender, and skeletal muscle diseases all have an impact on the concentration of plasma creatinine (Lesley and Andrew, 2019). Compared to blood urea nitrogen (BUN), creatinine is better suitable as a measure of renal function since it is less impacted by food (Prince et al., 2010). The most used screening test for renal failures is serum creatinine. Theoretically, because postmenopausal women have less muscle mass, serum creatinine would underestimate their level of renal failure (Schaubelet al., 2005).

Kidney disease is usually asymptomatic with a long latent period and only becomes symptomatic when at least 50% of functional renal is lost (MacLean and Ndubuisi, 2017). In women, over 195 million cases have been reported worldwide. Women are infrequently diagnosed with kidney diseases until they reach menopause (Jurimae, 2007). When their sex hormone- estrogen begins to disappear from their system, the rate of kidney disease begins to increase. As a result, estrogen is believed to have a protective effect against developing kidney diseases (Jurimae and Jurimae, 2007).

In recent years there has been an ever increase in research on women's health in post menopause. There is no confusion that biomedical research dominates the field. Joint and muscle pain are the most frequently encountered symptoms in post menopause. This symptom if not properly diagnosed, combines with other deteriorating factors such increase in uric acid and Creatinine which can eventually results in renal failure. Early diagnosis and treatment of this condition will prevent the occurrence of renal failure among postmenopausal women. This study was carried out to assess the level of uric acid and Creatinine among postmenopausal women residing in Maiduguri metropolitan council.

Symptoms

Menopausal transition, also known as "perimenopause," is a predetermined period of time that starts when menstrual cycles start to become erratic and ends until the last menstrual period occurs (Soares, 2023). Menstrual irregularities, including heavy, protracted periods mixed with amenorrheic episodes, diminished fertility, vasomotor symptoms, and sleeplessness, characterize this time period. A few of these symptoms could appear four years before menstruation stops (Brinton et al., 2015). Vasomotor symptoms, urogenital atrophy, osteoporosis, cardiovascular disease, cancer, mental symptoms, cognitive decline, and sexual issues are among the main health concns of menopausal women (Dalal and Agarwal, 2015).

Vasomotor Symptoms

Vasomotor symptoms affect most women during the menopausal transition, although their severity and duration vary widely between women (Mishra and kuh, 2012). Hot flashes are reported by up to 85% of menopausal women (Utian, 2014). Hot flashes are present in as many as 55% of women even before the onset of the menstrual irregularity that defines entry into the menopausal transition and their incidence and severity increases as women traverse the menopause, peaking in the late transition and tapering off within the next several years (Col et al., 2016).The duration of symptoms that are less severe, however, may be longer. Up to 25% of women still experience hot flashes five or more years following menopause (Freeman et al., 2014). Previously, it was believed that hot flashes were exclusively caused by the withdrawal of estrogen, although a hot flash doesn't cause an abrupt shift in blood estradiol levels (Thurston et al., 2017). Others have connected hot flashes to fluctuating levels of follicle-stimulating hormone (FSH) and estradiol (Freeman et al., 2014).

Vulvovaginal Atrophy

When estrogen levels fluctuate during the menopausal transition and then remain low after menopause, the delicate urogenital tissues may get damaged and exhibit painful symptoms (Freedman, 2018). About 27% and 60% of women experience mild to severe vaginal dryness or dyspareunia symptoms during menopause (Santoroet al., 2015). High rates of dyspareunia can also be caused by uterine prolapse, vaginal shortening and constriction, and vaginal atrophy (Castelo et al., 2015). In addition, the urethra and bladder in the urinary tract

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

contain estrogen receptors, and as the lack of estrogen becomes apparent, patients may experience Ul. In contrast to vasomotor symptoms, vulvovaginal atrophy does not go better on its own over time (Wurzet al., 2014).

Sleep Disturbances and Insomnia

Sleep quality generally deteriorates with aging, and menopause seems to add an additional, acute layer of complexity to this gradual process (Santoro et al., 2015). Women report more trouble sleeping as they enter into the menopausal transition, and sleep has been shown to be worse around the time of menses, both by self-report as well as by actigraphy (Kravitzet al., 2015). Women report sleep difficulties approximately twice as much as do men (Manber and Armitage,2018). In addition to hormones, the menopausal transition and aging-related hormonal changes are linked to further deterioration in sleep quality. Women's claims of sleep problems rise over time, and by the post-menopause, more than 50% of women report having trouble sleeping (Sherman et al., 2017). Compared to males, women appear to endure more negative sleep-related impacts as they age (Ohayon, 2016).

Kidney Failure In Post Menopause

One of the many issues that affect elderly populations is chronic kidney disease (CKD). Age affects the prevalence of CKD, with elderly people experiencing a much higher incidence (22.0%) than people of middle age (6.4%) or young age (2.8%) (Park et al., 2016). Men and premenopausal women had a lower incidence of CKD at 7.4 percent and 4.7 percent, respectively, compared to postmenopausal women, who have a higher incidence of 20.1 percent (Yu et al., 2010).

Metabolic abnormalities are related to the development of CKD. Estrogen reduces kidney disease under normal circumstances; however, as estrogen levels can fall by as much as 80% during menopause (Ramesh et al., 2017). For elderly women, this poses a major risk. Therefore, it's crucial to find strategies for maintaining renal function as people get older. Estrogen is a viable alternative for slowing the progression of CKD because it has been demonstrated to protect against both the development and progression of CKD. By lessening kidney damage brought on by the formation of superoxide, estrogen-based hormone replacement therapy (HRT) has been proven to have preventive effects against kidney-related disorders (Park et al., 2018).

Uric Acid Level In Post Menopause

Up until the early 1800s, uric acid was thought to be a biologically inert waste product, but hyperuricemia is now recognized as a well-established causal factor in gout and a potential risk factor for a number of chronic conditions, including chronic kidney disease, cardiovascular disease, and metabolic syndrome (Johnson et al., 2018). A common metabolic condition brought on by increased UA synthesis or poor uric acid elimination is hyperuricemia (Matsuo et al., 2014). Pre-menopause, early menopausal transition, late menopausal transition, and post-menopause are the transitional stages of the menopausal process, which include a gradual transition from pre- to post-menopause (Harlow et al., 2012). Menopausal status and hyperuricemia have been linked in prior studies (Hak and Choi, 2008). After adjusting for age and body mass index (BMI), menopause was found to be independently linked with a high level of UA (Mumford et al., 2013). Obesity increases the risk of cardiovascular disease in postmenopausal women and lower fertility and menstrual problems in premenopausal women (Messinis et al., 2015). In addition to varying from nation to country, the prevalence of obesity, a risk factor for hyperuricemia, rises following menopause (Lizcano and Guzman, 2014). Identification of the ideal time for hyperuricemia preventative treatments depends on a better knowledge of the association between menopausal stage and hyperuricemia (Cho et al., 2019).

UA levels are lower in women than in males when they are younger, but this gender difference vanishes as women age, especially after menopause (Cho et al., 2019). Recent data indicates that postmenopausal hyperuricemia was linked to an increased risk of the occurrence and progression of chronic kidney disease (CKD) (Mallat et al., 2016).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Mechanisms Of Hyperuricemia-Induced Renal Injury

Monosodium Urate (Msu) Crystal Deposition-Induced Renal Damage:

Uric acid has the characteristic of a weak organic acid, and most of it is ionized to MSU crystal at pH 7.4 and a temperature of 37°C (Marangella, 2005). A solubility study showed that serum was supersaturated for MSU crystal when the concentration of UA exceeded 6.5 mg/dL (Ruilope et al., 2016). As a consequence, UA and urate crystals may deposit in the joints, kidneys and other tissues, inducing tissue damage.

Hyperuricemia-Induced Renal Inflammation:

During necrosis, the dying cell releases amount of danger signals, such as ATP, high-mobility group box protein 1 (HMGB1), heat shock proteins, and UA, to activate immune response. UA may crystallize into MSU crystal in the extracellular fluid and can be recognized by pattern recognition receptors (e.g., TLRs) expressed on antigen-presenting cells (APCs, such as macrophages and TECs) as one of the danger-associated molecular patterns (DAMPs), which ultimately activates immune and inflammatory responses. Notably, hyperuricemia may induce renal inflammation via crystal-dependent and crystal-independent pathways (Braga et al., 2020).

Creatinine Level In Postmenopausal

Serum creatinine concentration increased steadily with age; in females from the age of 40 years, but it begins to decrease at post menopause due to decreasing muscle mass (frassetto et al., 2005). At post menopause again, the creatinine level can also increase when the woman begins to have kidney problem. The changes in serum creatinine concentration that occur with age are relevant in interpretation of the results of renal monitoring.

Creatinine Level In Kidney Disease

When there is kidney disease, the rate of creatinine excretion is substantially lower than the rate of production, which causes a sharp rise in blood creatinine levels, or azotemia (Jaromir and Radim, 2008). Since the body consistently produces creatinine, testing blood creatinine levels is a great approach to determine the glomerular filtration rate (GFR), a measure of total kidney function (Edmund and Christopher, 2015).

MATERIALS AND METHODS

Study Area

The study was carried out in Maiduguri metropolitan council (MMC). Maiduguri is the capital of Borno State, Nigeria, which lies within Latitude 10°N and 14°N and Longitude 11°30'E and 14°45'E and an area of 61435sq.km. The state is situated in the northeastern region of the country with over 20million people population, comprising of six states (Borno,Yobe,Adamawa,Taraba,Bauchi and Gombe) as well as sizeable number across the borders of Cameroon, Chad and Niger Republics (Nafadaet al,. 2011).

Study Subjects

A total of 215 subjects were recruited for this study. These consist of 165 postmenopausal subject and 50 premenopausal women who were used as control sample.

Inclusion Criteria

Only subjects that were 49 years and above, who gave their informed consent and were residing in Maiduguri metropolitan city were recruited for this study.

Exclusion Criteria

Subjects below 49 years of age and not residing in Maiduguri metropolitan were excluded from the study.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Postmenopausal subject with diabetes, kidney disease and cardiovascular disease were excluded from this study.

Informed Consent

The informed consent of the subject was obtained from the subjects using a standard protocol.

Ethical Consideration

Ethical approval for the study was granted by the Research and Ethics Committee of the Borno State Ministry of Health.

Sample Size Determination

The minimum sample size was calculated from a standard formula for calculation of minimum sample size (Petra, 2012) the formula is as shown below;

$$n = \frac{(z1-a)2(p)(1-p)}{d2}$$

Where;

n=minimum sample size

Z1-a=the value of standard normal deviation which is at 95% confidence intervals has been found to be 1.96

p=the estimate of the people prevalence obtained from literature review

d=the difference between the true population and the sample that can be tolerated, that is the absolute precision required (in percentage point) on either side of the population.

At prevalence rate of menopause of 12.2% (Amehet al., 2016). Using 5% precision at 95% confidence level, the minimum sample size n for this study was calculated as follows:

$$n = \frac{(z1-a)2(p)(1-P)}{d2}$$

$$n = \frac{(1.96)2(0.122)(1-0.122)}{(0.05)2}$$

$$n = \frac{3.84 \times 0.122 \times 0.878}{0.0025}$$

n= 165subjects

Therefore, the minimum sample size was 165 subjects.

Sample Collection, Processing and Storage

Five milliliter (5ml) venous blood sample was collected through venipuncture and was dispensed into plain containers. The blood in the plain container was allowed to clot, the serum was then obtained by centrifugation at 4000 rpm for 10minutes. Serum was then stored at 4oC for batch analysis.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Laboratory Analytical Method

Serum uric acid and creatinine were estimated using the following method;

Estimation of Serum Uric Acid

Serum uric acid was determined by enzyme colorimetric (uricase) method as described by fossattiet al. (1980).

Principle of Test

Uric acid is oxidized by uricase to allantoin and hydrogen peroxide, which under the catalytic reaction influence of peroxidase oxidizes 3,5- dichloro-2-hydroxybenzene sulfonic acid and 4-aminophenazone to red – violet quinonamine compound. The colour Sintensity formed is proportional to the uric acid concentration.

Procedure of Serum Uric Acid Estimation

In each clean test tube labeled as blank, standard and test, 1ml of uric acid reagent was dispensed and 0.02ml of standard and serum sample (test) was added respectively. It was mixed thoroughly and incubated for 10 minutes at room temperature. Absorbance was read against blank reagent using spectrophotometer at 546nm wavelength.

Conc. Of Test = Abs of Test x Conc. of Standard

Abs of Standard

Reference Range: 142-416µmol/L.

Estimation of Serum Creatinine

Serum creatinine was determined by Jaffe slot alkaline picrate method as described Jaffe (1886).

Principle of Test

Alkaline picrate reagent reacts with creatinine in serum to form an orange red coloured solution whose absorbance is directly proportional to the concentration of creatinine in the sample.

Procedure of Serum Creatinine Estimation

Procedure for serum creatinine estimation is of two stages;

Stage1: (Deproteinization Stage)

In each clean test tube labeled as blank, standard and test. 1000ul of 10% sodium tungstate (10%NaWO4) was dispensed into the test tubes and 1000ul of sulphuric acid was added respectively. 500ul of standard and test were added to standard and test respectively. The contents were vortexed vigorously and were centrifuged at 4000rpm for 10 minutes and the supernatant to each tube (1ml) were separated into another labeled test tubes respectively.

Stage2: (REACTION STAGE)

1ml of picric acid was dispensed into the test tubes containing the supernatants (1ml) and 1ml of sodium hydroxide (NaOH) was added to them respectively. The tubes were incubated for 10 minutes at room temperature and absorbance was read against the blank using spectrophotometer at 500nm wavelength.

Conc. of Test = Abs of Test x Conc. of Standard

Abs of Standard

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Reference Range: 44-132µmol/L.

Statistical Analysis

The statistical analysis was performed using the Statistical Product and Service Solutions (SPSS) version 21.0, 2012. The statistical methods included the mean, standard error of mean. The Student t-test was used for comparisons of data. A Pearson Correlation model was used to determine correlation between multiple data. A value of $p<0.05$ was considered if it's significant or not, a value of $p<0.01$ would be considered highly significant or not.

RESULT, DISCUSSION AND CONCLUSION

Results

Two hundred and fifteen (215) subjects, who had given informed consent, were recruited into the study and it consisted of 165 post-menopausal women (as the study subjects) with a mean age of 55.44±7.67 and 50 pre-menopausal women (the control subjects) with a mean age of 28.20±7.16. The study accessed the level of serum uric acid and creatinine in post-menopausal women residing in Maiduguri metropolitan city.

Table 1 shows a demographic data of the study subjects and control individuals. There was a significant difference ($p<0.05$) in the mean values of ages of post-menopausal women and control subjects. On the other hand, there is no significant difference ($p> 0.05$) in the means of BMI.

Table 1: Demographic Data of Post-Menopausal Women and Controls

Parameters	**Post-Menopausal Subjects (n=165)**	**Controls (n=50)**	**p-value**	**Remarks**
Age (years)	55.45 ± 7.67	28.20 ± 7.16	0.000	S
BMI	23.83 ± 2.52	23.38 ± 3.87	0.45	NS

All values are expressed as mean ± standard deviation.

NS- Not Significant and S- Significant

Table 2 shows the comparison of the biochemical parameters between post-menopausal women and control subjects. The table revealed that there is significant difference ($p< 0.05$) in the mean of serum uric acid (427.10 ± 114.54 vs 335.54 ± 48.22) and serum creatinine (118.43 ± 60.35 vs 66.74 ± 9.25).

Table 2: Serum Biochemical Parameters of Post-Menopausal Women and Control Subjects

Parameters	**Post-Menopausal (n=165)**	**Controls (n=50)**	**P value**	**Remarks**
Uric Acid (umol/l)	427.10 ± 114.54	335.54± 48.22	0.000	S
Creatinine (umol/l)	118.43 ± 60.35	66.74 ± 9.25	0.000	S

All values are expressed as mean ± standard deviation.

NS- Not Significant and S- Significant

Table 3 shows Karl Pearson's correlation between the levels of serum creatinine with the serum uric acid of post-menopausal women. It showed a weak positive significant correlation ($r= 0.53$; $P= 0.000$) between levels of serum uric acid and serum creatinine as shown in Fig. 1. The table also shows Karl Pearson's correlation between serum creatinine and BMI of post-menopausal women. It showed a weak positive significant correlation ($r= 0.01$; $P= 0.000$) as shown in Fig. 2.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Table 3: Karl's Pearson Correlation between Serum Creatinine with Uric Acid and BMI in Post-Menopausal Women

Parameters	**Karl Pearson Correlation Coefficient(r)**	**P-value**	**Remarks**
Uric Acid (umol/l)	0.53	0.000	S
BMI	0.01	0.000	S

S- Significant

Table 4 shows Karl Pearson's correlation between the levels of serum uric acid with BMI of post-menopausal women. It showed a weak positive significant correlation (r= 0.04; P= 0.000) between levels of serum uric acid and BMI as shown in Fig. 3

Table 4: Karl's Pearson Correlation between Serum Uric Acid and BMI in Post-Menopausal Women

Parameters	**Karl Pearson Correlation Coefficient(r)**	**P-value**	**Remarks**
BMI	0.04	0.000	S

S- Significant

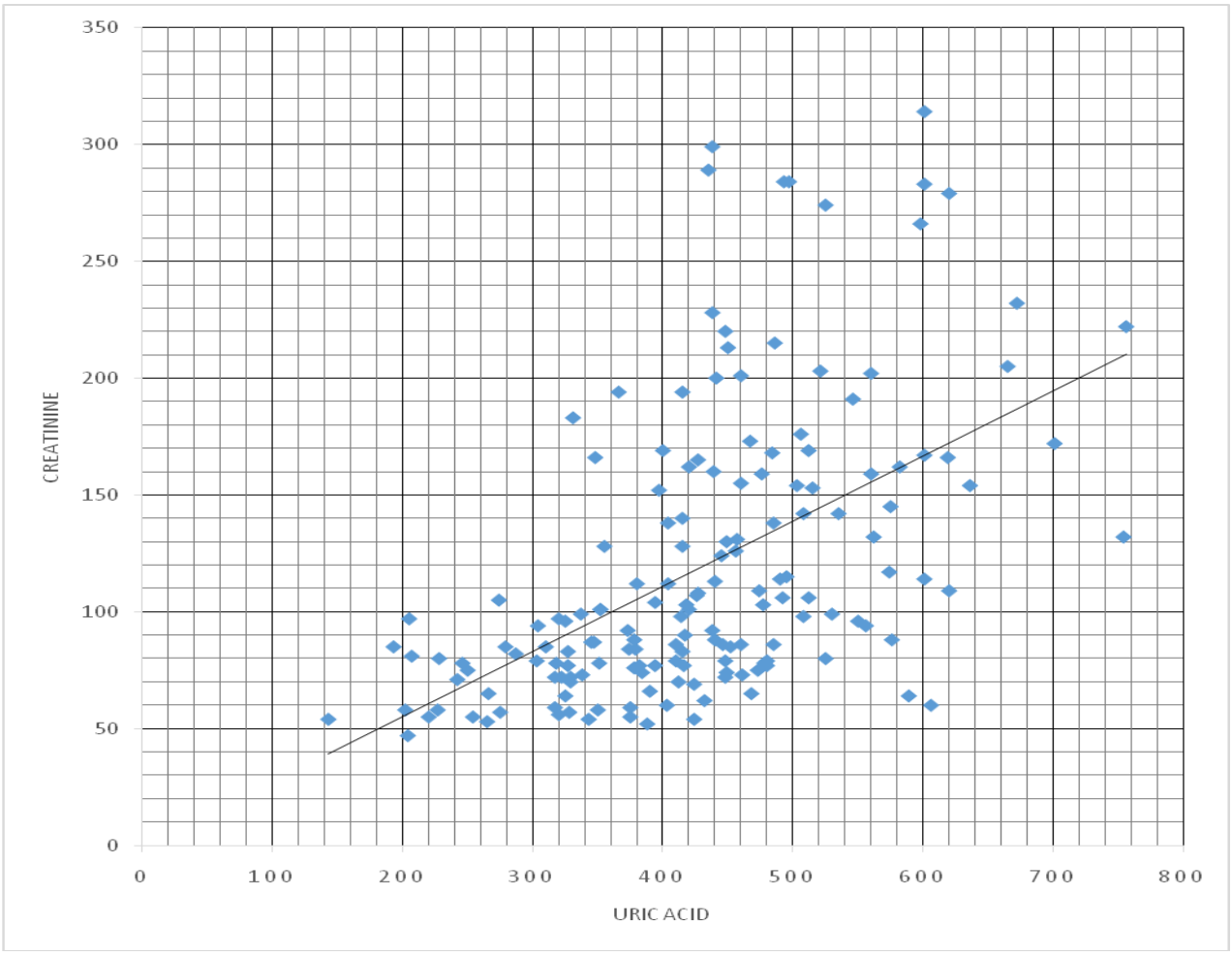


Fig 1: Scattered Graph Showing the Relationship between Serum Creatinine and Uric Acid in Post-Menopausal Women

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

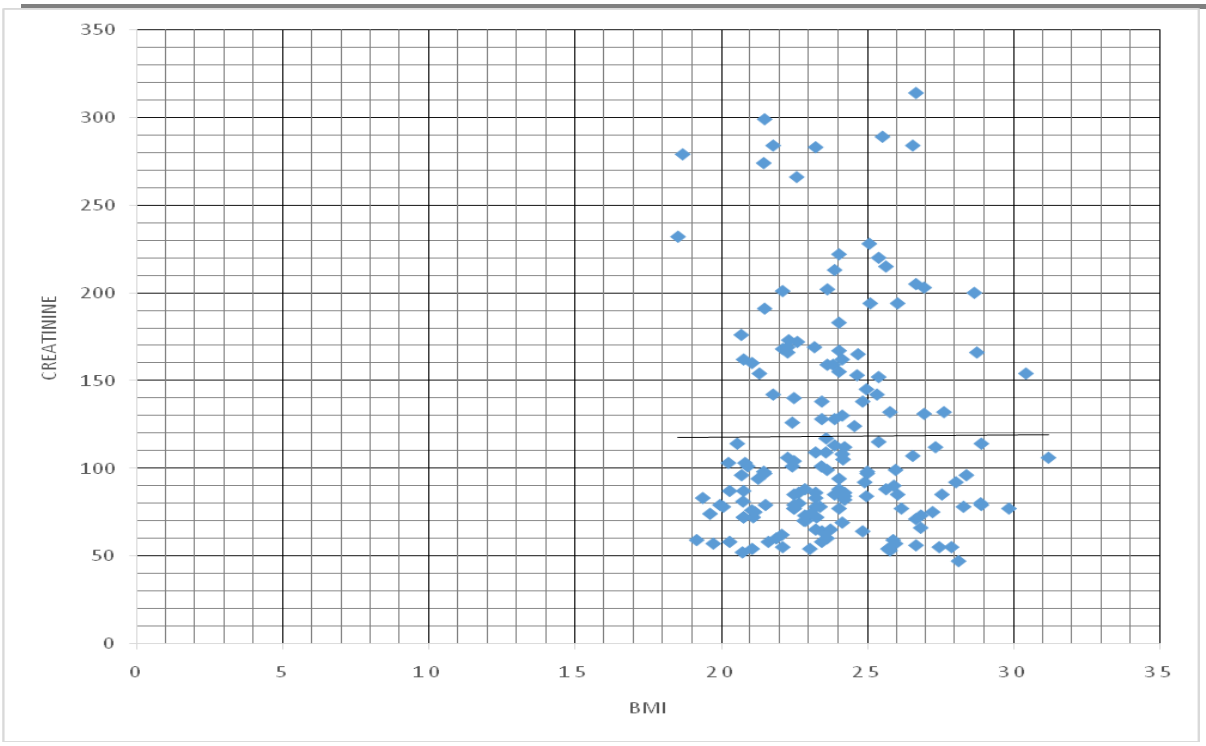


Fig 2: Scattered Graph Showing the Relationship between Serum Creatinine and BMI in Post-Menopausal Women

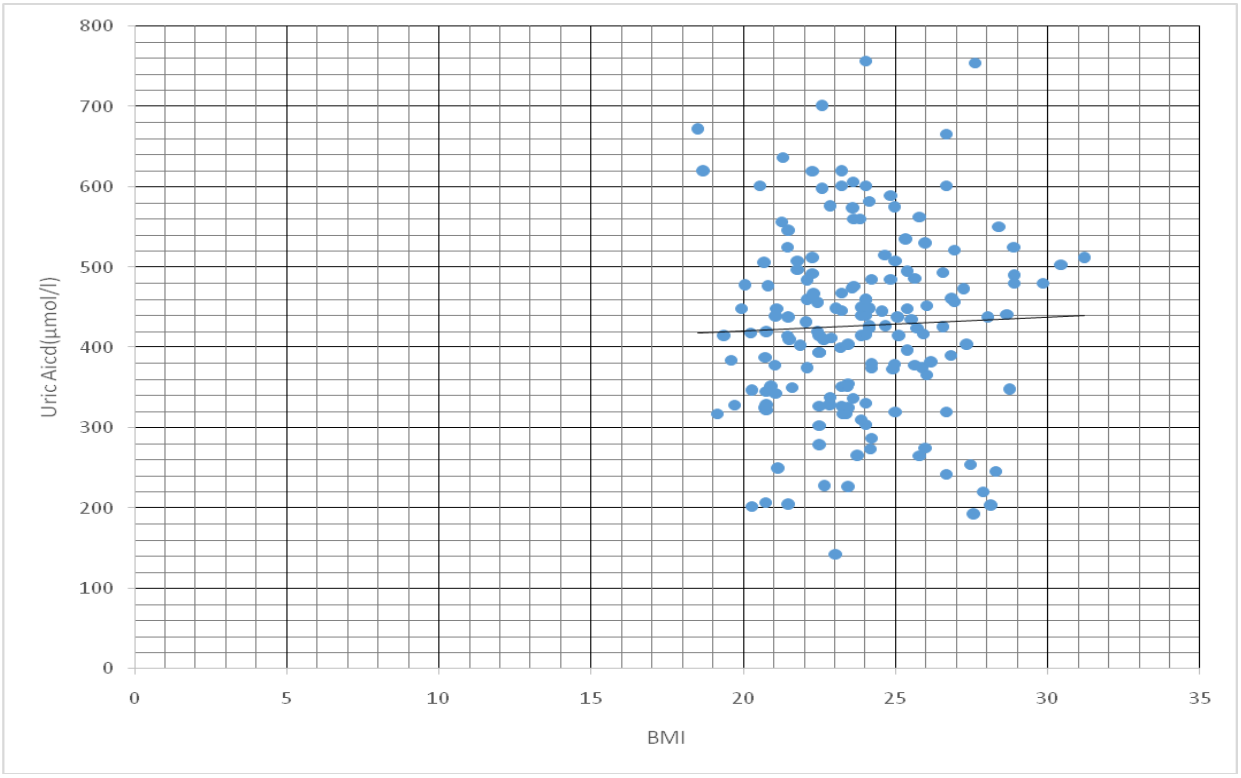


Fig 3: Scattered Graph Showing the Relationship between Serum Uric Acid and BMI in Post-Menopausal women

DISCUSSION

Menopause is characterized by a change in the physiological condition as well as biochemical state of women that in most cases causes a decrease in estrogen, which is vital in regulation of metabolism and kidney protection (Dalal&Agarwal, 2015). This research explored the serum creatinine levels and uric acid in post-menopausal women who might have an indication of renal dysfunction as compared to the pre-menopausal

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

women who were the study controls. The increase in serum uric acid and creatinine is prominent in the post-menopausal women due to the indicated possibility of renal health implications after menopause.

Mean serum uric acid in post-menopausal group (427.10 ± 114.54 pmol/L) was significantly higher than the control group level (335.54 ± 48.22 pmol/L) with the value of $p < 0.05$, which is considered to be significant. The result correlates with the original research conducted byHak et al. (2010), who also found that the levels of serum uric acid elevate in women at post menopause as the estrogen levels fall since they boost the excretion of uric acids. Estrogen is considered to have uricosuric activity; therefore, its decrease in menopause affects the inability to eliminate uric acid and increases the predisposition of women to hyperuricemia (Mallet et al., 2016; Lytvynet al., 2015).

Likewise, the serum creatinine levels were also significantly raised in post-menopausal women (118.43 ± 60.35 µmol/L) as compared to controls (66.74 ± 9.25 µmol/L) with a p-value < 0.05. An indicator of kidney functioning that can be used to predict the presence of impaired glomerular filtration rate is elevated creatinine (Edmund & Christopher, 2015). It is consistent with the results of Ikegwuonu et al. (2020) who also found elevated creatinine levels in post-menopausal women, implying that subclinical kidney dysfunction may occur.

The study also established that there is a positive correlation between uric acid and creatinine ($r = 0.53$, $p = 0.000$) which makes it possible that the poor renal functioning could be linked to the presence of the two waste-products. These data are added by the fact that hyperuricemia on its part can also lead to kidney damage through processes like oxidative stress, endothelial dysfunction and inflammation based on research (Roumeliotiset al., 2019; Braga et al., 2020).

Moreover, serum creatinine and BMI had a weak but significant positive correlation with each other ($r = 0.01$, $p = 0.000$), as well as did the uric acid and BMI ($r = 0.04$, $p = 0.000$). These are correlations that can be interpreted to mean that body composition is a factor that could affect renal biomarkers, but they produce poor relationships. Earlier studies have already associated obesity and high BMI with a distorted kidney work and uric acids metabolism, especially in post-menopausal females (Lizcano& Guzman, 2014).

The results of this research also support the need to monitor post-menopausal women with biochemical indicators early enough due to the asymptomatic progress of chronic kidney disease (MacLean & Ndubuisi, 2017). As the world is facing an increased population of aging women, these biomarkers can act as important indicators of renal risk factors among post-menopausal women more so in low resource environments like Maiduguri.

CONCLUSION

This research has shown that there is a significant increase in serum uric acid and creatinine levels in post-menopausal women in comparison to pre-menopausal women in the Maiduguri Metropolitan Council. These data indicate that menopause is also the time of the first symptoms of renal impairment, presumably caused by an insufficiency of estrogens and metabolic changes typical of this period in life. The correlations of serum markers with BMI observed also indicate that body composition might alter the renal vulnerability. On the whole, the study constitutes a piece of evidence that confirms the relation of menopause and the steadily worsening renal functioning and promotes the use of uric acid and creatinine as predictors of early-stage renal dysfunction in post-menopausal females.

RECOMMENDATION

1. Routine Monitoring: Health practitioners ought to promote frequent screening of serum uric acid and creatinine among peri- and post-menopausal women during pre-preventive medical examination.

2. Community Awareness: The community should be aware of the renal health issues that may occur as a result of menopause, and this should focus on the early symptoms and the preventive measures.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

3. Lifestyle Interventions: Healthier lifestyles in terms of weight control, balanced diet and exercise should be recommended to post-menopausal women who need to develop healthier lifestyles to reduce risk factors with the potential of inducing or worsening the condition of renal impairment (if they are obese).

4. Longitudinal studies: Future research would take a longitudinal study to track the change in the renal biomarkers over the time as well as the effectiveness of hormone replacement therapy (HRT) in improving the renal functioning.

REFERENCE

1. Ameh, N., Madugu, N. H., Onwusulu, D., Eleje, G., &Oyefabi, A. (2016).Prevalence and predictors of menopausal symptoms among postmenopausal Ibo and Hausa women in Nigeria.Tropical Journal of Obstetrics and Gynaecology, 33(3), 263.
2. Braga, T. T., Foresto-Neto, O., &Camara, N. O. S. (2020).The role of uric acid in inflammasome-mediated kidney injury.Current Opinion in Nephrology and Hypertension, 29(4), 423-431.
3. Brinton, RD., Yao, J., Yin, F., Mack, WJ.,Cadenas, E., (2015). Perimenopause as a neurological transition state, Nat Rev Endocrinol. 11 (7), 393-405.
4. Brosnan, J. T., &Brosnan, M. E. (2010).Creatine metabolism and the urea cycle.Molecular genetics and metabolism, 100, S49-S52.
5. Castelo-Branco, C, Cancelo, M. J., Villero, J, Nohales, F., & Julia, M. D. (2015) Management of post-menopausal vaginal atrophy and atrophic vaginitis.Maturitas, 52, 46-52.
6. Chaudhary, K., Malhotra, K., Sowers, J., &Aroor, A. (2013).Uric acid-key ingredient in the recipe for cardiorenal metabolic syndrome.Cardiorenal medicine, 3(3), 208-220.
7. Cho, S. K., Winkler, C. A., Lee, S. J., Chang, Y., &Ryu, S. (2019). The prevalence of hyperuricemia sharply increases from the late menopausal transition stage in middle-aged women. Journal of clinical medicine, 8(3), 296.
8. Col, N. F., Guthrie, J. R., Politi, M., &Dennerstein, L. (2016). Duration of vasomotor symptoms in middle-aged women: a longitudinal study. Menopause, 16(3), 453-457.
9. Dalal, P. K., & Agarwal, M. (2015).Postmenopausal syndrome. Indian journal of psychiatry, 57(Suppl 2), S222-S232.
10. Edmund J. L, and Christopher P.P. (2015). Kidney function test-creatinine, urea anduric acid.In; Carl B.A and David B. E. Tietz fundamentals of clinical chemistry and molecular diagnostics. 7th edt; 364-370.
11. Frassetto, L, Morris Jr, R. C., & Sebastian, A. (2005). Potassium bicarbonate reduces urinary nitrogen excretion in postmenopausal women. The Journal of Clinical Endocrinology & Metabolism, 82(1), 254-259
12. Freedman, M. (2018).Vaginal pH, estrogen and genital atrophy.Menopause Management, 17(4), 9-13.
13. Freeman, E W, Sammel, M. D, & Sanders, RJ (2014) Risk of long term hot flashes after natural menopause evidence from the Penn Ovarian Aging Cohort. Menopause (New York, NY). 21(9), 924
14. Hak, A. E., Curhan, G. C., Grodstein, F., & Choi, H. K. (2010).Menopause, postmenopausal hormone use and risk of incident gout.Annals of the rheumatic diseases, 69(7), 1305-1309.
15. Harlow, SD., Gass, M., Hall, JE., Lobo, R., Maki, P., Rebar, RW., Sherman, S., Sluss, PM, de-Villiers, TJ., (2012). Executive summary of the stages of reproductive aging workshop+ 10: addressing the unfinished agenda of staging reproductive aging. Menopause.19 (4), 387-95.
16. Harlow, SD., Gass, M., Hall, JE., Lobo, R., Maki, P., Rebar, RW., Sherman, S., Sluss, PM, de-Villiers, TJ., (2012). Executive summary of the stages of reproductive aging workshop+ 10: addressing the unfinished agenda of staging reproductive aging. Menopause.19 (4), 387-95.
17. Hoffman, Barbara (2012). Williams gynecology. New York: McGraw-Hill Medical. pp. 555–56.
18. Ikegwuonu, I. C., Okwor, C. P., Chukwu, J. I., & Mba, B. C. (2020). Assessment of serum Calcium, Alkaline phosphatase and Creatinine levels in postmenopausal women in Enugu metropolis.
19. Jaromir K., Radim C. (2008). Clinic schemistry and enzymology laboratory manual.
20. Johnson, R. J. Bakris, G. L, Borghi, C., Chonchol, M. B Feldman, D, Lanaspa, M A, &Chertow, G. M. (2018) Hyperuricemia, acute and chronic kidney disease, hypertension, and cardiovascular disease

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

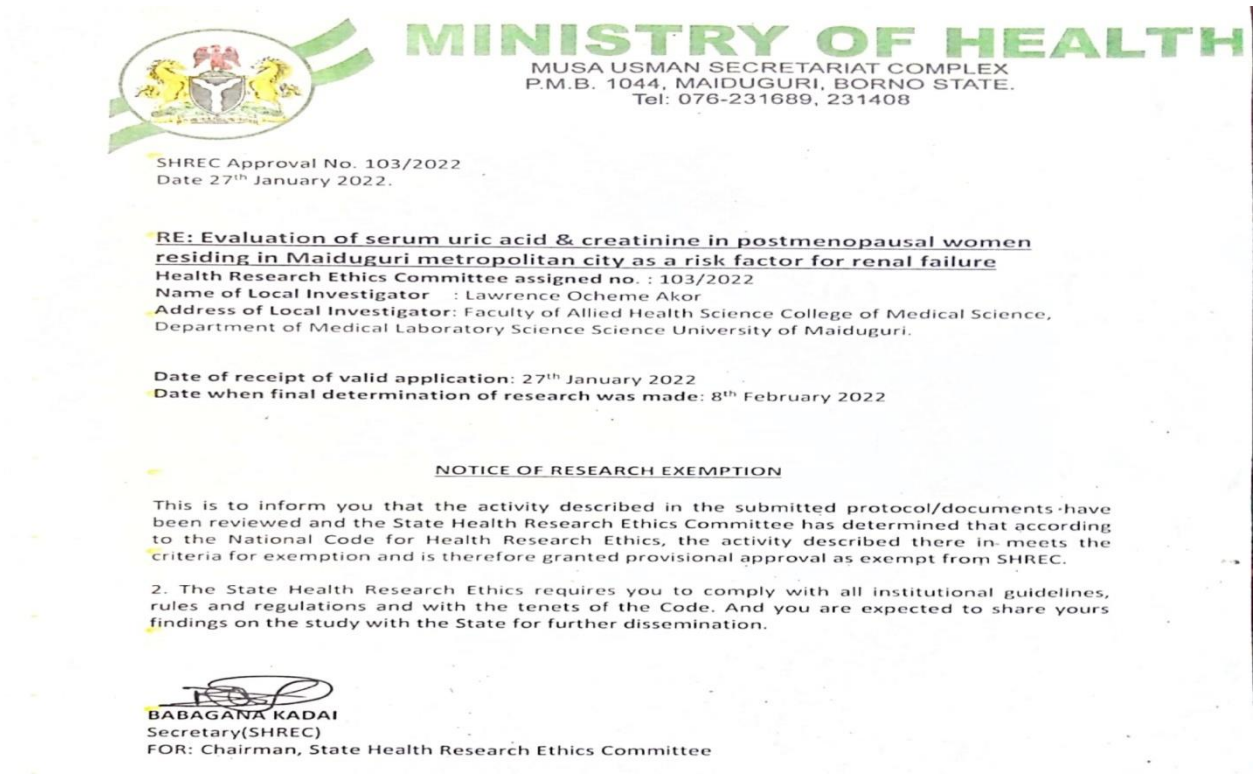
report of a scientific workshop organized by the National Kidney Foundation. American Journal of Kidney Diseases, 71(6), 851 865.
21. Jurimae, J., & Jurimae, T. (2007). Plasma adiponectin concentration in healthy pre-and postmenopausal women: relationship with body composition, bone mineral, and metabolic variables. American Journal of Physiology-Endocrinology and Metabolism, 293(1), E42-E47.
22. Kravitz, H. M., Zheng, H., Bromberger, J. T., Buysse, D. J., Owens, J., & Hall, M. H. (2015).An Actigraphy Study of Sleep and Pain in Midlife Women–The SWAN Sleep Study.Menopause (New York, NY), 22(7), 710.
23. Lesley A. I, Andrew S L (2019). Measurement and estimation of kidney function; in Jonathan H., Alplkizler T. Chronic kidney disease, dialysis and transportation. 4th edt; 23-41.
24. Lizcano, F, & Guzman, G. (2014). Estrogen deficiency and the origin of obesity during menopause.BioMed research international, 2014.
25. MacLean R.A, Ndubuisi N.U (2017), Asymptomatic chronic kidney disease and correlations in untreated hypertensive patients attending a referral hospital in southern Nigeria, clinical practice,6(1) 9-14.
26. Mallat, S. G., Al Kattar, S., Tanios, B. Y., &Jurjus, A. (2016). Hyperuricemia, hypertension, and chronic kidney disease: an emerging association. Current hypertension reports,18(10), 1-6.
27. Manber, R., & Armitage, R. (2018). Sex, steroids, and sleep: a review. Sleep, 22(5), 540-541.
28. Marangella, M. (2005).Uric acid elimination in the urine.Hyperuricemic syndromes: pathophysiology and therapy, 147, 132-148.
29. Matsuo, H., Takada, T, Nakayama, A, Shimizu, T., Sakiyama, M., Shimizu, S., & Ichida, K (2014) ABCG2 dysfunction increases the risk of renal overload hyperuricemia. Nucleosides, Nucleotides and Nucleic Acids, 33(4-6), 266-274
30. Messinis, I. E, Messini, C. I., Anifandis, G., &Dafopoulos, K. (2015) Polycystic ovaries and obesity. Best Practice & Research Clinical Obstetrics &Gynaecology, 29(4), 479-488.
31. Mishra, G D., &Kuh, D. (2012) Health symptoms during midlife in relation to menopausal transition: British prospective cohort study Bmj, 344.
32. Monterrosa-Castro, A., Romero-Pérez, I., Marrugo-Flórez, M., Fernández-Alonso, A.M., Chedraui, P. and Pérez-López, F.R., 2012. Quality of life in a large cohort of mid-aged Colombian women assessed using the Cervantes Scale. Menopause, 19(8), pp.924-930.
33. Mumford, S. L., Dasharathy, S. S, Pollack, A. Z., Perkins, N. J., Mattison, D. R, Cole, S. R. &Schisterman, E. F. (2013) Serum uric acid in relation to endogenous reproductive hormones during the menstrual cycle findings from the BioCycle study. Human reproduction, 28(7), 1853-1862.
34. Nafada, B.G., Baba, M.M., Hyelcinta C.J., Tahir, B., Talle, M., Obi, S.O. (2011).Capacity Utilization of University of Maiduguri Teaching Hospital, Nigeria.Report and Opinion3(8):35-38.
35. Ohayon, M. M. (2016). Severe hot flashes are associated with chronic insomnia. Archives of internal medicine, 166(12), 1262-1268.
36. Park, J. I., Baek, H., & Jung, H. H. (2016). Prevalence of chronic kidney disease in korea: The korean national health and nutritional examination survey 2011–2013. Journal of Korean medical science, 31(6), 915-923.
37. Park, Y. J., & Kim, J. M. (2018).Klotho and postmenopausal hormone replacement therapy in women with chronic kidney disease.Journal of menopausal medicine, 24(2), 75-80.
38. Pérez-López, F. R., Cuadros, J. L., Fernández-Alonso, A. M., Chedraui, P., Sánchez-Borrego, R., &Monterrosa-Castro, A. (2012).Urinary incontinence, related factors and menopause-related quality of life in mid-agedwomenassessed with the Cervantes Scale.Maturitas, 73(4), 369-372.l
39. Prince, C. T., Secrest, A. M., Mackey, R. H., Arena, V. C., Kingsley, L. A., & Orchard, T. J. (2010). Augmentation pressure and subendocardial viability ratio are associated with microalbuminuria and with poor renal function in type 1 diabetes. Diabetes and Vascular Disease Research, 7(3), 216-224.
40. Ramesh, S., James, M. T., Holroyd-Leduc, J. M., Wilton, S. B., Seely, E. W., Wheeler, D. C., & Ahmed, S. B. (2017). Sex hormone status in women with chronic kidney disease: survey of nephrologists' and renal allied health care providers' perceptions. Canadian Journal of Kidney Health and Disease, 4.
41. Ruilope, L. M., & Garcia-Puig, J. (2016).Hyperuricemia and renal function.Current hypertension reports, 3(3), 197-202.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

42. Salazar, J. H (2014) Overview of urea and creatinine. Laboratory medicine, 45(1), e19-20.
43. Santoro, N., Epperson, C. N., & Mathews, S. B. (2015).Menopausal symptoms and their management.Endocrinology and Metabolism Clinics, 44(3), 497-515.
44. Schaubel, D. E., Jeffery, J. R., Mao, Y., Semenciw, R., Yeates, K., & Fenton, S. S. (2002). Trends in mortality and graft failure for renal transplant patients.Cmaj, 167(2), 137-142.
45. Sherman, S., Miller, H., Nerurkar, L., & Schiff, I. (2017).Research opportunities for reducing the burden of menopause-related symptoms.The American journal of medicine, 118(12), 166-171.
46. Sievert, Lynnette Leidy. "Evolutionary perspectives, comparative approaches, and the lived experience of menopause." American journal of biological anthropology 186 (2024): e25067.
47. Soares, C. N. (2023). Anxiety and depression in midlife transition and beyond: the role of estrogens. Current Opinion in Endocrine and Metabolic Research, 31, 100457.
48. Soares, C. N., & Warren, M. P. (Eds.). (2009). The menopausal transition: interface between gynecology and psychiatry (Vol. 175). Karger Medical and Scientific Publishers.
49. Takahashi TA, Johnson KM (2015). Menopause,The Medical Clinics of North America. 99 (3): 521–34.
50. Thurston, RC, Chang, Y Barinas-Mitchell, E Jennings, J. R. von Känel, R, Landsittel, D. P & Matthews, K A (2017) Physiologically assessed hot flashes and endothelial function among midlife women. Menopause (New York, NY), 24(8), 886.
51. Utian, W. H (2014) Psychosocial and socioeconomic burden of vasomotor symptoms in menopause: a comprehensive review. Health and Quality of Life outcomes, 3(1), 1-10.
52. Wurz, G. T. Kao C J,&DeGregorio, M W (2014) Safety and efficacy of ospemifene for the treatment of dyspareunia associated with vulvar and vaginal atrophy due to menopause. Clinical Interventions in Aging, 9, 1939.
53. Yu, M., Ryu, D. R., Kim, S. J., Choi, K. B., & Kang, D. H. (2010). Clinical implication of metabolic syndrome on chronic kidney disease depends on gender and menopausal status: results from the Korean National Health and Nutrition Examination Survey. Nephrology Dialysis Transplantation, 25(2), 469-477.

APPENDICES

Appendix I



MINISTRY OF HEALTH

MUSA USMAN SECRETARIAT COMPLEX
P.M.B. 1044, MAIDUGURI, BORNO STATE.
Tel: 076-231689, 231408

SHREC Approval No. 103/2022
Date 27th January 2022.

RE: Evaluation of serum uric acid & creatinine in postmenopausal women residing in Maiduguri metropolitan city as a risk factor for renal failure

Health Research Ethics Committee assigned no. : 103/2022
Name of Local Investigator : Lawrence Ocheme Akor
Address of Local Investigator: Faculty of Allied Health Science College of Medical Science, Department of Medical Laboratory Science Science University of Maiduguri.

Date of receipt of valid application: 27th January 2022
Date when final determination of research was made: 8th February 2022

NOTICE OF RESEARCH EXEMPTION

This is to inform you that the activity described in the submitted protocol/documents have been reviewed and the State Health Research Ethics Committee has determined that according to the National Code for Health Research Ethics, the activity described there in meets the criteria for exemption and is therefore granted provisional approval as exempt from SHREC.

2. The State Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code. And you are expected to share yours findings on the study with the State for further dissemination.

BABAGANA KADAI
Secretary(SHREC)
FOR: Chairman, State Health Research Ethics Committee