International Journal of Scientific & Engineering Research, Volume 5, Issue 11, November 2014
ISSN 2229-5518

Influence of sex differences and aging in serum biochemical values in subjects in Jeddah

Haleema AlNahari

Abstract—Ageing is an important part of all human societies reflecting the biological changes that occur. The specimens were collected from a group of 50 males and 50 females with age from 50- Above 80 years. The measured parameters included total protein, albumin, Creatinin (Cr), Uric acid (UA), blood urea nitrogen (BUN), calcium, phosphorus, sodium, chloride, potassium, alkaline-phosphatase. UA/Cr, BUN/Cr, CA/Cr, P/Cr, Na/Cr, Cl/ Cr, K/Cr, Na/K ratio. The results showed significant decrease in total protein, globulin, Cr, UAandalkaline phosphatase in females compared with males. The results found that no significant change in sodium, chloride and potassium in females compared with males. There was a significant increase in UA/Cr, BUN/Cr, Cl/ Cr, P/ Cr, Na/ Cr and K/Cr ratio in female compared to male. No differences in the CA/Cr ratios between females and males.

Keyword—total protein, albumin, Cr, UA, BUN, calcium, phosphorus, sodium, chloride, potassium, alkaline-phosphatase and age and sex.

1 Introduction

Agin has been defined as a progressive unfavorable loss of adaptation, a city to the INC, and decreased life expectancy,

The study of the aging process in the human body is known as Gerontology. Ageing is characterized by a failure to maintain homeostasis under conditions of physiological stress and this failure is associated with a decrease in the viability and an increase in the vulnerability of an individual.

In general, aging is associated with decreasing in maintenance of homeostasis, a decrease in cell water, a reduction in muscle mass and gradual decline in respiratory, cardiovascular, kidney, liver, immune system neuralgic, and endocrine system functions. Carbohydrate, protein, lipids and calcium metabolism all decline with age. Aging is also associated with accelerated incidence of many diseases, including diabetes mellitus, atheroscleroses, hypertension, and osteoporosis.

Renal function changes with age. Creatinine clearance, glauerular filtration rate and renal plasma flow all decrease. Analysts such as serotonin blood urea nitrogen and inorganic phosphate that reflects the glonerular filtration rate are increased. Gardner and Scott. (1980) analyzed blood specimens from randomly selected adults aged 19-88 years to establish age- and sex-related reference ranges for plasma calcium, phosphate, total protein, albumin, globulins, urea, creatinine (Cr), and urate. Lochmiller and Grant. (1984) studied the values of serum biochemistry obtained from adult and six juvenile. The juvenile had significantly lower concentrations of total protein and globulins, but had higher concentrations of alkaline phosphatase, calcium and a higher albumin/globulin ratio than did adults. An adult had significantly higher levels of serum urea nitrogen, urea nitrogen/creatinine ratio, and chloride concentrations. But levels of uric acid (UA), calcium, and potassium were significantly lower. Reilly et al. (1987) resulted that in elderly subjects statistically significant circannual variations in the serum concentrations of albumin, bilirubin, calcium, chloride, globulin, potassium, sodium, UA, and total protein in elderly subjects. Bohnen et al. (1992) determined blood variation in disease-free persons. It was found that the blood variables were significantly affected by age or sex. Significant age differences were found in sodium, urea, Cr, phosphate, alkaline phosphatase and albumin were characterized by both age and sex differences. No age or sex differences were found for potassium, chloride, calcium, and total protein. The findings suggest that the age or sex-related changes of a number of blood variables not only of statistical significance, but are also of clinical relevance. Khan et al. (1997) They suggested the reference values of blood chemistry analyses in the healthy population, aged newborn to 80 years. Serum urea, Cr, UA, total bilirubin, total protein, and alkaline phosphatase were analyzed. The values in adult females, children and elderly subjects were slightly different than adult males. Matos et al. (1997) determined reference Pubmed? For urinary phosphate/creatinine (P/Cr) ratios and urinary calcium/creatinine (CA/Cr) in healthy infants, children, and adolescents. There were no differences related to sex. Interindividual and intraindividual variations decreased with age. Urinary P/Cr and Cu/Cr vary strongly with age. Work .1999 and Sato et al. (2005) determined the effects of age and sex on serum biochemical values of monkeys and brown boobies. There were significant variations with age and sex included alkaline phosphatase, total protein, albumin, and globulin, UA, blood urea nitrogen(BUN),Cr, calcium, phosphorus, chloride, potassium, and albumin/globulin ratio, blood urea nitrogen/creatinine ratio (BUN/Cr) and sodium/potassium ratio (Na/K).Safarinejad. (2003) found that (CA/Cr), (P/Cr), sodium/creatinine (Na/Cr), potassium/creatinine (K/Cr),

Department of Biological Sciences , Faculty of Science , King Abdulaziz University, Saudi Arabia.
.

International Journal of Scientific & Engineering Research Volume 5, Issue 11, November 2014
ISSN 2229-5518

(Na/K), calcium/sodium (CA/Na), and uric acid/creatinine (UA/Cr) ratios were not significantly different between the sexes in normal Iranian children. No significant relationships were found between urinary CA/Cr and Na/Cr, CA/Cr and Na/K, and CA/Cr and Cu/Na. The P/Cr and Cu/Na ratios showed a gradual decrease. The CA/Cr ratio was highest between 6 months and 3 years. Thea/Cr ratios decreased in those less than 7 years in the 11- to 14-year group. Urinary Na/Cr ratios were significantly lower in younger age groups compared with the older age group. Urinary K/Cr ratio was higher in younger children, and then steadily decreased with age. A child's age and ethnicity should be taken into consideration when assessing the urinary solute/creatinine ratios. Oyeyinka et al. (2004) resulted that none of the 149 healthy Ghanaians in three age groups had serum urea, Cr, UA, calcium, total protein and albumin levels within the normal range. Ozkaya et al. (2005) They showed a positive correlation between urinary CA/Cr, Na/Cr and K/Cr ratios with age. Scholtz et al. (2009) They found that females Japanese quail had higher concentrations of albumin and total protein. There were no significant sex-based differences observed for Cr and UA. Mann and Gerber (2010) They administrator that sodium excretion was shown to be accurately estimated from a late afternoon/early evening spot urine Na/Cr ratio, adjusted for 24-h Cr excretion. Work (1999); Slevet al (2010) and Clifford et al. (2011) They found that hematologic and serum chemistry values varied with age and sex. Friedlander et al. (2014) They suggested there are numerous age-related changes in the metabolic profile. This highlights the importance of evaluating stone-forming patients of all ages with 24-hour urine collections because both the type and degree of metabolic abnormality may change with age.

Click the forward arrow in the pop-up toolbar to modify the header or footer on subsequent pages.

The aim of the project

The purpose of this study was to determine the effect of aging on kidney integrity and function in males and female geriatrics patients.And evaluate the relationship between UA/Cr, BUN/Cr, CA/Cr, P/Cr, Na/Cr, Chloride/ Creatinin (Cl/ Cr), K/Cr, sodium / potassium ratio (Na/K) in the same group.

Materials and methods

The specimens were collected from a group of 50 males and 50 females with age from 50-Above 80 years. The measured parameters included total protein, albumin, Cr, UA, BUN, calcium, phosphorus, sodium, chloride, potassium, alkaline-phosphatase. UA/Cr, BUN/Cr, CA/Cr, P/Cr, Na/Cr, Cl/ Cr, K/Cr, Na/K ratio. All samples were assayed using the Hitachi 717 analyzer in the clinical chemistry lab, King Abdulaziz University Hospital.

Statistical analysis

The statistical evaluations were conducted utilizing at the conventional Student`s t-test. Comparison of the results was

TABLE 1. SOME CLINICAL CHEMISTRY LEVELS IN GERIATRIC MALE AND FEMALE SUBJECT

	Male Mean ± S.E	Female Mean ± S.E
Total protein g/L	75.7 ±1.38	70.74 ±1.35*
Albumin g/L	37.20 ±0.93	36.16 ±1.13
Globulin g/L	38.50 ±1.73	34.58 ±1.16*
Albumin/ Globulin ratio	1.11 ±0.06	1.15 ±0.06
Creatinine(Cr)µmol/L	102.62 ±7.29	63.28 ±1.1*
Uric acid(UA)µmol/L	304.42 ±14.08	266.68 ±10.47*
Blood urea nitrogen (BUN)mmol/L	7.08 ±0.55	5.91 ±0.45
Calcium mmol/L	2.38 ±0.04	2.37 ±0.03
Phosphorus mmol/L	1.03 ±0.03	1.11 ±0.05
Sodium mmol/L	139±0.62	139±0.62
Chloride mmol/L	102.8±0.76	103.76±0.77
Potasiummmol/L	4.13±0.08	4.03±0.08
Uric acid/ Creatinine	3.28±0.18	4.27±0.18*
Blood urea nitrogen/ Creatinine-BUN/Cr	0.07±0.01	0.09±0.01*
Calcium/ CreatinineCa/Cr	0.03±0.001	0.03±0.001
Phosphorus/ CreatinineP/Cr	0.011±0.0004	0.018±0.001*
Sodium/ CreatinineNa/Cr	1.52±0.055	2.23±0.036*
Chloride/ CreatinineCl/ Cr	1.12±0.04	1.17±0.03*
Potasium/creatinineK/Cr	0.04±0.002	0.06±0.002*
Sodium /PotasiumNa/K	34.04±0.06	35.29±0.08
Alkaline phosphates IU/L	134.22 ±9.18	109.34 ±7.65*

Reported $p<0.05$ level.

Results

The present results recorded that males and females at age 50-Above 80 years.Thes subjects had serum total protein, albumin, globulin, creation, UA, BUN, calcium, phosphorus, sodium, chloride, potassium, alkaline-phosphatase levels that were within normal limits

The total protein has a mean (75. 7 in male, 70.74 g/L informal). The albumin has a meaning (37. 2in male, 36.16 g/L informal). The globulin has a meaning (38. 50 in male, 34. 58 g/L in female). The creatinine value appears to be normally distributed with a mean (102. 62 in male, 63. 28 µmol/L informal). The UA has a mean (304. 42in male, 266. 68 µmol/L in female). The Alkaline phosphatase values appear to be normally distributed mean (134. 22 in male, 109.34 IU/L informal). Sodium/ Creatinine (1.52 in male, 2.23 in female). The results recorded significant decrease in total protein, globulin, Cr, UA, and Alkaline phosphatase (ALP), in female compare with male.,Also, there was a significant increase in Uric acid/ Creatinine (3.28 in male, 4.27 in female), Blood urea nitrogen/ Creatinine (0.07 in male, 0.09 in female), Phosphorus/ Creatinine (0.11 in male, 0.18 in female), Chloride/ Creatinine (1.12 in male, 1.17 in female), Potasium/creatinine (0.04 in male, 0.06 in female) ratio in female compared to male.

International Journal of Scientific & Engineering Research Volume 5, Issue 11, November 2014
ISSN 2229-5518

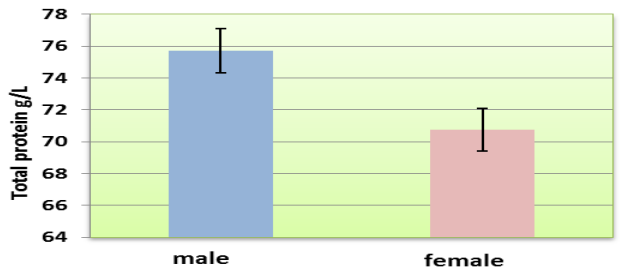

Fig.(1): Total protein g/L level in male and female geriatric patients

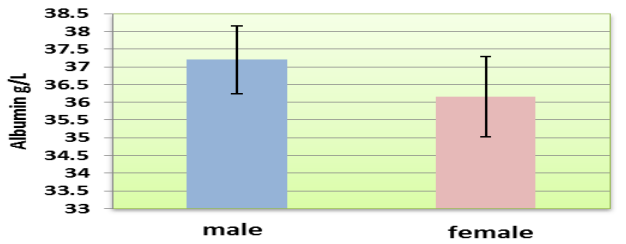

Fig.(2): Albumin g/L level in male and female geriatric patients

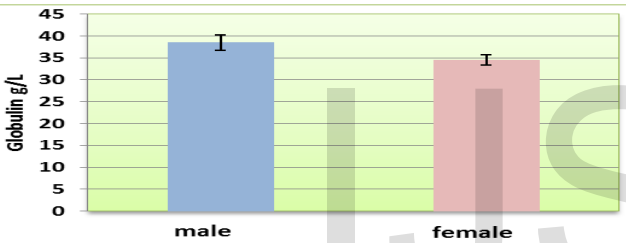

Fig.(3): Globulin g/L level in male and female geriatric patients

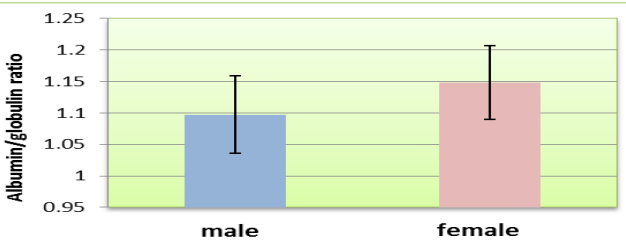

Fig.(4): Albumin:globulin ratio level in male and female geriatric patients

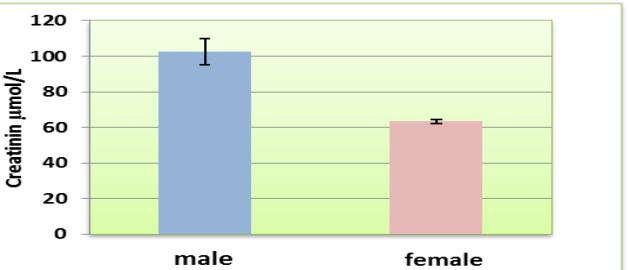

Fig.(5): Creatinine µmol/L level in male and female geriatric patients.

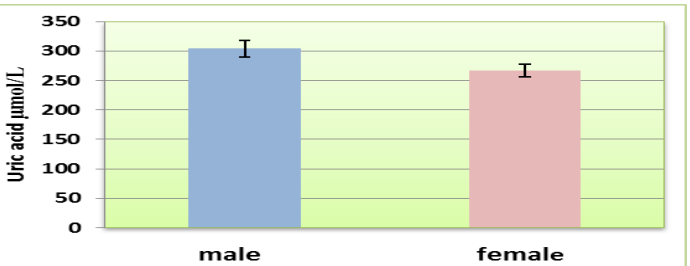

Fig.(6): Uric acid µmol/L level in male and female geriatric patients

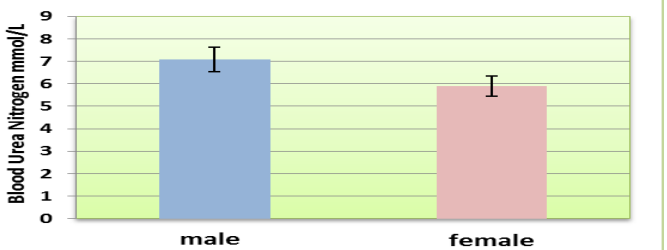

Fig.(7): Blood urea nitrogen mmol/L level in male and female geriatric patients

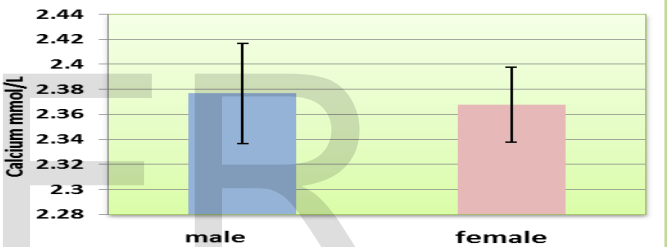

Fig.(8): Calcum mmol/L level in male and female geriatric patients

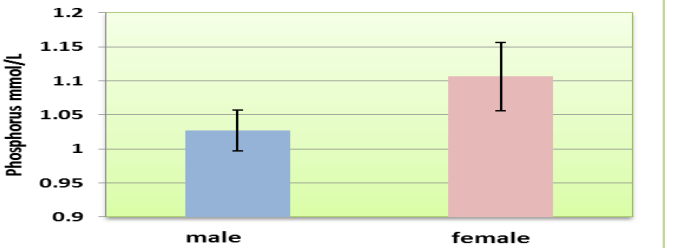

Fig.(9): Phosphorus mmol/L level in male and female geriatric patients

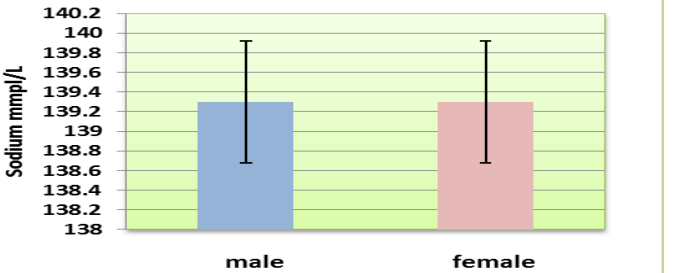

Fig.(10): Sodium mmol/L level in male and female geriatric patients

International Journal of Scientific & Engineering Research Volume 5, Issue 11, November 2014
ISSN 2229-5518

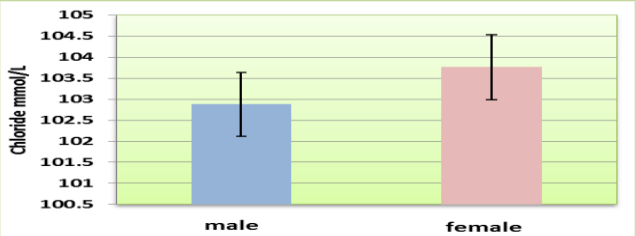

Fig.(11): Chloride mmol/L level in male and female geriatric patients

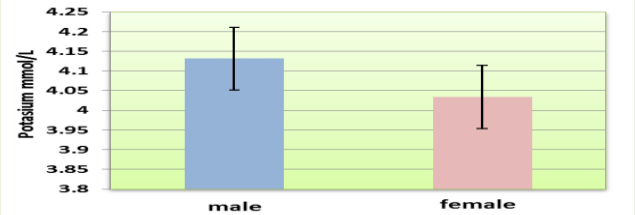

Fig.(12): Potasium mmol/L level in male and female geriatric patients

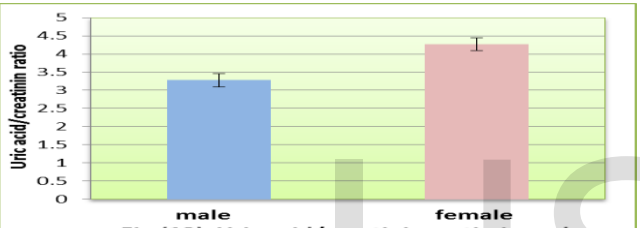

Fig.(13): Uric acid/creatinine ratio in male and female geriatric patients

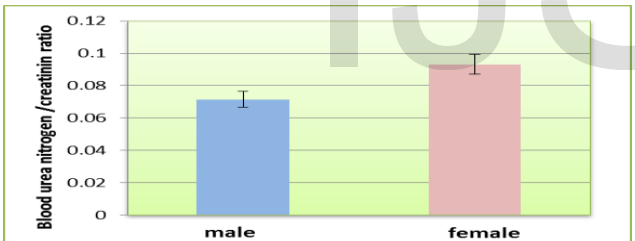

Fig.(14): Blood urea nitrogen /creatinine ratio in male and female geriatric patients

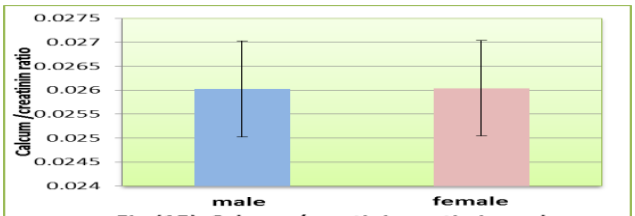

Fig.(15): Calcum /creatinine ratio in male and female geriatric patients

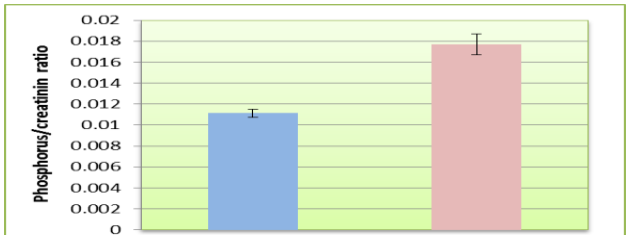

Fig.(16): Phosphorus/creatinine ratio in male and female geriatric patients

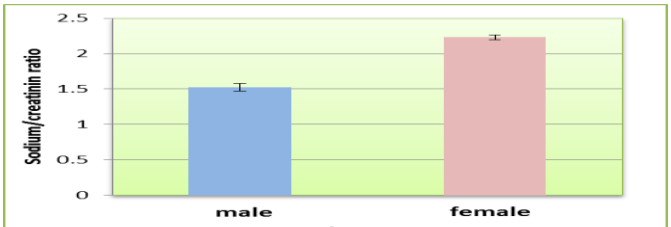

Fig.(17): Sodium/creatinine ratio in male and female geriatric patients.

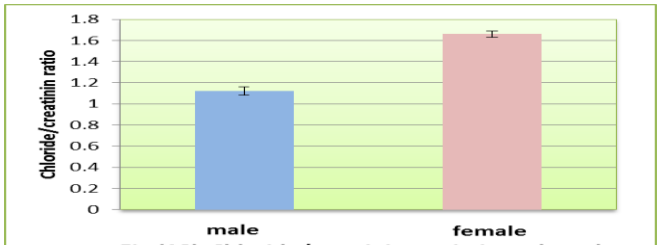

Fig.(18): Chloride/creatinine ratio in male and female geriatric patients

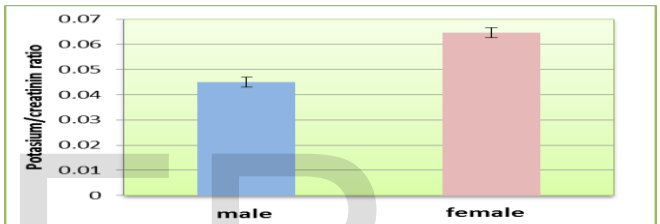

Fig.(19): Potasium/creatinine ratio in male and female geriatric patients

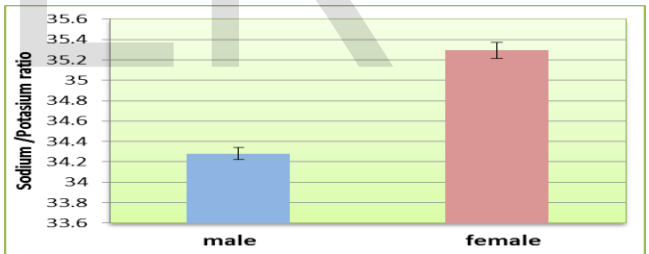

Fig.(20):Sodium /Potasium ratio in male and female geriatric patients

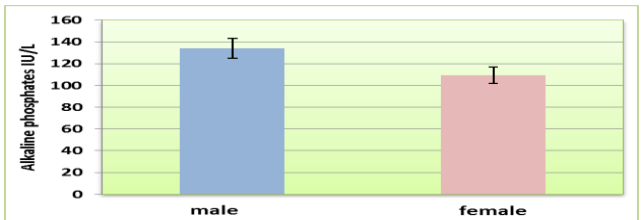

Fig.(21): Alkaline phosphates IU/L level in male and female geriatric patients

DISCUSSION

The results showed significant decrease in total protein and globulin in females compared with males. Increased male rat urinary protein is attributable mainly to α- and β-globulins, uromucoid proteins and prealbumin Thrall (2004). The increment in male globulin may be markers for chronic inflammation that was agreed with Ichihara et al. (2008) resulted that

International Journal of Scientific & Engineering Research Volume 5, Issue 11, November 2014
ISSN 2229-5518

increase of globulin are markers of chronic inflammation by increase in α- and β-globulins.Cherian and Hill . (1978) Showed that a significantly related to age in total protein. Kitamura et al. (2012) demonstrated that a decrease in serum albumin levels is associated with a decrease in activities of daily living levels. Kitamura et al. (2010) concluded that low body mass index and low serum albumin are strong predictors of mortality in frail elderly individuals. That was not agree with these studies because the total protein and albumin with normal range.

Our data showed that significant decrease in Cr and UA in females compared with males. That was agreement with those of Rodger et al. (1985) and Cherian and Hill. (1978) Showed there where the significant relationship to sex in Cr. Ho.Et al. (2010) it is true that men tend to have higher serum urate levels than women. Increased Cr reflects the greater body mass of male rats compared with females Thrall (2004). Andrew et al. (2011) They resulted that impairment of renal function is common in the elderly. The decrease in Cr and UA in females may be due to impairment of renal function in geriatric patients. In contrast, (Park et al. 2012; Gómez-Marcos et al. 2013; Ioannou and Boyko. 2013; Jin et al. 2013 and Kawamoto et al.2013) found that serum UA levels are strongly correlated with aging, gender, renal function, obesity and metabolic abnormality. These results suggested that age and serum UA have a synergistic effect on the blood pressure status in women, independent of conventional cardiovascular risk factors. Xiong et al. (2013) suggested that the prevalence of hyperuricemia is higher in elderly women. Obesity, meat and seafood intake and alcohol consumption are associated with a higher prevalence of hyperuricemia, whereas daily physical activity is inversely related to the prevalence of hyperuricemia.

The results found that no significant change in sodium, chloride and potassium male compared with males. This agreement with those of Ichihara et al. (2008) observed that Na, K and Cl are less dependent on genetic factors. Because their concentrations are under tight physiologic control by homeostatic mechanisms. Potassium concentration appears to be determined by the balance between oral intake and excretion in urine and sweat.

The present results recorded solute /Cr ratio that is a useful and reliable method for determining hypercalciuria and also is a non-invasive and relatively inexpensive method (Sorkhi and Haji Aahmadi.2005) .From this study there was a significant increase in Uric acid/ creatine ratio. That was agreement with those of Poyrazoğlu et al. (2009) Found that determining uric acid to creatinine ratios may be useful to assess the excretion of uric acid. Because urinary uric acid excretion varies with age.

For this study there was a significant increase in the BUN / Cr ratio in female compared with male. Elevated BUN/Cr ratio confers an increased risk of death in patients with chronic heart failure. (Lin et al. 2009).Felber et al.(1988) ; Richards et al.(1990);Prieto Bozano et al.(1990) and Ernst.et al.(1999). The BUN/Cr ratio and age correlated significantly with an upper gastrointestinal source of bleeding . The BUN/Cr ratio in the initial evaluation of gastrointestinal bleeding may prove useful in guiding the sequence of diagnostic procedures and examinations.The increase in BUN/Cr ratio in female my due to increase risk of death in patients with chronic heart failure

From this study there was a significant increase in Cl/ Cr ,P/ Cr ,Na/ Cr and K/Cr ratio in female compared to male.The blood pressure at was significantly correlated with the urinary Na/ Cr ratio , but not with the urinary sodium or potassium concentrations or K/Cr ratio. The change in mean systolic blood pressure was significantly correlated with the sodium / creatinine ratio and urinary sodium concentration (Poulter et al. 1985; Sorof et al. 1997 ;Lip et al. 1999; Xie, et al. 2001 and Kwok et al. 2003). Urinary K/Cr ratio was inversely related to blood pressure. Higher mean blood pressure in men was accompanied by lower urinary K/Cr and potassium concentration and higher Na / K ratio, even though men had the same mean body mass index. When compared with women. A difference in potassium intake between the sexes may partly account for this finding (Woo et al. 1992). In this study the increase in Na/ Cr and K/Cr ratio in female my significantly correlated. With systolic blood pressure.

No differences in the CA/Cr ratios between females and males were found in the present study. CA/Cr has been used for screening hypercalciuria (Sorkhi et al. 2005). From the present results there was no difference in the CA / Cr ratio between male and female.That was agreement with those of Sorkhi et al. (2005) found no difference in the CA / Cr ratio between both sexes .

The present results it is demonstrated that alkaline phosphatase values a significant decrease in in female compared with male. The observed decrease in alkaline phosphatase may suggest liver or bone involvement. Davy and Kumar (2012) proved that there was no adverse effect of ageing on either the liver integrity or on its overall functional ability to meet the ordinary metabolic demands. This, however, does not rule out, that there was a decrease in the functional reserve of the ageing liver.Lum (1995) observed that alkaline phosphatase decreased in postmenopausal women with osteoporosis taking estrogen replacement therapy.

References

[1] Andro, M.; Estivin, S.; Comps, E.and Gentric, A. (2011). Assessment of renal function in elderly after eighty years: Cockroft and Gault or Modification of diet in renal disease equation? Rev. Med. Interne. 32(11): 698-702.

[2] Bohnen, N.; Degenaar, C.;P.and Jolles, J.(1992). Influence of age and sex on 19 blood variables in healthy subjects. Z. Gerontol. 25(5): 339-345.

[3] Cirillo, M.; Botta, G.; Chiricone, D.and De Santo, N.;G.(2009). Glomerular filtration rate and serum phosphate: an inverse relationship diluted by age. Nephrol. Dial. Transplant. 24(7):2123-2131.

[4] Clifford, S.M.; Bunker, A.M.; Jacobsen, J.;R.and Roberts, W.;L.(2011). Age and gender specific pediatric reference intervals for aldolase, amylase, ceruloplasmin, creatine kinase, pancreatic amylase, prealbumin, and uric acid. Clin. Chim. Acta. 11;412(9-10): 788-790.

[5] Cherian, A.;G.and Hill, J.;G.(1978). Percentile estimates of reference values for fourteen chemical constituents in sera of children and adolescents.Am. J. Clin. Pathol.69(1): 24-31.

International Journal of Scientific & Engineering Research Volume 5, Issue 11, November 2014
ISSN 2229-5518

[6] Devy, R.and Kumar,M.P.(2012).Effect of aging and sex on the caeruloplasmin (CP) and the plasma protein levels.J.Clin.Diag.Res.6(4): 577-580.

[7] Ernst, A.; A.; Haynes, M.;L.; Nick ,T.;G.andWeiss, S.;J.(1999). Usefulness of the blood urea nitrogen/creatinine ratio in gastrointestinal bleeding. Am. J. Emerg. Med. 17(1): 70-72.

[8] Felber, S.; Rosenthal, P.and Henton, D.(1988). The BUN/creatinine ratio in localizing gastrointestinal bleeding in pediatric patients. J. Pediatr. Gastroenterol. Nutr. 7(5): 685-687.

[9] Friedlander, J.I.1; Moreira, D.M; Hartman, C; Elsamra, S.E; Smith, A.D; Okeke, Z. (2014). Age-Related Changes in 24-Hour Urine Composition Must be Considered in the Medical Management of Nephrolithiasis. J. Endourol.

[10] Gardner, M.;D.and Scott, R.(1980). Age- and sex-related reference ranges for eight plasma constituents derived from randomly selected adults in a Scottish new town. J. Clin. Pathol. 33(4): 380-385.

[11] Gómez-Marcos, M.;A.; Recio-Rodríguez, J.;I.; Patino-Alonso, M.;C.; Agudo-Conde, C.; Rodríguez-Sánchez, E.; Gómez-Sánchez, L.; Gómez-Sánchez, M.and García-Ortiz, L. (2013). Relationship Between Uric Acid and Vascular Structure and Function in Hypertensive Patients and Sex-Related Differences. Am. J .Hypertens.

[12] Ho, W.;J.; Tsai, W.;P.; Yu, K.;H.; Tsay, P.;K.; Wang, C.;L.; Hsu, T.;S.andKuo, C.;T.(2010):Association between endothelial dysfunction and hyperuricaemia. Rheumatology (Oxford).49(10): 1929-1934.

[13] Ichihara, K.; Itoh, Y.; Lam, C.;W.; Poon, P.;M.; Kim, J.;H.; Kyono, H.; Chandrawening, N.; Muliaty, D.; Science Committee for the Asian-Pacific Federation of Clinical Biochemistry.(2008). Sources of variation of commonly measured serum analytes in 6 Asian cities and consideration of common reference intervals. Clin. Chem. 54(2): 356-365.

[14] Ioannou, G.;N.and Boyko, E.;J.(2013).Effects of menopause and hormone replacement therapy on the associations of hyperuricemia with mortality. Atherosclerosis. 226(1): 220-227.

[15] Jin, Y.;L.; Zhu, T.; Xu, L.; Zhang, W.;S.; Liu, B.; Jiang, C.;Q.; Yu, H.; Huang, L.;M.; Cheng, K.;K.; Thomas, G.;N.and Lam, T.;H. (2013).Uric acid levels, even in the normal range, are associated with increased cardiovascular risk: The Guangzhou Biobank Cohort Study. Int. J .Cardiol. 28. pii: S0167-5273(13)00274-X.

[16] Kawamoto, R.; Tabara, Y.; Kohara, K.; Kusunoki, T.; Abe, M.and Miki, T.(2013). Synergistic influence of age and serum uric acid on blood pressure among community-dwelling Japanese women. Hypertens .Res.

[17] Khan, F.A.; Dilawar, M.and Khan, D.A. (1997). Reference values of common blood chemistry analytes in healthy population of Rawalpindi-Islamabad area. J. Pak. Med. Assoc. 47(6): 156-159.

[18] Kitamura, K.; Nakamura, K.; Nishiwaki, T.; Ueno, K.and Hasegawa, M.(2010). Low body mass index and low serum albumin are predictive factors for short-term mortality in elderly Japanese requiring home care. Tohoku. J. Exp. Med. 221(1): 29-34.

[19] Kitamura, K.; Nishiwaki, T.; Ueno, K.; Nakazawa, A.and Hasegawa, M.(2012). Determination of whether the association between serum albumin and activities of daily living in frail elderly people is causal. Environ. Health.Prev. Med.17(2): 164-168.

[20] Kwok, T.;C.; Chan, T.;Y.and Woo, J. (2003). Relationship of urinary sodium/potassium excretion and calcium intake to blood pressure and prevalence of hypertension among older Chinese vegetarians. Eur. J. Clin. Nutr.57(2): 299-304.

[21] Lin, H.;J.; Chao, C.;L.; Chien, K.;L.; Ho, Y.;L.; Lee,C.;M.; Lin,Y.;H.; Wu,Y.;W.;Hsu, R.;B.; Chou, N.;K.; Wang, S.;S.; Chen, C.;Y.and Chen, M.F.(2009). Elevated blood urea nitrogen-to-creatinine ratio increased the risk of hospitalization and all-cause death in patients with chronic heart failure. Clin. Res .Cardiol. 98(8): 487-492.

[22] Lip, G.;Y.; Douglas, M.; Gupta, A.and Beevers, D.;G.(1999). Urinary sodium excretion and blood pressure in chronic psychiatric inpatients. J. Hum. Hypertens. 13(7): 461-466.

[23] Lochmiller, R.;L. and Grant, W.;E.(1984). Serum chemistry of the collared peccary (Tayassu tajacu). J .Wildl. Dis. 20(2): 134-140.

[24] Lum G.(1995). Significance of low serum alkaline phosphatase activity in a predominantly adult male population. Clin. Chem. ;41(4):515-518.

[25] Mann, S.;J.and Gerber, L.;M.(2010). Estimation of 24-h sodium excretion from a spot urine sample using chloride and creatinine dipsticks. Am. J. Hypertens. 23(7): 743-748.

[26] Matos, V.; van Melle, G.; Boulat, O.; Markert, M.and Guignard, J.;P. (1997) . Urinary phosphate/creatinine, calcium/creatinine, and magnesium/creatinine ratios in a healthy pediatric population. J. Pediatr.131(2):252-257.

[27] Ozkaya, O.; Buyan, N.; Erol, I.; Atalay, Y.; Beyazova, U.; Sahin, F. and Söylemezoğlu, O.(2005). The relationship between urinary calcium, sodium, and potassium excretion in full-term healthy newborns. Turk. J. Pediatr.47(1): 39-45.

[28] Oyeyinka, G.;O.; Ofei, V.; Maddy, S.Q.; Duah, O.A.; Akafo, S.;K.; Aquaye, J.;K. and Dosoo, D.K.(2004). Homogeneous immunoglobulins in Ghanaians living in Accra, Ghana. Afr. J. Med. Med. Sci. 33(4): 311-316.

[29] Park, J.;S.; Kang, S.; Ahn, C.;W.; Cha, B.;S.; Kim, K.;R. and Lee, H.;C.(2012) . Relationships between serum uric acid, adiponectin and arterial stiffness in postmenopausal women. Maturitas. 73(4): 344-348.

[30] Poulter, N.;R.; Khaw, K.;T.; Mugambi, M.; Peart, W.;S.; Rose, G. and Sever, P. (1985). Blood pressure patterns in relation to age, weight and urinary electrolytes in three Kenyan communities. Trans. R .Soc. Trop. Med. Hyg. 79(3): 389-392.

[31] Poyrazoğlu, H.;M.; Düşünsel, R.; Yazici, C.; Durmaz, H.; Dursun, I.; Sahin, H.; Gündüz, Z. and Gürgöze, M.;K.(2009). Urinary uric acid : creatinine ratios in healthy Turkish children. Pediatr .Int. 51(4): 526-529.

[32] Prieto Bozano, G.; Escribano Burgos, C.; Ortega Páez, E.; Carrasco Gandía, S.; Lama More, R. and Polanco Allue, I. .(1990). Value of the BUN/creatinine ratio in localizing digestive system hemorrhage in children. An. Esp. Pediatr. 32(3): 222-224.

[33] Reilly, C.; Nicolau, G.;Y.; Lakatua, D.;J.; Bogdan, C.; Sackett-Lundeen, L.; Petrescu, E. and Haus, E.(1987). Circannual rhythms of laboratory measurements in serum of elderly subjects. Prog. Clin. Biol. Res.227B:51-72.

[34] Richards, R.;J.; Donica, M.;B. and Grayer, D.(1990). Can the blood urea nitrogen/creatinine ratio distinguish upper from lower gastrointestinal bleeding? J. Clin. Gastroenterol.12(5): 500-504.

[35] Rodger, R.;S.; Laker, M.;F.; Fletcher, K.; White, T.;F.; Heaton, A.; Ward, M.;.K. and Kerr, D.;N.(1985). Factors influencing normal reference intervals for creatinine, urea, and electrolytes in plasma, as measured with a Beckman Astra 8 Analyzer. Clin. Chem. 31(2): 292-295.

[36] Safarinejad, M.;R.(2003). Urinary mineral excretion in healthy Iranian children. Pediatr. Nephrol. 18(2): 140-144.

International Journal of Scientific & Engineering Research Volume 5, Issue 11, November 2014
ISSN 2229-5518

[37] Sato, A.; Fairbanks, L.;A.; Lawson, T. and Lawson, G.;W.(2005). Effects of age and sex on hematologic and serum biochemical values of vervet monkeys (Chlorocebus aethiops sabaeus). Contemp. Top. Lab. Anim .Sci.44(1): 29-34.

[38] Scholtz, N.; Halle, I.; Flachowsky, G. and Sauerwein, H.(2009). Serum chemistry reference values in adult Japanese quail (Coturnix coturnix japonica) including sex-related differences. Poult. Sci. 288(6): 1186-1190.

[39] Slev, P.;R.; Bunker, A.;M.; Owen, W.;E. and Roberts, W.;L.(2010). Pediatric reference intervals for random urine calcium, phosphorus and total protein. Pediatr. Nephrol.25(9): 1707-1710.

[40] Sorof, J.;M.; Forman, A.; Cole, N.; Jemerin, J.;M. and Morris, R.;C.(1997). Potassium intake and cardiovascular reactivity in children with risk factors for essential hypertension. J. Pediatr.131: 87-94.

[41] Sorkhi, H. and Haji Aahmadi, M.(2005). Urinary calcium to creatinin ratio in children. Indian .J. Pediatr.72(12): 1055-1056.

[42] Thrall M. A.(2004). Veterinary Hematology and Clinical Chemistry. Baltimore, MD: Lippincott Williams & Wilkins.

[43] Woo, J.; Lau, E.; Chan, A.; Cockram, C.and Swaminathan, R. (1992). Blood pressure and urinary cations in a Chinese population. J. Hum. Hypertens. 6(4): 299-304.

[44] Work, T.;M.(1999). Weights, hematology, and serum chemistry of free-ranging brown boobies (Sula leucogaster) in Johnston Atoll, Central Pacific. J. Zoo. Wildl. Med. 30(1): 81-84.

[45] Xie, J.; Liu, L. and Kesteloot, H. (2001). Blood pressure and urinary cations in a low-fat intake Chinese population sample. Acta. Cardiol.56(3): 163-168.

[46] Xiong, Z.; Zhu, C.; Qian, X.; Zhu, J.; Wu, Z. and Chen, L.(2013). Serum uric acid is associated with dietary and lifestyle factors in elderly women in suburban Guangzhou in Guangdong province of south China. J. Nutr .Health. Aging. 17(1): 30-34.