ISSN No:-2456-2165

Urinalysis for Dehydration, Kidney Injury and Urinary Tract Infection Assessment in Rural Riverside, Bayelsa State, Nigeria

Faith Ajiebabhio Ogbole
Biochemistry Unit, Department of Chemical Sciences
University of Africa Toru – Orua, Bayelsa State, Nigeria

Abstract:- Rural riverside are restricted geographic areas with poor health care system. Limited data exist on the magnitude of dehydration and renal disorders in these areas. The present study sought to determine the prevalence and association patterns of dehydration, kidney injury and urinary tract infections (UTIs) among rural riverside populations in Bayelsa State. A cross sectional study design was employed. Socio-demographic data were collected using a structured questionnaire. Biomarkers for UTIs (leukocyturia and nitrituria), kidney injury (haematuria and proteinuria) and dehydration (specific gravity (> 1.020) and dark urine) were measured using dipstick and visual urinalysis. A total of 732 individuals [males: 343; females: 389; median age 39.5 years (15 – 64 years)], participated in the study. Prevalence of dehydration, kidney injury and UTIs were 80%, 6.3% and 79.1% respectively. Leukocyturia (67.9%) was the commonest, followed by specific gravity >1.020 (62.3%), dark urine (58.5%), nitrituria (51.6%), proteinuria (4%), and haematuria (2.1%). Kidney injury was associated with UTIs. Significant associations were found among the biomarkers (P < 0.05): Leukocyturia was associated with proteinuria and nitrituria, while specific gravity >1.020 was associated with dark urine and nitrituria. None of the urinary abnormalities were associated with marital status. Age 18 – 45 years was associated with dehydration. More males than females had leukocyturia, dark urine and dehydration. A high prevalence of dehydration and UTIs exist in rural riverside areas in Bayelsa State, Nigeria. A call for habitual water intake as well as UTI and kidney disorder interventions in rural riverside communities is implicated in this study.

Keywords:- *Dehydration; kidney injury; UTIs; rural riverside; Bayelsa State; Nigeria.*

I. INTRODUCTION

Inadequate water intake is an age long problem which has been consistently associated with kidney stones. Previous study have showed that obesity, type 2 diabetes and urinary tract infections (UTIs) can be improved by regular water intake. However, high fluid intake is not recommended for patients with cardiovascular disorders, chronic renal failure stage three, hypoalbuminemia, endocrinopathies, or in tumor patients with cisplatin therapy (IIb) [1, 2, 3]. UTIs are inflammatory diseases of the urinary tract. The attention of World Health Organization (WHO) has been drawn to the resistance of UTI causing pathogens to antibiotics. This implies that the world is running out of UTI antibiotics, as a result, the importance of early detection of UTIs cannot be over emphasized [4]. UTIs accounts for almost 25% of all infections and is commoner among women than among men, with over 50% of women reporting having had UTIs in their life time. *Escherichia coli* is the most commonly reported uropathogenic organism [5].

Despite the fact that chronic kidney disease attributed deaths have increased over the past two decades, yet, late detection of chronic kidney diseases is still prominent in middle and low income countries where health care facilities are poor. This might be the reason why most of the increase in chronic kidney disease attributable deaths has been reported in low-income and middle-income countries. Early detection and management of diseases in asymptomatic individuals may help reduce the economic cost of chronic diseases and health care [6].

Most rural riverside communities are situated in restricted geographic areas with limited accessibility. These pose great challenges to health care provision. Also, basic social amenities and infrastructures are poor in these areas [7]. Furthermore, limited information exist on the magnitude of renal disorders and associated risk factors in these localities. A knowledge of the magnitude and dynamics of the prevalent renal disorders and associated risk factors in these areas may help plan and execute custom made intervention programmes for individuals living in rural riverside. Therefore, the objectives of the present study were to determine the prevalence and association patterns of dehydration, kidney injury and urinary tract infection among rural riverside populations in Bayelsa State.

II. MATERIALS AND METHODS

A. Study location and design

The study location was selected riverside communities in Bayelsa State. Bayelsa State is centrally located in the core of the Niger Delta region of Southern Nigeria with latitude and longitude, 4.664030, and 6.036987 respectively[8]. A community-based cross sectional study design was employed [9].

B. Study population

Adults (18 years and above), living within the study location were randomly selected for the study after informed consent was obtained from each of them. The study was approved by the research and ethics committee of the Primary Health Care Unit in charge of the selected localities and all subjects provided informed consent [9]. Individuals on

ISSN No:-2456-2165

medications and menstruating females were excluded from the study.

C. Sample collection

Socio-demographic variables were collected using a structured questionnaire [9]. Mid-stream clean catch urine collection method was use to collect fresh early morning urine from each participant [10].

D. Urine biomarkers and urinalysis

Dark urine [11] and specific gravity > 1.020 [12] were taken as biomarkers of dehydration, while proteinuria [13] and haematuria [14] were taken as biomarkers of kidney injury. Leukocyturia and nitrituria [10] were taken as biomarkers of UTIs. On spot urinalysis was carried out. Urine colour was visually examined and dipstick urinalysis was carried out following the manufacturer`s protocol for ACCU-ANSWER® urine test strips (Guilin, China). Briefly, an ACCU-ANSWER® urine test strips (Guilin, China) was immersed into a urine sample for five seconds, excess urine was drained and the semi-quantitative value for each biomarker was read by direct visual comparison and matching of the urine soaked test strip with the colour chart printed on the vial label. Semi-iquantitative values corresponding to trace and above were considered positive test for each biomarker, except for specific gravity were values > 1.020 (colour shades from light yellowish green to deep yellowish green) were considered positive. Test principle for dipstick urinalysis was as previously described [10].

E. Statistical analysis

SPSS version 20 statistical software was used for data analysis. Prevalence was expressed as percentage. Test of significant difference and association patterns between variables were measured using Chi-squared test. Significant level was set at $P < 0.05$.

III. RESULTS

A. Socio-demographic variables

The socio-demographic variables of the study participants are presented in Table 1. Median age of the study participants was 39.5 years (15 – 64 years).

B. Prevalence of dehydration, kidney injury and UTIs

Presented in Figure 1 is the result for the prevalence of dehydration, kidney injury and UTIs stratified by sex. The prevalence of dehydration, kidney injury and UTIs were 80%, 6.3% and 79.1% respectively.

Variables	Male (%) 343 (46.9)	Female (%) 389 (53.1)	Total (%) 732 (100)
Age (years)			
18 – 45	246 (33.6)	267 (36.5)	513 (70.1)
>45	97 (13.3)	122 (16.7)	219 (29.9)
Marital status			
Not married	250 (34.2)	288 (39.3)	538 (73.5)
Married	93 (12.7)	101 (13.8)	194 (26.5)

Table 1: Socio-demographic variables

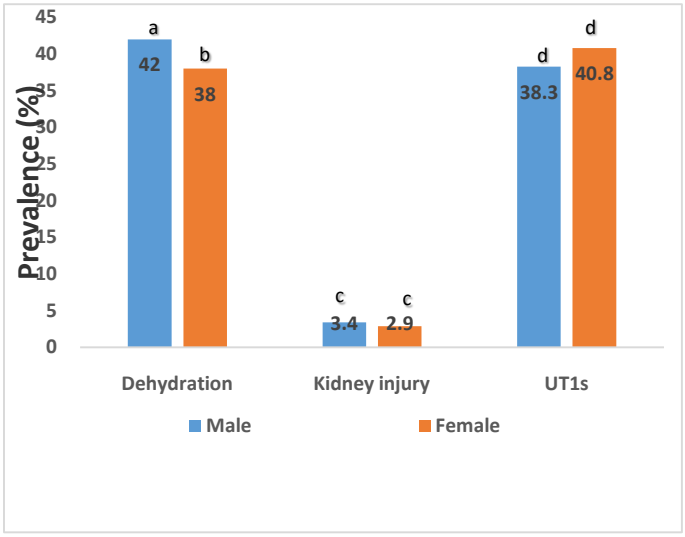

Fig. 1: Prevalence of dehydration, kidney injury and UTIs. Bar with different superscript letters are significantly different ($p < .05$)

Biomarkers	Males (%) 343 (46.9)	Females (%) 389 (53.1)	Total (%) 732 (100)	$P <$ 0.05
SG (> 1.020)	223 (30.5)	233 (31.8)	456 (62.3)	0.243
Dark urine	278 (38.0)	150 (20.5)	428 (58.5)	0.001
Leukocyturia	254 (34.7)	243 (33.2)	497 (67.9)	1.001
Nitrituria	184 (25.1)	194 (26.5)	378 (51.6)	0.308
Haematuria	8 (1.1)	7 (1.0)	15 (2.1)	0.612
Proteinuria	16 (2.2)	13 (1.8)	29 (4.0)	0.360

Table 2: Prevalence of urinary biomarkers

SG; Specific gravity

C. Prevalence of urinary biomarkers

The prevalence of the respective urinary biomarkers for dehydration, kidney injury and UTIs is shown in Table 2 above. The most prevalent biomarker was leukocyturia. More males than females had leukocyturia and dehydration ($P < 0.05$).

D. Association patterns among urinary variables and among selected renal disorders

Presented in Table 3 and 4 are the patterns of association among dehydration, kidney injury and UTIs as well as among the urine biomarkers. A significant association ($P < .05$) was found between kidney injury and UTIs (Table 3). Also, significant association ($P < .05$) was also found among the urine biomarkers (Table 4).

Parameters	Dehydration	Kidney injury	UTIs
Dehydration	-	0.407	0.428
Kidney injury	0.407	-	0.428
UTIs	0.428	0.013	-

Table 3: Patterns of association among urine biomarkers

Values represent *p*-values; UTIs: urinary tract infections; -: same variable,

no association

Urinary biomarker	SG (>1.020)	Dark urine	Leukocyturia	Nitrit-uria	Haema-turia	Protein-uria
SG (> 1.020)	-	0.001	0.504	0.001	0.102	0.148
Dark urine	0.001	-	0.584	0.231	0.238	0.987
Leukocy-turia	0.504	0.001	-	0.004	0.310	0.003
Nitrituria	0.001	0.231	0.004	-	0.239	0.057
Haematu-ria	0.102	0.238	0.310	0.239	-	0.427
Protein -uria	0.148	0.987	0.003	0.057	0.427	-

Table 4: Patterns of association among urine biomarkers

SG: Specific gravity (> 1.020); Values represent *P*-values, *P*-values greater than 0.05 are not significant; -same variables (no association)

E. Patterns of association between the socio-demographic variables and urinary abnormalities

Shown in Tables 5 are the patterns of association between the selected socio-demographic variables and urinary abnormalities. None of the urinary abnormalities were associated with marital status. More males than females ($p < .05$), had leukocyturia, dark urine and dehydration.

Parameters	Age	Sex	Marital status
Specific gravity	0.028	0.243	0.670
Dark urine	0.001	0.001	0.942
Leukocyturia	0.567	0.001	0.260
Nitrituria	0.078	0.308	0.843
Haematuria	0.047	0.612	0.564
Proteinuria	0.169	0.360	0.893
Kidney injury	0.937	0.293	0.947
UTIs	0.343	0.113	0.600
Dehydration	0.001	0.001	0.186

Table 5: Patterns of association between the sociodemographic variables, urine biomarkers and renal disorders

SG: Specific gravity (> 1.020); Values represent *P*-values, *P*-values greater than 0.05 are not significant; -same variables (no association)

IV. DISCUSSION

Early detection of diseases particularly in middle and low income countries where health care facilities are poor might prevent progression of diseases into terminal stages [6]. Urinalysis is an analytical tool in routine clinical care for detecting or ruling out renal diseases and can also be used to detect asymptomatic cases [15]. The importance of community based urinalysis in geographically restricted rural riverside, where poor health care facilities exist cannot be overemphasized. This study complements previous findings on water borne diseases in these localities [8].

A high prevalence of dehydration (dark urine and specific gravity > 1.020) was found among the study participants in the present study. The two biomarkers for dehydration were the second and third highest urinary abnormalities found among the study population. This calls for programmes that will sensitize the populace on the importance of habitual water intake. People tend not to drink water even when thirsty except during meals. The association between hydration and overall health has been shown in literature [1, 2, 3]. Previous studies have showed that urine colour reflects hydration status [11, 16, 17], however, report on urine colour is often left out in several urinalysis studies [10, 18, 19]. Thus, the present study has filled the research gap that exist in several urinalysis studies.

The prevalence of leukocyturia and nitrituria among the study population was also very high with leukocyturia having the highest. This indicates the existence of urinary tract infections among the study participants. In a previous study carried out by Hamade *et al.* [20] in an urban locality, leukocyturia was also the most prevalent. However, the prevalence of leukocyturia found in this present study (67.9%) was higher than that found in the Hamade *et al*. [20] study (39%). This indicates that although leukocyturia is prevalent in both urban settings and rural riverside settings, leukocyturia is more prevalent in rural riverside areas. Thus rural riverside communities must not be left out in targeted renal function interventions. Furthermore, although the present study was carried out among adult population, previous studies have reported leukocyturia and nitrituria among children [18, 19], suggesting that these urinary abnormalities cut across different age groups. UTIs cause symptoms that are often distressing to patients and can lead to serious complications [21].

A low prevalence of proteinuria and haematuria was found in the present study. This is unlike the findings of previous studies where haematuria [20] and proteinuria [10,18] were highly prevalent Findings of the present study together with finding from previous studies point to the fact that the pattern of urinary abnormalities varies across different

geographical locations, suggesting the need for region specific urinalysis to be carried out. Aside indicating renal dysfunction, proteinuria and haematuria may also indicate cardiovascular diseases and cancer respectively [22, 23].

In terms of association among variables, none of the urinary abnormalities was dependent on marital status, indicating that marital status does not actually determine whether or not an individual may have a given urinary abnormality. This may explain why most studies on urinalysis have not been reporting any association between marital status and urinary abnormalities [18, 19, 20, 22]. However significant association was found between age (18- 45 years) and dehydration. This compliments the findings of Zhang *et al.* [24] in a study carried out to assess the drinking patterns of young adults. The present study together with the study carried out by Zhang *et al.* [24] show that young adults have not formed the habit of drinking water regularly. Again, associations between urine biomarkers are not often reported in urinalysis studies [18, 19, 20, 22]. The present study has helped to fill this research gap. The significant association found among the urine biomarkers highlights the importance of identifying biomarkers that affect comorbidity. Thus a positive test for a given disease biomarker might inform testing for the presence of other biomarkers.

V. CONCLUSION

The present study revealed a high prevalence of dehydration and urinary tract infection among riverine rural communities in Bayelsa State, Southern Nigeria. Findings from this study reveal that rural riverside communities are not left out in the occurrence of urine abnormalities, rather they present a unique pattern of prevalence and association among the urinary abnormalities. Based on these findings, public health interventions to promote habitual water drinking and help prevent and treat UTIs and kidney injury in order to avoid progression to terminal stages is implicated in this study.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

REFERENCES

[1.] S. N. Cheuvront, "Urinalysis for hydration assessment: an age-old problem," *Am.J Clin Nutr*, 2016, vol.104, no.1, pp. 3–4.
[2.] L. E. Armstrong, "Challenges of linking chronic dehydration and fluid consumption to health outcomes," Nutr Rev, 2012, vol.70 no.2, pp. 121-127.
[3.] F. Manz, "Hydration and Disease," *J Am Coll Nutr*, 2007, vol. 26, no.5, pp. 535S-541S.
[4.] World Health Organization, "Antimicrobial Resistance," Factsheets 2021, Geneva, Switzerland.
[5.] A. Al-Badr and G. Al-Shaikh, "Recurrent Urinary Tract Infections Management in Women: A review" *Sultan Qaboos Univ Med J*, 2013, vol.13, no.3, 359–367.
[6.] C. Bradshaw, D. Konda, M.E. Montez-Rath, J. Han, Y. Zheng, R Shivashankar, *et al*. "Early detection of chronic kidney disease in low-income and middle-income countries: development and validation of a point-of-care screening strategy for India," *BMJ Glob. Health*, 2019, vol.4, no.5.
[7.] L. Garnelo, R.C.P. Parente, M.L.R. Puchiarelli, P.C. Correia, M.V. Torres and F.J. Herkrath, "Barriers to access and organization of primary health care services for rural riverside populations in the Amazon," *Int J Equity Health*, 2020, vol.19, no.54, pp. 1-14.
[8.] F.A. Ogbole and O. Oyelana, "Health Risk Assessment of the Drinking Water from Sagbama River, Bayelsa State, Niger Delta, Nigeria," *Int J Sci Eng Res*, 2020, vol.11, no.9, 1455-1460.
[9.] F.A. Ogbole and A.O. Fatusi, "Co-occurrence of health risk behaviours for communicable and non-communicable diseases in a tertiary institution in South West Nigeria," *IJRSI* 2020, vol.7, no.1, 10-14.
[10.] R.W. Braimoh, Akinkugbe AO, Ale OK and Balogun MR. Prevalence and pattern of urinary abnormalities among healthy adult Nigerians. *J Clin Sci* 2016; 13:153-157.
[11.] R. Belasco, T. Edwards, A.J. Munoz, V. Rayo and M.J. Buono, "The effect of hydration on urine color objectively evaluated in CIE $L^*a^*b^*$ Color Space," *Front nutr*, 2020, vol.*7*.
[12.] C. Flasar, "What is urine specific gravity," *J Nurs*, 2008, vol.38, 7-14.
[13.] P. Cravedi and G. Remuzzi, "Pathophysiology of proteinuria and its value as an outcome measure in chronic kidney disease," *Br J Clin Pharmacol*, 2013, vol.*76*, *no.*4, 516–523.
[14.] A.K.H. Lim, S. Brown, I. Simpson and J.P. Dowling, "Acute kidney injury due to glomerular haematuria and obstructive erythrocyte casts associated with thrombocytopaenia and thin basement membrane disease: a case report," *BMC Nephrol*, 2015, vol.16 pp.180.
[15.] A.Yates, "Urinalysis: how to interpret results," *Nurs Times*, 2016, vol.2, 1-3.
[16.] R. Siener and A. Hesse, "Fluid intake and epidemiology of urolithiasis," *Eur. J. Clin. Nutr*, 2003, Vol.57 no.2, 47–51.
[17.] E.T. Perrier, E.C. Johnson, A.L. McKenzie, L.A. Ellis and L.E. Armstrong," Urine colour change as an indicator of change in daily water intake: a quantitative analysis," *Eur J Nutr*, 2016, vol.55, pp. 1943 – 1949.
[18.] F. Akor, N.S. Okolo, E.I Agaba and A. Okolo, "Urine examination findings in apparently healthy new school entrants in Jos, Nigeria," *S. Afr. J. child health*, 2009, vol.3, no.2, pp. 60 – 63.
[19.] A.K. Alaje, T. Runsewe-Abiodun, O.O. Olawale, "Prevalence, pattern and determinants of urine abnormalities among school pupils in a semi-urban community," *Ann Health Res*, 2019, vol.3, no.1.
[20.] A. Hamade, F. Najjar and T. Dagher, "Variations of biochemical and cellular urine parameters among a healthy Lebanese group," *Univers J Med Sci*, 2017, vol.5, no.1, pp. 1-7.
[21.] N.P. Beahm, L.E. Nicolle, A. Bursey, D.J. Smyth and R.T. Tsuyuki, "The assessment and management of urinary tract infections in adults: Guidelines for pharmacists," *CPJ*, 2017, vol.150, no.5, pp. 298–305.

[22.] R.S. Matulewicz, J.O. Delancey and E. Pavev, "Dipstick urinalysis as a test for microhematuria and occult bladder cancer," *Bladder Cancer*,2017, vol.3, pp. 45-49.
[23.] G. Currie and C. Delles, "Proteinuria and its relation to cardiovascular disease," *Int J Nephrol Renovasc Dis*, 2014, vol.7, pp. 13-24.
[24.] J. Zhang, N. Zhang, Y. Wang, S. Liang, S. Liu, S. Du, *et al*. "Drinking patterns and hydration biomarkers among young adults with different levels of habitual total drinking fluids intake in: a cross-sectional study," *BMC Public Health*, 2020, vol.20 no.468.