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Risk of Chronic Kidney Disease among Roadside Traders in Kano, North-Western - Nigeria

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Abstract
Chronic kidney disease (CKD) is becoming a major health problem in developing nations due to increasing prevalence of hypertension and diabetes mellitus. There are few well-established risk factors of CKD, but both human and animal studies implicate exposure to chemicals including polluted air. Automobile exhaust emissions especially from poorly serviced and old vehicles may, in part, account for the dangerously high level of ambient roadside respirable particles in Kano which put Roadside traders at a risk of adverse health effects. Information regarding the renal implications of roadside trading is grossly scarce, this study therefore aimed at assessing serum levels of urea, creatinine, electrolytes, proteinuria and some putative risk factors for renal disease among roadside traders in Kano metropolis. Fifty six (56) roadside traders were selected and matched for age and sex with 59 bank employees (controls). Serum urea and creatinine were estimated using auto analyzer based method while serum potassium (K^+), sodium (Na^+), chloride (Cl^-) and bicarbonate ($HCO3^-$) ions were determined as described in their respective kits. Haematuria and proteinuria were assessed using urinary dipstix. Weighing scale and stadiometer were used to obtain weights and heights from which BMI was computed. Pulse pressure and mean arterial pressure were calculated from systolic and diastolic blood pressures obtained by Auscultatory method. Fasting blood sugar (FBS) was estimated using Glucometer. Data was analyzed using SPSS $V_{20.0}$. Independent samples t-test was used to compare the means of quantitative data between the groups while categorical variables were compared using person's Chi-square, in all cases, $P \leq 0.05$ was considered as significant. The mean SBP, DBP, PP, MAP and PR between the groups are not significantly different. However, serum levels of urea, creatinine and potassium were significantly higher, while those of Na^+, Cl^- and $HCO3^-$ were significantly lower among the study group than in the controls. Similarly, proteinuria was found higher among traders than the controls (p=0.003). The findings indicate that roadside traders in Kano have biochemical evidence of renal derangement and significant proteinuria, hence, might be a risk group for CKD. Awareness campaign of the health implications of roadside pollution as well as monitoring and enforcement of emission standards and regulations would go a long way in reducing air pollution, roadside hawking and its attendant health effects.

Keywords: Roadside traders, Roadside pollution, CKD, Proteinuria.

INTRODUCTION
Chronic kidney disease (CKD) is a major health problem in developed countries and is becoming so in developing nations like Nigeria due to the increasing prevalence of hypertension and diabetes mellitus which remain the leading causes (Nalado *et al.*, 2012; Oga *et*

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al., 2012). It is defined as decreased kidney function shown by glomerular filtration rate (GFR) of less than 60 mL/min per 1·73 m^2, or markers of kidney damage, or both, of at least 3 months duration irrespective of cause or diagnosis (Webstar *et al*., 2017). There are few well-established risk factors of CKD, but both human observational and animal experimental studies implicate exposure to chemicals including hydrocarbons (Ravnskov *et al*., 1983; Brautbar, 2004; Ravnskov, 2005). In addition, environmental pollution, food additives, herbs, pesticides and analgesics are also implicated risk factors in developing nations (Jha *et al*., 2013).

Roadside trading is getting ground in most urban settings possibly due to urbanization-associated demographic transitions, unemployment among youth, limited availability and high cost of renting shops. The increasing motorization associated with urbanization results in corresponding increase in automobile exhaust emissions especially from old and/or poorly maintained vehicles which may in part, account for the alarmingly high level of ambient roadside respirable particles in Kano that is reportedly 640% higher than the WHO recommended 20 $\mu g/m^3$ safe limits (Efe, 2008; Okunola *et al.,* 2012). This therefore put roadside traders in Kano under constant exposure to both respirable and non respirable exhaust-related emissions and other roadside pollutants.

Even though these pollutants may not be exceptionally toxic, however, as they enter the atmosphere, they dramatically change composition and biological effects (Majid *et al*., 2012). Similarly, their large surface area to volume ratio and their ability to remain airborne for a longer period of time, before they drift back to the road-side, allows them to carry a high proportion of adsorbed toxic metals and acids which have been reported to cause significant direct, as well as cumulative adverse health effects (Ibrahim, 2014) which includes; central nervous and cardiovascular systems damages, renal dysfunction, thyroid disorder as well as induction of epigenetic changes and lung cancer (Majid *et al*., 2012). Inhalation of these combustion-derived particulate matters at concentrations occurring in urban road traffic has also been reported to cause decreased nitric oxide, immediate pro-ischemic effects and impairment in tissue Plasminogen activator release-possibly via both its oxidant and pro-inflammatory properties (Nicholas *et al*., 2007). The oxidative stress, reduced nitric oxide and the impaired endogenous fibrinolytic capacity may play a role in mediating thrombotic and adverse vascular effects (Nicholas *et al*., 2007).

Several attempts to assess the health implications associated with road-side trading are majorly limited to the respiratory and cardiovascular systems; however, the kidney being a highly vascular metabolically active organ, may perhaps, not be spared from adverse effect of blood-borne vehicular-exhaust-related hazardous compounds. This is especially important because overt chronic kidney disease seen in health settings may just be a tip of an iceberg and equally, early characterization or recognition of CKD risks may help prevent end-organ damage. This study therefore aimed to assess serum biochemical markers of renal function, urinary markers of renal dysfunction as well as some cardio-metabolic risk factors for CKD among roadside traders in Kano metropolis.

METHODOLOGY

This analytic comparative study was conducted among roadside traders located on the five (5) major roads linking the metropolitan Kano to neighboring states, viz; Gwarzo road, Zaria road, Maiduguri road, Hadejia road and Katsina road. Kano metropolis, comprising of six local government areas, is the capital of Kano state and the commercial hub of Northern-Nigeria. It is located about 1,580 feet above sea level, between latitude 11º59' and 12º02' N and longitude 8º33' and 8º40' E with a savanna vegetation and semi-arid hot climate. Majority of its residents are Muslims and Hausa-Fulani whose dominant occupation is trading, civil service or farming (Ibrahim *et al.*, 2018).

Using a multistage sampling technique, fifty six (56) recruited roadside traders were matched for age and sex with 59 bank employees who served as controls. Ethical approval for the study was obtained from Kano State Ministry of Health's Research and Ethics Committee (Ref: MOH/Qff/797/T.I./39) while informed consent was sought and obtained from each of the study participants after a detailed explanation of the intent, content and extent of the research. Thereafter, brief medical history and general physical examinations were conducted on each selected subject under privacy, behind a screen, close to their point of business along the roadside. Those who were into the business for less than one year duration, those found to have an eventful medical history or physical examination findings, traders less than 18 years and those aged above forty years were excluded from the study.

Recruited subjects were advised to fast overnight through the following morning and were also handed over a sterile sample bottle for next day's early morning urine sample collection after a brief explanation on how to do so. A repeat urine sample collection was done for those with observed proteinuria to ensure persistence and also to rule out orthostatic proteinuria. From a peripheral vein in the cubital fossa, five millilitres (5 ml) of blood were drawn from the participants for venous blood glucose estimation and to obtain serum for use in the estimation of other analytes at postgraduate laboratory of Biochemistry Department, Bayero University, Kano and Plasma diagnostic limited, Yanfiga street, Tarauni, Kano. Serum urea and creatinine were estimated using auto-analyzer based methods (Mahmood *et al.*, 2013), whereas serum K^+, Na^+, HCO_3^- and Cl^- were determined as described in their respective kits (Uboh *et al.*, 2009). Pulse pressure (PP) and mean arterial blood pressure (MAP) were calculated from systolic blood pressure (SBP) and diastolic blood pressure (DBP) both obtained by auscultatory method using mercurial sphygmomanometer. Fasting blood sugar (FBS) was estimated using a Glucometer (ACCU-CHEK® Active {Roche Diagnostics Gmbh sandhofer strasse 11668305 Mannheim, Germany}). Weighing scale and stadiometer were used to obtain weights and heights of the participants from which their BMI was computed. Urinalysis reagent strip (Mission® Expert REFU034-111, ACON Laboratories, Inc. San Diego, CA 92121, USA) was used to assess the presence or otherwise of proteinuria and haematuria.

Data were analysed using the statistical package for social sciences version 20.0 ($SPSSV_{20.0}$). Discrete and categorical variables were summarized using counts and percentages while continuous variables were summarized using mean±SD, and were both presented in tables. An independent samples t-test was used to compare the means of quantitative variables while Pearson's chi-square/Fisher's exact test (where appropriate) was used to compare categorical variables between the groups, in all cases, $P \leq 0.05$ was considered as statistically significant.

RESULTS AND DISCUSSION

The results showed that the mean age and height of the roadside traders and the controls are statistically similar; however, the controls are significantly heavier than the roadside traders (Table 1). Equally, when some of their cardio metabolic risk factors were compared, it was observed that cardiovascular parameters (mean SBP, DBP, PP, MAP and PR) of the two groups are statistically similar. However, the mean FBS level and BMI in the controls is significantly higher than among the roadside traders. In addition, the FBS level in the controls is higher than the acceptable upper limits of normal (Table 1).

Table 1: Age, Somatometrics and Cardiometabolic Parameters of Subjects and Controls

Variables	Controls	Roadside traders	t-value	p-value
Age (years)	30.54±5.27	30.91±5.04	-0.383	**0.703**
Height (m)	1.69±0.56	1.68±0.72	0.818	**0.415**
Weight (kg)	68.93±6.38	63.66±7.89	3.949	**0.000**
SBP (mmHg)	126.71±15.73	129.02±12.95	-0.856	**0.394**
DBP (mmHg)	71.07±12.67	73.71±10.09	-1.235	**0.219**
PP (mmHg)	55.64±13.17	55.30±10.10	0.155	**0.877**
MAP	89.61±12.29	92.16±10.06	-1.214	**0.227**
PR (beats/minute)	77.92±12.59	74.13±12.27	1.634	**0.105**
BMI (kgm^{-2})	24.16±2.81	22.50±2.62	3.229	**0.002**
FBS (mg/dl)	133.24±16.50	113.43±21.57	5.520	**0.000**

Serum biochemical markers of renal function of the groups were also compared. It was found that roadside traders have significantly higher serum levels of urea, creatinine and potassium, whereas the mean serum levels of bicarbonate, sodium and chloride are significantly lower in the roadside traders than in controls (Table 2). In addition, the serum levels of potassium, bicarbonate and creatinine among the roadside traders falls within the acceptable limits of normal, while that of sodium and chloride falls lower and that of urea significantly higher than the acceptable limits of normal. It was also observed that five or more years duration of roadside trading (Table 3) and co-morbid cigarette smoking (Table 4) are possibly the significant contributory factors for high serum levels of urea among the roadside traders. On the other hand, more frequent stay (Table 5) and/or spending longer hours at the roadside (Table 6) did not alter serum levels of urea and creatinine significantly but, perhaps, affects these renal parameters negatively. The burden of urinary markers for renal dysfunction was found to be higher among roadside traders than controls, signifying an adverse renal affectation among the roadside traders. Proteinuria was found in 37.5% of the roadside traders as compared to 13.6% in the controls (p=0.003) whereas, haematuria was found among 12.5% and 5.1% of subjects and controls respectively (p=0.196) (Table 7).

The overall findings of this study demonstrate an altered state of biochemical markers of renal function and an increased manifestation of urinary markers of renal dysfunction with co-morbid cigarette smoking and five or more years of roadside trading as significant contributory factors. The biochemical findings of hyponatraemia, hypochloraemia, uremia and significant proteinuria among the study subjects may be clear manifestations of renal impairment.

By being on the roadside, usually under the sun, for most hours of their day, roadside traders are at increasing tendency to perspiration that may lead them to lose sodium excessively via sweat. This, coupled to a possibility of eating a low salt containing diet and drinking a lot of hypoosmolar fluids such as water, may manifest as a pseudo hyponatraemia. However, this possibility of pseudo hyponatraemia may not explain the findings of hyponatraemia and uraemia occurring together in this study. Interestingly, plasma creatinine levels do not usually exceed the upper limits of the reference range until the GFR has been reduced by approximately

60% (Crook, 2012), therefore, although the serum levels of creatinine among the subjects fall below the upper limit of the reference range, it has however increased significantly when compared with the controls. By implication, the roadside traders therefore, exhibited a state of raised serum levels of both urea and creatinine. As the renal tubular system has little effect on these substances, their retention in the plasma is a direct pointer to impaired GFR which could also explain the low bicarbonate and high potassium levels (Crook, 2012) observed among the roadside traders.

Decreased GFR also reduce sodium filtration which, supposedly, should lead to hypernatraemia. However, the reduction in sodium delivery to the distal nephron reduces the amount of sodium to be available for exchange with hydrogen and potassium ions (Guyton & Hall, 2011). Consequently, the distal tubular secretion of potassium and hydrogen ion will eventually decrease. Decrease potassium secretion leads to potassium retention while reduced hydrogen ion secretion leads to decrease reclamation of bicarbonate ion which manifests as low plasma bicarbonate level (Crook, 2012). As against the possibility of dehydration-induced hyponatraemia and hypochloraemia, the biochemical features observed among the study subjects, is a pointer toward increasing risk of glomerular function impairment. .

On the other hand, the observed proteinuria among the subjects was significantly higher than in controls. The reported prevalence among the subjects is also higher than the 19.4% point prevalence reported by Nalado, *et al*. (2012), among apparently healthy civil servants in Kano. The high prevalence of proteinuria noticed among the roadside traders is another surrogate marker of glomerular dysfunction. Significant persistent proteinuria has been emphasized as an important marker of kidney damage (Levey *et al*., 2003). Although proteinuria can be of tubular origin, however, the absence of other features such as glucosuria and hyperchloraemiac acidosis strengthens the possibility of glomerular proteinuria (Crook, 2012). Even though proteinuria is commonly seen in conditions associated with increase glomerular permeability (Crook, 2012), dissipation of the negative electric charge on the glomerular filtration barrier can make small molecular weight proteins, such as albumin, to pass through the glomeruli in large quantities beyond that can be reabsorbed in the proximal tubule, thus appearing in the urine (Guyton & Hall, 2011).

The possibility of roadside traders to come up with glomerular dysfunction may perhaps be due to their constant exposure to ambient roadside particulate matter and other exhaust related pollutants. These pollutants have been reported to induce oxidative stress, decrease nitric oxide levels and impair the release of tissue Plasminogen activator (Nicholas *et al*., 2007). Oxidative stress on the other hand, induces nonspecific tissue damage (Butterfield, 2006) and is directly related to inflammatory response via recruitment and activation of inflammatory cells (Thanan *et al*., 2015). These inflammatory cells may initiate glomerular inflammation via activation of endothelial cells and mesangial cells. Activation of endothelial cells results to increase capillary permeability allowing many plasma proteins to reach the renal interstitium and trigger another inflammatory cycle leading to endothelial damage and dysfunction, proliferation of mesangial and smooth-muscle cells as well as podocytes. Consequently, a progressive decline in the surface area of interstitial capillaries leads to hypoxia within the kidney and affects the function of cells involved in degradation of collagen including matrix metalloproteinases, serine proteases and lysosomal enzymes (Webstar *et al*., 2017). This promotes the deposition of basement membrane proteins, proteoglycans, glycoproteins and collagens which results to interstitial fibrosis, tubular atrophy and glomerulosclerosis (Webstar *et al.*, 2017). Even though, these pathophysiological effects affects both the glomeruli and tubules, chronic pro-ischemic state induced by decreased nitric oxide levels as a consequent of inhaling roadside particulate matter (Nicholas *et al.*, 2007) may be more injurious to the glomeruli than tubules.

Although renal dysfunction of any kind affects all parts of the nephron to some extent, however, the net effect of renal disease on plasma and urine compositions depend on the proportion of glomeruli to tubules affected and on the number of nephrons involved (Crook, 2012). Notwithstanding, the presence of low serum bicarbonate, hypochloraemia, hyponatraemia, azotaemia and hyperkalaemia are all good reasons to assume a predominant glomerular dysfunction among the roadside traders studied.

As research efforts on the health implications of roadside trading are majorly focused on respiratory and cardiovascular systems, giving these findings limited chances of comparison of findings, renal impairments have been reported among diverse group of people working along or closer to the roadside. For example, a study on petrol pump attendants (PPAs) in Sulaimani city of Pakistan by Mahmood *et al.* (2013), reported increased levels of urea and creatinine than in controls. Similar finding of azotaemia and proteinuria was also reported among PPAs in Owerri (Nwanjo & Ojiako, 2007) and also, among motor mechanics in Port-Harcourt (Bartimaeus & Jacobs 2003).

Table 2: Serum Biochemical Markers of Renal Function between Subjects and Controls

Variables*	Controls	Roadside traders	t-value	p-value
Potassium	3.17±0.53	4.39±0.73	-10.30	**0.001**
Urea	3.25±0.72	9.90±5.18	-9.77	**0.001**
Bicarbonate	24.34±2.92	20.02±2.09	9.07	**0.001**
Creatinine	36.85±8.47	100.86±24.34	-19.02	**0.001**
Chloride	98.14±2.84	91.05±5.91	8.26	**0.001**
Sodium	136.12±3.87	126.82±7.98	8.01	**0.001**

*Mean values are presented in millimoles per liter (mmol/l)

Table 3: Duration of Job and Serum Biochemical Markers of Renal Function among Subjects

Variables*	1- 5 years n=16	> 5 years n=40	t-value	p-value
Potassium	4.22±0.82	4.49±0.67	-1.186	**0.241**
Urea	7.66±4.25	11.32±5.34	-2.233	**0.030**
Bicarbonate	20.69±2.60	19.46±1.76	1.912	**0.062**
Creatinine	94.10±16.39	106.10±26.69	-1.518	**0.135**
Chloride	91.08±5.36	90.14±6.10	0.493	**0.624**
Sodium	125.62±9.32	127.57±7.46	-0.760	**0.451**

*Mean values are presented in millimoles per liter (mmol/l)

Table 4: Smoking Habit and Serum Biochemical Markers of Renal Function among Subjects

Variables*	Non-smokers n=39	Smokers n=11	t-value	p-value
Potassium	4.32±0.74	4.75±0.49	-1.776	**0.082**
Urea	9.41±4.85	13.77±5.60	-2.545	**0.014**
Bicarbonate	20.08±2.02	18.73±1.90	1.982	**0.053**
Creatinine	99.74±22.24	114.36±31.01	-1.760	**0.085**
Chloride	90.54±6.13	89.82±5.10	0.356	**0.724**
Sodium	126.23±8.07	130.00±6.96	-1.406	**0.166**

*Mean values are presented in millimoles per liter (mmol/l)

Table 5: Frequency of Shifts and Serum Biochemical Markers of Renal Function among Subjects

Variables*	≤5 shifts/week n=11	>5 shifts/week n=39	t-value	p-value
Potassium	4.04±0.67	4.52±0.69	-2.069	**0.044**
Urea	9.06±5.36	10.74±5.29	-0.927	**0.358**
Bicarbonate	20.73±2.10	19.51±1.99	1.770	**0.083**
Creatinine	103.36±35.47	102.85±21.56	0.060	**0.952**
Chloride	91.09±5.39	90.18±6.06	0.450	**0.654**
Sodium	127.73±8.55	126.87±7.86	0.313	**0.756**

*Mean values are presented in millimoles per liter (mmol/l)

Table 6: Duration of Shifts and Serum Biochemical Markers of Renal Function among Subjects

Variables*	≤8 hours/shift n=15	>8 hours/shift n=41	t-value	p-value
Potassium	4.25±0.81	4.49±0.67	-1.104	**0.275**
Urea	9.38±5.28	10.80±5.32	-0.866	**0.391**
Bicarbonate	20.00±2.62	19.69±1.80	0.492	**0.625**
Creatinine	101.00±30.34	103.80±22.50	-0.362	**0.719**
Chloride	90.33±6.00	90.40±5.92	-0.036	**0.971**
Sodium	128.33±8.31	126.51±7.82	0.740	**0.463**

*Mean values are presented in millimoles per liter (mmol/l)

Table 7: Urinary Markers of Renal Dysfunction

Variables	Controls	Roadside traders	Chi-square value	p-value
Proteinuria	O=8(13.6%) E=14.9 SR=-1.8	O=21(37.5%) E=14.1 SR=1.8	8.732	0.003
Haematuria	O=3(5.1%) E=5.1 SR=-0.9	O=7(12.5%) E=4.9 SR=1.0	1.990	0.158

O= observed counts/frequencies E=expected counts/frequencies SR=standardized residual

CONCLUSION

In conclusion, by observing abnormal serum urea, creatinine and electrolytes as well as proteinuria among the roadside traders, this study has unveiled a possibility that roadside traders have a predisposition to renal impairments and hence might be a risk group for CKD. Incidentally also, it was observed that the bank employees recruited as controls are marginally overweight and have a fasting hyperglycaemia.

RECOMMENDATIONS

Awareness campaign of the health implications of roadside pollution, Personal protection efforts, improvement of public transport system, more employment opportunities, monitoring of emission standards and the enforcement of regulations and guidelines would go a long way in reducing air pollution, roadside hawking and its attendant health effects.

REFERENCES

Bartimaeus, C.S. and Jacobs, M.J. (2003). The effect of exposure to petroleum products on some renal function parameters of motor mechanics in Port Harcourt Metropolis of Nigeria. *Global Journal of Pure and Applied Sciences*. **9**(1): 59-63.

Brautbar, N. (2004). Industrial solvents and kidney disease. *International journal of occupational and environmental health*. **10**: 79-83.

Butterfield, D.A. (2006). Oxidative stress in neurodegenerative disorders. *Antioxid. Redox Signal*. **8:** 1971–1973.

Crook, M.A. (2012). *Clinical biochemistry and metabolic medicine*. 8th ed. Hodder & Stoughton Ltd, London. **3**: 36-58

Efe, S.I. (2008). Spatial distribution of particulate air pollution in Nigerian cities: implications for human health. *Journal of environmental health research* **7**(2): 1-7.

Guyton, A.C. and Hall, J.E. (2011). *Text book of Medical physiology*. International Edition: 978-0-8089-2400-5. 12th Ed. Elsevier. Philadelphia, United States of America. **29**: 361-378

Ibrahim, A.M. (2014). Paying for the Priceless: The Consequences of Air and Noise Pollution in Some Commercial Areas of Kano Metropolis. *International Journal of Humanities and Social Science Invention*. **3**(6): 17-21

Ibrahim, A.M., Idris, H.A. and Kiyawa, A.I. (2018). Economic and Environmental Implications of Fodder Production in Kano Metropolis. *Dutse Journal of Pure and Applied Sciences*. **4**(1): 29-41

Jha, V., Garcia-Garcia, G., Iseki, K., Li, Z., Naicker, S. *et al*. (2013). Chronic kidney disease: global dimension and perspectives. *Lancet*. **382**: 260-272 http://dx.doi.org/10.1016/S0140-6736(13)60687-X.

Levey, A.S., Coresh, J., Balk, E., Kausz, A.T., Levin, A. e*t al*. (2003). Nationl Kidney foundation practice guidelines for chronic kidney disease: evaluation, classification and stratification. *Annals of internal medicine*. **139**(2): 137-147

Mahmood, N.M.A.M., Sharef, D.M.S. and Hussain, S.A. (2013). Plasma proteins profile and renal function relative to exposure time of gasoline filling station workers in sulaimani city. *International Journal of Pharmacy and Pharmaceutical Sciences*. **5**(4): 334-338

Majid, H., Madl, P. and Alam, K. (2012). Ambient air quality with emphasis on roadside junctions in metropolitan cities of Pakistan and its potential health effects. *The Health*. **3**(3): 79-85

Nalado, A.M., Abdu, A., Muhammad, H., Abdu, A., Sakajiki, A.M. *et al*. (2012). Prevalence of risk factors for chronic kidney disease among civil servants in Kano. *Nigerian journal of basic and clinical* sciences. **9**(2): 70-74.

Nicholas, L., Mills, H.T., Manuel, C.G., Elen, V., Simon, D.R. *et al*. (2007). Ischemic and Thrombotic Effects of Dilute Diesel-Exhaust Inhalation in Men with Coronary Heart Disease. *New England Journal of Medicine*. **357**: 1075-1082. DOI: 10.1056/NEJMoa066314

Nwanjo, H.U. and Ojiako, O.A. (2007). Investigation of the potential health hazards of petrol station attendants in Owerri, Nigeria. *J. Appl. Sci. Environ. Manage.* **11**(2): 197-200.

Oga, O.S., Ikechi, O., Innocent, I.C., Joshua, O.A., Basden, J.C.O. *et al*. (2012). Blood pressure, prevalence of hypertension and hypertension related complications in Nigerian Africans: A review. *World journal of Cardiology* **4**(12): 327-340.

Okunola, O.J., Uzairu, A., Gimba C.E. and Ndukwe, G.I. (2012).Assessment of Gaseous Pollutants along High Traffic Roads in Kano, Nigeria. *International journal of environment and sustainability*. **1**(1): 1-15

Ravnskov, U. (2005). Experimental glomerulonephritis induced by hydrocarbon exposure: A systematic review. *BMC Nephrol*. **6**: 15

Ravnskov, U., Lundstrom, S. and Norden, A. (1983). Hydrocarbon exposure and Glomerulonephritis: Evidence from patients' occupation. *Lancet*. **2**(8361): 1214-1216.

Thanan, R., Oikawa, S., Hiraku, Y., Ohnishi, S., Ma, N., *et al*. (2015). Oxidative Stress and Its Significant Roles in Neurodegenerative Diseases and Cancer. *Int. J. Mol. Sci*. **16**: 193-217 doi:10.3390/ijms16010193

Uboh, F., Akpanabiatu, M., Ekaidem, I., Eteng, M. and Eyong, E. (2009). Exposure to gasoline and kerosene vapors: A risk factor for nephrotoxicity in rats. *The internet journal of toxicology*. **7**(2): 1-7

Webster, A.C., Nagler, E.V., Morton, R.L. and Philip, M. (2017). Chronic Kidney Disease. *The lancet*. **389**(10075): 1238-1252. https://doi.org/10.1016/S0140-6736(16)32064-5