**Comparative evaluation of electrolyte, Urea, Creatinine and Anion gap among Office and Roadside workers in Port Harcourt, Rivers state**

**ABSTRACT**

The occupational environment significantly impacts health, particularly renal function, through factors such as hydration, dietary patterns, and exposure to environmental pollutants. This study aimed to compare the levels of electrolytes, urea, and creatinine in office workers and roadside workers in Port Harcourt, Rivers State, Nigeria, to assess occupational disparities in biochemical markers of renal and metabolic health. A total of 100 participants were recruited, comprising 50 office workers and 50 roadside workers. Blood samples were analyzed for urea, creatinine, sodium (Na), potassium (K), chloride (Cl), bicarbonate (HCO3), and anion gap. Statistical comparisons were made using SPSS with significance set at p≤0.05. The results showed that roadside workers had significantly higher levels of urea (4.93 ± 1.32 mmol/L vs. 4.32 ± 0.34 mmol/L, p=0.049) and creatinine (109.5 ± 20.47 µmol/L vs. 82.62 ± 13.87 µmol/L, p=0.0033), suggesting possible environmental or occupational impacts on renal function. Conversely, office workers exhibited higher potassium levels (5.10 ± 0.048 mmol/L vs. 3.98 ± 0.018 mmol/L, p=0.001), potentially due to dietary or lifestyle differences. No significant differences were observed for bicarbonate, chloride, or sodium between the groups. The anion gap was significantly higher in roadside workers (40.29 vs. 32.64, p=0.001), indicating potential metabolic alterations. Gender-based comparisons revealed significant differences within groups. Among office workers, females had higher sodium (150.81 ± 0.007 mmol/L vs. 138.67 ± 0.024 mmol/L, p<0.001) and chloride levels (94.67 ± 0.018 mmol/L vs. 88.52 ± 0.041 mmol/L (p=0.020). Among roadside workers, females showed higher creatinine levels (96.21 ± 22.0 µmol/L vs. 86.9 ± 18.9 µmol/L, p=0.01) and lower sodium levels (140.61 ± 0.29 mmol/L vs. 146.77 ± 0.037 mmol/L, p<0.001). Age-stratified analyses indicated that older roadside workers (31 years and above) exhibited higher urea, creatinine, and sodium levels, with significant differences in urea (p=0.023), creatinine (p=0.041), and sodium (p<0.001). Among office workers, older individuals also showed significantly elevated sodium levels (p=0.02). Roadside workers face greater renal and metabolic challenges, likely attributable to occupational and environmental stressors. These findings underscore the need for targeted interventions, including improved hydration, dietary support, and environmental protections, to mitigate health risks in vulnerable occupational groups.

**Introduction**

* 1. **Background to the Study**

Occupational health remains a critical public health issue, especially in settings where workers face exposure to various physical, chemical, and environmental hazards. The renal system, tasked with fluid balance, electrolyte regulation, and waste filtration, is particularly vulnerable to these occupational risks. Biomarkers such as sodium, potassium, chloride, urea, and creatinine are essential indicators of kidney function and overall health. Monitoring these biomarkers can provide insights into how occupational exposures affect renal function, particularly in diverse work environments (Chowdhury, 2017).

Port Harcourt, Nigeria, is a rapidly urbanizing city with diverse occupational sectors, including oil and gas, construction, and transportation. Office and roadside workers represent two common occupational groups with distinct work environments. Office workers often engage in sedentary tasks within controlled settings, which can predispose them to risks such as hypertension and metabolic syndrome. In contrast, roadside workers are frequently exposed to pollutants, harsh weather, and physical exertion, which can negatively impact renal function through oxidative stress and inflammation (Akintayo & Bolarinwa, 2018; Guzman & Gamarra, 2014).

Environmental factors and lifestyle choices significantly influence renal health outcomes among these groups. Roadside workers are often subjected to extreme conditions, inadequate hydration, and poor nutrition, exacerbating renal stress caused by pollutants. Dehydration, for instance, can impair kidney perfusion and increase serum creatinine levels, whereas, office workers face risks related to prolonged sitting, such as increased blood pressure and impaired glucose metabolism, both of which are linked to chronic kidney disease (Cheungpasitporn *et al*., 2015; Suvag *et al.,* 2014).

Understanding these occupational impacts on renal function is essential for developing targeted interventions. Roadside workers could benefit from measures like pollution controls and protective equipment, while office workers might be encouraged to adopt healthier lifestyles through workplace wellness programs. Despite the significance of these risks, there is limited research comparing renal biomarkers across occupational groups in developing countries. This study aims to address this gap by providing region-specific data on electrolyte, urea, and creatinine levels among office and roadside workers in Port Harcourt, ultimately informing occupational health policies and reducing disparities (Ezejimofor *et al*., 2017; Ogunbode *et al*., 2014; Sukumar *et al.,* 2016).

**Materials and Method**

**2.1 Study Area**

This study was conducted in Port Harcourt, Nigeria, the capital of Rivers State, which is located in the southern part of the country and consists of 23 local government areas. Situated along the Bonny River in the Niger Delta region. Port Harcourt is recognized as a commercial hub for Nigeria's oil industry, with an estimated population of 1,865,000. The city serves as a major industrial center, housing numerous multinational companies and other industrial enterprises, particularly those related to the petroleum sector. Port Harcourt is the leading city for oil refining in Nigeria, with two primary oil refineries located in the Eleme Local Government Area.

**2.2. Study Design**

This was a comparative cross-sectional study aimed to assess and compare the levels of electrolytes, urea, and creatinine between office workers and roadside workers in Port Harcourt, Rivers State. The design will allow the collection of data at a single point in time from both groups to determine the differences in their biochemical parameters.

**2.3. Study Population**

The study will involve two distinct groups:

1. **Office Workers**: Individuals working in offices within Port Harcourt. These participants are presumed to work in a controlled indoor environment with minimal exposure to environmental pollutants.
2. **Roadside Workers**: Individuals working on the streets or by the roadside, such as vendors, traffic personnel, and artisans. These participants are expected to have a higher exposure to environmental pollutants, heat, and possibly dehydration.

A total of 100 subjects were recruited from Port-Harcourt with 50 individuals as office workers and were used as control subjects while the other 50 individuals were road side workers and are used as test subjects. They were intimated about the study, and oral consent was obtained from interested persons. Also, a well-structured questionnaire was used to gather relevant information (such as age, sex, other occupational or residential exposures, smoking status, use of medication, alcohol status, medical history, meal quality etc) from each subject.

**2.4 Inclusion and Exclusion Criteria**

**2.4.1 Inclusion Criteria**

Individuals aged 18-60, working in an office environment for at least 1 year.

Individuals aged 18-60, working by the roadside for at least 1 year.

Willingness to participate and provide informed consent.

**2.4.2 Exclusion Criteria**

Individuals with known chronic kidney disease, hypertension, or diabetes mellitus.

Participants on medication that could affect electrolyte balance (e.g., diuretics).

Pregnant women.

Individuals who do not provide informed consent.

**2.5 Blood Sample Collection**

About 10 ml of whole blood was collected from each subject via venipuncture and was transferred to Lithium Heparin sample bottle. The plasma was obtained from the sample container after centrifugation at 3500 rpm for 5 minutes and was transferred into a plain container and stored in the freezing compartment of the refrigerator at -4oC until time for analysis, where it was used for the determination of sodium, potassium, chloride, bicarbonate, creatinine and Urea levels.

**2.6 Laboratory Procedures**

**2.6.1 Urea Estimation:** Urea was estimated using the modified Urease-Berthelot method (Fawcett and Scott, 1960), using urea kit obtained from Spectrum Diagnostics Egypt employing manufacturer’s instructions. Briefly: 1 ml of reagent 1 was added into three tubes labelled test, standard and blank followed by 1 drop of reagent 2 and 10µl of sample, standard and distilled water added. This was allowed to stand for 5 minutes at room temperature, the 200 µl of reagent 3 was added and allowed to stand for 10 minutes at room temperature and absorbances read at 600nm.

**2.6.2 Creatinine Estimation**: This was estimated using modified Jeffe’s Alkaline Picrate Method (Larsen, 1972), employing creatinine kit obtained from Spectrum diagnostics Egypt. Briefly, equal volumes of reagent 1(R1) andreagent 2 (R2) were mixed to produce to working reagent. 1ml of working reagent was pipette into cuvettes 100µl of sample/control/Standard was added and mixed gently. Absorbances were recorded at 510 nm after 30 seconds (A1) and after 90seconds (A2) of the sample or standard addition.

**2.6.3 Determination of Potassium, Sodium & Chloride.**  Electrolytes were analyzed using Besic CBS 50 Electrolyte Analyzer, from Biomed suppliers .com employing manufacturers instructions.

**2.6.5 Bicarbonate Estimation:** Bicarbonate was estimated by colorimetric method using bicarbonate kit obtained from Spectrum Diagnostics Egypt. As specified by the manufacturer, 1 ml of reagent is added into 3 test tubes labelled sample, calibrator and blank. 10µl of sample and calibrator are added to their respective tubes and incubated for 2 minutes. Then, read the absorbance of A1 and exactly after 1 min read A2, Determine ΔA = A1-A2.

Calculation of CO2 conc.(mmol/L) =

(A. sample)- (A. Blank) / (A. Calibrator)- (A. Blank x concentration of calibrator

**2.6.6 Calculation of Anion Gap**

The anion gap of the subjects was calculated using the formula: **Anion gap**= (Na+K) – (Cl +HCO3)

**2.7 Statistical Analysis**

The data generated from the analysis were expressed as mean ± standard deviation, and analyzed using the statistical package for Social Sciences (SPSS) version 24. Comparison of the mean and standard values were made for the various parameters using one-way ANOVA and Turkey tests. Result where considered statistically significant at 95% confidence interval (p≥0.05)

**RESULTS**

Table 1 shows the result of biochemical parameters between office and roadside workers. There is significantly higher urea (4.93±1.32 vs. 4.32±0.34 mmol/L, P = 0.049) and creatinine levels (109.5±20.47 vs. 82.62±13.87 µmol/L, P = 0.0033) in roadside workers. In contrast, office workers had significantly higher potassium levels (5.10±0.048 vs. 3.98±0.018 mmol/L, P = 0.001), No significant differences were observed for bicarbonate (HCO3), chloride (Cl), or sodium (Na) between the groups. These findings highlight occupational disparities in biochemical health markers.

**Table 1: Results of parameters among study subjects**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** |  |  | **Parameters** |  |  |
| **Urea mmol/L** | **Creatinine µmol/L** | **HCO3 mmol/L** | **Cl mmol/L** | **K mmol/L** | **Na mmol/L** |
| Office workers | 4.32±0.34 | 82.62±13.87 | 26.22±3.23 | 89.64±0.034 | 5.10±0.048 | 143.4±0.083 |
| Roadside workers | 4.93±1.32 | 109.5±20.47 | 25.32±2.63 | 90.67±0.32 | 3.98±0.018 | 152.3±0.034 |
| P-value | 0.049 | 0.0033 | 0.062 | 0.32 | 0.001 | 0.102 |
| Remark | S | S | NS | NS | S | NS |

**Keys:** **Na**- Sodium, **Cl**-Chloride, **K**-Potassium, **HCO3**-Bicarbonate, **S**-significant, **NS**-Not Significant

The table 2 compares urea, creatinine and electrolyte parameters between office and roadside female workers. Urea levels were slightly higher in roadside females (4.48±1.23 mmol/L) compared to office females (4.19±2.03 mmol/L), but this difference was not statistically significant (p = 0.27). Creatinine levels were significantly elevated in roadside females (96.21±22.0 µmol/L) versus office females (88.9±11.9 µmol/L, p = 0.002). Bicarbonate (HCO₃) levels were comparable between the groups (p = 0.99). Chloride levels were significantly higher in roadside females (98.63±0.79 mmol/L) compared to office females (94.67±0.018 mmol/L, p = 0.020), Potassium levels were lower in roadside females (4.10±0.23 mmol/L) than office females (4.76±0.018 mmol/L), though not significantly different (p = 0.069). Sodium levels were significantly higher in office females (150.81±0.007 mmol/L) than roadside females (140.61±0.29 mmol/L, p < 0.001).

**Table 2 Result of parameters among office and roadside female workers**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** |  |  | **Parameters**  |  |  |
| **Urea mmol/L** | **Creatinine µmol/L** | **HCO3 mmol/L** | **Cl mmol/L** | **K mmol/L** | **Na mmol/L** |
| Office Female | 4.19±2.03 | 88.9±11.9 | 26.9±3.29 | 94.67±0.018 | 4.76±0.018 | 150.81±0.007 |
| Roadside Female | 4.48±1.23 | 96.21±22.0 | 23.1±1.31 | 98.63±0.79 | 4.10±0.23 | 140.61±0.29 |
| P-value | 0.27 | 0.002 | 0.99 | 0.020 | 0.069 | <0.001 |
| Remark | NS | S | NS | S | NS | S |

**Keys:** **Na**- Sodium, **Cl**-Chloride, **K**-Potassium, **HCO3**-Bicarbonate, **S**-significant, **NS**-Not Significant

Table 3 shows urea, creatinine and electrolyte parameters between office and roadside male workers. Roadside males had slightly higher urea levels (4.56±1.98 mmol/L) than office males (4.21±2.91 mmol/L), but this was not significant (p = 0.300). Creatinine was significantly lower in roadside males (86.9±18.9 µmol/L) compared to office males (90.6±13.04 µmol/L, p = 0.01), Bicarbonate levels were similar between the groups (p = 0.211), Roadside males had significantly higher chloride levels (99.62±0.18 mmol/L) than office males (88.52±0.041 mmol/L, p = 0.001). Potassium levels were similar (p = 0.569), but sodium levels were significantly higher in roadside males (146.77±0.037 mmol/L) than office males (138.67±0.024 mmol/L, p < 0.001).

**Table 3:** **Comparison of parameters among office and road side male workers**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** |  |  | **Parameters**  |  |  |
| **Urea mmol/L** | **Creatinine µmol/L** | **HCO3 mmol/L** | **Cl mmol/L** | **K mmol/L** | **Na mmol/L** |
| Office Male | 4.21±2.91 | 90.6±13.04 | 25.5±7.8 | 88.52±0.041 | 4.22±0.012 | 138.67±0.024 |
| Roadside Male | 4.56±1.98 | 86.9±18.9 | 24.9±3.19 | 99.62±0.18 | 4.31±0.14 | 146.77±0.037 |
| P-value | 0.300 | 0.01 | 0.211 | 0.001 | 0.569 | <0.001 |
| Remark | NS | S | NS | S | NS | S |

**Keys:** **Na**- Sodium, **Cl**-Chloride, **K**-Potassium, **HCO3**-Bicarbonate, **S**-significant, **NS**-Not Significant

In table 4, the comparison of biochemical parameters among office workers of different age ranges showed no significant differences in urea, creatinine, bicarbonate (HCO3), chloride, or potassium levels. However, sodium levels were significantly higher in the oldest age group (31 and above) compared to younger groups 145.81±0.007 vs. 136.73±0.083 mmol/L

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Age**  |  |  | **Parameters**  |  |  |
| **Urea mmol/L** | **Creatinine µmol/L** | **HCO3 mmol/L** | **Cl mmol/L** | **K mmol/L** | **Na mmol/L** |
| 18-25 | 4.12±0.24 | 92.62±13.87 | 24.22±3.23 | 89.64±0.034 | 4.53±0.048 | 136.73±0.083 |
| 26-30 | 4.53±1.32 | 90.43.5±2.47 | 26.32±2.63 | 89.67±0.32 | 4.38±0.018 | 138.79±0.034 |
| 31-above | 4.19±2.03 | 88.9±11.9 | 26.9±3.29 | 91.67±0.018 | 4.26±0.018 | 145.81±0.007 |
| P-value  | 0.500 | 0.07 | 0.121 | 0.061 | 0.569 | 0.02 |
| Remark  | NS | NS | NS | NS | NS | S |

 **Table 4 Comparison of parameters among** **office workers based on age ranges**

**Keys:** **Na**- Sodium, **Cl**-Chloride, **K**-Potassium, **HCO3**-Bicarbonate, **S**-significant, **NS**-Not Significant

Table 5 on the comparison of biochemical parameters among roadside workers of different age groups revealed significantly higher urea, creatinine, and sodium levels in the oldest age group (31years and above), with P-values of 0.023, 0.041, and < 0.001, respectively. However, no significant differences were observed for bicarbonate (HCO3), chloride, or potassium levels.

**Table 5 Comparison of parameters among road side workers based on age**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Age**  |  |  | **Parameters**  |  |  |
| **Urea mmol/L** | **Creatinine µmol/L** | **HCO3 mmol/L** | **Cl mmol/L** | **K mmol/L** | **Na mmol/L** |
| 18-25 | 3.93±1.34 | 87.6±23.04 | 24.5±3.48 | 97.58±0.01 | 4.28±0.016 | 139.63±0.024 |
| 26-30 | 4.19±2.03 | 86.9±22.9 | 23.9±3.29 | 96.61±0.08 | 4.29±0.011 | 143.71±0.007 |
| 31-above | 4.21±1.08 | 99.21±32.09 | 24.1±1.03 | 95.63±0.079 | 4.30±0.23 | 144.78±0.019 |
| P-value  | 0.023 | 0.041 | 0.79 | 0.090 | 0.069 | <0.001 |
| Remark  | S | S | NS | NS | NS | S |

**Keys:** **Na**- Sodium, **Cl**-Chloride, **K**-Potassium, **HCO3**-Bicarbonate, **S**-significant, **NS**-Not Significant

**Table 6:** Comparison of Anion Gap Among Study Subjects

Table 6compares the anion gap between office workers and roadside workers. Roadside workers have a significantly higher mean anion gap (40.29) compared to office workers (32.64), with a p-value of 0.001, indicating a statistically significant difference.

**Table 6**: Comparison of Anion Gap Among Study Subjects

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Group** |  |  | **Parameters** |  |
| **Na** **mmol/L** | **K** **mmol/L** | **HCO3****mmol/L** | **Cl** **mmol/L** | **Anion gap****mmol/L** |
| Office workers | 143.4±0.083 | 5.10±0.048 | 26.22±3.23 | 89.64±0.034 | 32.64 |
| Roadside workers | 152.3±0.034 | 3.98±0.018 | 25.32±2.63 | 90.67±0.32 | 40.29 |
| P-value |  |  |  |  | 0.001 |
| Remark |  |  |  |  | S |

**Keys:** **Na**-Sodium, **Cl**-Chloride, **K**-Potassium, **HCO3**-Bicarbonate, **S**-significant, **NS**-Not Significant

**Discussion**

This study evaluated biochemical parameters such as urea, creatinine, bicarbonate (HCO₃), chloride (Cl), potassium (K), sodium (Na) and anion gap in office workers and roadside workers. The findings reveal notable occupational disparities, with specific parameters significantly varying between the groups.

Roadside workers exhibited significantly higher levels of urea and creatinine compared to office workers. These findings suggest increased renal stress among roadside workers, possibly due to exposure to pollutants, dehydration from prolonged outdoor work, and occupational physical stress. A similar pattern was observed by Olayemi *et al*. (2021), who reported elevated urea and creatinine levels in traffic police officers, attributing this to chronic exposure to vehicular emissions and heat stress.

Prolonged exposure to heavy metals such as leads and cadmium, commonly found in roadside environments, may impair renal function over time. A review by Akinwumi *et al*. (2020) highlighted that such exposure leads to nephrotoxicity, characterized by increased serum creatinine and urea levels. This aligns with the current findings, underscoring the occupational vulnerability of roadside workers. Conversely, office workers had significantly higher potassium levels. Elevated potassium levels in this group may result from dietary habits favoring potassium-rich foods or reduced excretion in sweat and physical exertion as compared to roadside workers. In contrast, roadside workers displayed a non-significant trend toward higher sodium levels.

The increase in sodium levels in roadside workers might reflect chronic dehydration and salt retention mechanisms, as suggested by environmental stress studies; Ismail *et al*. (2020) reported elevated sodium levels in individuals exposed to high environmental temperatures due to sweat-induced water loss and compensatory sodium retention. No significant differences were observed in bicarbonate (HCO₃) or chloride levels between the two groups. These findings are consistent with the work of Adamu *et al*. (2019), who noted that bicarbonate and chloride levels often remain stable unless severe metabolic disturbances occur. This suggests that both groups maintain relatively balanced acid-base and chloride homeostasis, despite differences in their occupational settings.

The analysis of renal and electrolyte parameters among office and roadside female workers highlights the impact of occupational and environmental factors on physiological homeostasis. Urea levels were marginally higher in roadside females compared to office females, though the difference was not statistically significant. Elevated urea levels can indicate increased protein catabolism or impaired renal clearance, which may result from occupational exposure to pollutants common in roadside environments. According to Nkwocha et al. (2020), roadside workers are frequently exposed to vehicular emissions containing urea-metabolizing substances, which could contribute to subtle elevations in urea levels. Creatinine was significantly elevated in roadside females compared to office females. This indicates a higher renal workload or potential nephrotoxicity among roadside workers, possibly due to chronic exposure to heavy metals or other toxins from traffic pollution. Chuang et al. (2021) reported similar findings where roadside workers exhibited higher creatinine levels due to prolonged inhalation of particulate matter and exposure to lead, which can compromise renal function over time.

The bicarbonate levels were comparable between the two groups (p = 0.99), suggesting similar acid-base homeostasis. This aligns with the findings of Ogundele et al. (2019), who observed no significant variation in bicarbonate levels between urban and rural populations exposed to differing environmental conditions. Chloride levels were significantly higher in roadside females than in office females. Increased chloride levels may reflect dietary patterns or environmental exposure to salts in dust and air pollutants. Yusuff et al. (2018) noted elevated chloride levels among workers in high-pollution areas, attributing this to inhalation of particulate matter containing chlorides. Potassium levels were lower in roadside females than in office females, though the difference was not statistically significant. Potassium is vital for muscle and nerve function, and its depletion may be related to stress or dehydration, common in outdoor work settings. Adebayo and Akinrinlola (2022) highlighted occupational stress as a factor influencing potassium regulation. Sodium levels were significantly higher in office females compared to roadside females. This significant difference could reflect dietary differences, as office workers might consume more processed foods with higher sodium content. Additionally, roadside workers, exposed to higher physical activity and heat, might lose more sodium through sweat. Nguyen et al. (2020) reported similar trends, with higher sodium levels associated with sedentary lifestyles.

The significant difference in the anion gap between office workers and roadside workers, as shown in in this study, reflects variations in metabolic activity and potential environmental or occupational impacts on the workers. The roadside workers demonstrated a higher mean anion gap compared to office workers. This elevated anion gap among roadside workers could be attributed to chronic exposure to environmental pollutants, dehydration, and oxidative stress, which are prevalent in their occupational setting.

The anion gap is an important biochemical marker used to assess the balance of cations and anions in the blood. A higher anion gap often indicates the presence of unmeasured anions, which can result from metabolic acidosis, renal impairment, or increased production of organic acids such as lactate or ketones. The observed disparities in sodium, potassium, chloride, and bicarbonate levels between the two groups also play a role in this difference. Specifically, the elevated sodium levels in roadside workers compared to office workers may contribute to the increased anion gap. Elevated sodium levels can be indicative of dehydration, which is a common challenge faced by outdoor workers due to prolonged exposure to heat.

The findings of this study align with previous studies that reported significant metabolic and electrolyte imbalances among individuals exposed to environmental pollutants and occupational stress. Olawale *et al*. (2018) observed a higher anion gap in workers exposed to industrial chemicals, attributing the imbalance to oxidative stress and subclinical renal dysfunction. Similarly, Brown *et al*. (2021) highlighted the role of dehydration and poor nutritional status in altering electrolyte and acid-base balance among outdoor workers. The higher anion gap in roadside workers suggests a need for occupational health interventions. Regular health screenings, adequate hydration, and provision of personal protective equipment can mitigate the adverse effects of environmental exposure.

The occupational health disparities observed in the present study align with findings from similar research globally. A study by Jain *et al*. (2021) on factory workers exposed to chemical pollutants revealed elevated urea and creatinine levels, supporting the hypothesis that occupational exposure affects renal function. Similarly, research in urban Nigeria by Nwankwo *et al*. (2022) demonstrated that roadside hawkers experienced higher oxidative stress markers, correlating with impaired renal parameters.

Conversely, office workers in this study showed stable renal and electrolyte profiles, consistent with studies emphasizing the health advantages of controlled indoor environments. However, sedentary lifestyles, common among office workers, may predispose them to other metabolic risks, such as hyperkalemia and hypertension, as highlighted by Oguntade *et al*. (2020). The findings emphasize the need for targeted occupational health interventions. For roadside workers, periodic renal function monitoring and access to clean drinking water are essential to mitigate the risks of dehydration and toxic exposure. Protective measures, such as personal protective equipment and reduced exposure should also be prioritized. While office workers need to promote physical activity and reduce intake of processed foods, this will go a long way to prevent lifestyle-related metabolic disorders.

**4.2 Conclusion**

This study underscores significant occupational, gender-based, and age-related disparities in biochemical parameters among office and roadside workers. Roadside workers demonstrated elevated urea and creatinine levels, likely due to environmental stressors, particularly dehydration resulting from elevated out door temperatures conversely, office workers exhibited higher potassium levels, possibly influenced by dietary habits and reduced excretion resulting from low temperature. Gender and age significantly modulated these parameters, reflecting the interplay between physiological, environmental, and lifestyle factors.

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