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Metabolite Assessement in the Kidney of Oryclotagus Cuniculus Impacted by Produced Water (PW)

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Abstract **Original Research Article**

This research which evaluated the impact of produced water on Oryclotagus cuniculus, assesses its effect on kidney metabolites, after 30 days of exposure to sublethal concentrations of toxicant in a randomized experiment. A small portion of the kidney from experimental animals were collected by dissection, crushed in a ceramic mortar, harmonized with deionized water, and centrifuged for 15 minutes at 3000 rpm after the exposure. The supernatant was collected in sample bottles for metabolites assay. Kidney metabolites shows significant disruption where urea levels significantly increased in all treatment group peaking at 6.60 mg/L (7.77±3.78 µmol/L) compared to control that recorded (3.36±0.65 µmol/L) at 0.00mg/L. This also impacted on the creatinine which were also elevated across treatment groups, in particular at 13.30 mg/L and 20.00 mg/L compared to the control at 0.00mg/L.On the other hand, protein and bilirubin levels dropped respectively at 13.30 mg/L (2.79±0.74 g/L) compared to control that recorded 4.67±0.89g/L at 0.00mg/L and at 20.00 mg/L (16.96±18.65 µmol/L) compared to control that recorded 33.01±5.38 µmol/L at 0.00mg/L. These findings confirmed that produced water disrupts kidney metabolites exposed to rabbits, giving a scientific basis for advocating improved waste management practices and reinforcing environmental protection policies to mitigate the deleterious effects of oil industry effluents.

Keywords: Metabolites, Sublethal, Impact and Producd Water.

Introduction

Numerous nations, including Nigeria, have relied heavily on petroleum exploration and production for their economic growth. The Niger Delta region in particular has gained international recognition for its abundant oil and gas deposits, which contribute significantly to the nation's foreign exchange earnings (Ololade & Lajide, 2010). Nevertheless, despite these economic advantages, oil and gas operations have come at a noteworthy cost to the environment and public health, particularly because of the improper handling and disposal of petroleum by-products like produced water (Ehirim & Nwankwo, 2010).

Among the many organic and inorganic materials found in produced water, a significant waste stream produced during the extraction of oil, are heavy metals, hydrocarbons, radionuclides, and chemical additives (Emma et al., 2014). It can provide major ecological hazards when discharged into the ecosystem without proper treatment, especially to aquatic and terrestrial organisms (Nduka & Orisakwe,

2011). With its system of rivers, creeks, and wetlands, the Niger Delta has been especially susceptible to contamination, which has impacted not only biodiversity but also human health and livelihoods that rely on natural resources (Fagbuaro, 2011).

This underscores the need for thorough investigation into the toxicological effects of produced water on sentinel organisms such as *Clarias gariepinus* and *Oryctolagus cuniculus*, which serve as models for assessing aquatic and terrestrial environmental health, respectively. According to Gabardo et al., (2011), there are roughly three barrels of produced water generated for every barrel of oil extracted worldwide. As a result, it is the biggest waste stream connected to oil production

Material and Methods

The oil drilling location is situated at Imiringi Community, Ogbia Local Government Area, Bayelsa State, in the Nigerian Niger Delta, which is well-known for having a high hydrocarbon and trace metal concentration, is where the produced water was obtained. The generated water was gathered in sanitized, cleaned containers and kept cold during its journey to the laboratory, where it was kept at 4°C for 2days before the experiment. Healthy adult *Oryctolagus cuniculus* (weight range of 1.5–2.0 kg) were sourced from certified breeders and hatcheries, obtained from Kester rabbit farm at Mbiama, Rivers State of Nigeria. They were maintained in separate clean holding containers under standard conditions (12-hour light/dark cycle, 25±2°C temperature at adequate ventilation for rabbits, and fed with commercial feed appropriately to their species. They were transported in aerated carton and containers in a closed vehicle to the animal farm, Department of Livestock production in Niger Delta University for the experimental procedure

ANALYSIS

The data obtained during the experiment was further subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS), version 20.8 software. The results obtained was then expressed as mean± standard deviation. A one way analysis of Variance was also conducted at α=0.05 to determine the significance in the experiment.

RESULT

Relative activities of metabolites in the kidney of *Oryclotagus cuniculus* exposed to produced water for 30days

Conc. of PW (mg/L)	T-Protein (g/L)	Albumin (g/L)	Urea (g/L)	Creatinine (g/L)	Bilirubin (g/L)
0.00	4.67±0.89^{a}	0.47±0.27^{b}	3.36±0.65^{c}	57.70±7.33^{b}	33.01±5.38^{a}
6.60	4.60±2.40^{a}	0.68±0.44^{b}	7.77±3.78^{a}	72.75±22.91^{a}	23.07±1.82^{b}
13.30	2.79±0.74^{b}	0.44±0.16^{b}	7.17±3.53^{a}	74.75±23.44^{a}	30.73±5.74^{a}
20.00	4.04±1.56^{a}	1.76±2.01^{a}	5.72±0.47^{a}	71.75±10.78^{a}	16.96±18.65^{c}

All data are expressed as mean ± standard deviation using program statistical package for Social Sciences Version 20.8. Different superscript indicated a significant variation ($p<0.05$) a*b*c*

KEY:

g/L= gram per liter

µmol/L = nanomol per liter

DISCUSSION

The kidney metabolite profile of *Oryclotagus cuniculus*, exposed to produced water for 30 days indicates significant biochemical disruptions compared to the control group, where markers of total protein (TP), albumin, urea, creatinine, and bilirubin which are vital indicators of renal metabolic functions and potential nephrotoxic damage induced by environmental contaminants were disrupted. In this study, **Total protein** showed slight reduction at 6.60mg/L, including a drop at 13.30 mg/L and 20.00mg/L, suggesting possible protein catabolism or inhibition of protein synthesis, a response consistent with chronic exposure to contaminants such as hydrocarbons (Akan et al., 2010). **Albumin** concentrations remained statistically similar at lower doses but rose markedly at the highest concentration at (20.00 mg/L) compared to the control at 0.00mg/L, which might reflect compensatory protein synthesis or altered glomerular permeability under chemical stress (Alimba et al., 2015). The **Urea** concentrations was elevated to a peak at 6.60 mg/L compared to control at 0.00mg/L, likely indicating an early onset of renal stress, which may be due to reduced excretion efficiency or enhanced protein breakdown, both of which signify nephrotoxicity (Ezeonyejiaku & Obiakor, 2011). Interestingly, urea levels slightly declined at higher concentrations, which may reflect severe damage leading to impaired metabolic function or physiological adaptation. **Creatinine** values followed a similar pattern, rising at 13.30 mg/L, before slightly dropping at 20.00 mg/L compared to the control at 0.00mg/L. Elevated creatinine confirmed reduced glomerular filtration rate, consistent with kidney dysfunction from chronic exposure to pollutants in produced water. **Bilirubin,** a hepatic byproduct often reabsorbed or cleared renaly, varied widely. It decreased in mid-dose groups at 6.60mg/L and 13.30mg/L, and dropped significantly at 20.00 mg/L compared to control at 0.00mg/L. This drop could suggest impaired reabsorption or damage to proximal tubule functions due to toxicant exposure (Obiakor et al., 2020).

Conclusion

This research work which assessed the physiological impacts of produced water on Oryclotagus cuniculus (New Zealand rabbit) following a 31 days exposure confirmed significant disruption of kidney metabolites and revealed dose-dependent renal disturbances. The elevated urea and creatinine levels, along with albumin fluctuations indicated nephrotoxic effects of produced water components such as heavy metals, polyaromatic hydrocarbons, and salts, thereby compromising kidney filtration and metabolic homeostasis, while Elevated creatinine confirmed reduced glomerular filtration rate, consistent with kidney dysfunction from chronic exposure to pollutants in produced water

Ethical Issues

The authors are aware of the ethical issues as stipulated by the laws of the land and completely complied with the best practices while carrying out this research.

Competing Interest

Authors declared that there is no conflict of interest that would affect the authenticity of this scientific manuscript

Authors Contribution

All the authors of this scientific research made equal impute both for data collection, analysis and manuscript writing.

Reference

Akan, J. C., Abdulrahman, F. I., Dimari, G. A., & Ogugbuaja, V. O. (2010). Physicochemical determination of pollutants in wastewater and vegetable samples along the Jakara wastewater channel in Kano Metropolis, Kano State, Nigeria. *European Journal of Scientific Research*, 23(1), 122–133.

Alimba, C. G., Bakare, A. A., & Aina, O. O. (2015). Evaluation of environmental

contaminants in rabbit blood and tissues using oxidative stress and biochemical biomarkers. *Environmental Toxicology and Pharmacology*, *39*(1), 9–20.

Ehirim, C. N., & Nwankwo, C. N. (2010). Environmental impact of produced water discharges from petroleum exploration and production operations. *Journal of Applied Sciences and Environmental Management*, **14**(2), 5–10

Emam A. Emam et al., (2014). Evauating the Characteristics of Offshore Oilfield Development Document for Effluent Limitations Guidelines and New Source performance standard for the Offshore Subcategory of the Oil and Gas Extraction point Source category, EPA 821-R-93-003, u.s Environmental protection Agency, Jan. Ernest H. Price (1980)

Ezeonyejiaku, C. D., & Obiakor, M. O. (2011). Toxic effects of industrial effluents on African catfish (*Clarias gariepinus*) and Wistar albino rat. *Bioresearch Bulletin*, 5, 295–301.

Fagbuaro, O. and OSO, J. A. (2011). Skeletal malformation among the Clarias species from fish mongers in Ekiti State. *Continental Journal of Fisheries and Aquatic Science*, 5(2): 32-37

Gabardo, I., E. Platte, A. Araujo, E. Yassada and F. Pulgatti. 2011.Evaluation of produced water from Brazilian Offshore platforms. In: produced water: Environmental Risks and Mitigation Technologies. K. Lee and J. Neff (editions), Springer Publishing (this volume).

Nduka, J. K., & Orisakwe, O. E. (2011). Water quality issues in the Niger Delta of Nigeria: A look at heavy metal levels and implications. *African Journal of Environmental Science and Technology*, **5**(10), 846–853. https://doi.org/10.5897/AJEST11.201

Obiakor, M. O., Okonkwo, J. C., & Odo, G. E. (2020). Biomarkers of oxidative stress and liver function in *Clarias gariepinus* exposed to petroleum refinery effluent. *Toxicology Reports*, 7, 163–172.

Ololade, I. A., & Lajide, L. (2010). Organic geochemical characterization and source identification of contamination in water and sediments of the Niger Delta, Nigeria. *Journal of Environmental Chemistry and Ecotoxicology*, **2**(5), 82–90.