***Original Research Article***

**Prevalence of gastro-intestinal parasites, proximate and heavy metal analysis of *Lutjanus campechanus*, *Mugil cephalus* and *Callinectes amnicola* from New Calabar River, Rivers State, Nigeria**

**ABSTRACT**

**Aim:** Edible aquatic organisms are a major source of protein among several individuals in Nigeria; therefore, a study was conducted to evaluate the prevalence of gastro-intestinal parasites, proximate and heavy metal analysis of *Lutjanus campechanus*, *Mugil cephalus* and *Callinectes amnicola* from New Calabar River, Rivers State, Nigeria

**Study Design:** A cross-sectional randomized study from July to December 2024

**Methodology:** One hundred and eighty (180) randomly selected aquatic organisms (60 species of each sampled organism) were used for this study. Standard laboratory techniques were used to analyse each sample and all data generated were analysed statistically using student T test and analysis of variance (ANOVA) with Tukey’s HDS post hoc test as well as all statistical results were considered significant at P<0.05.

**Results:** An overall parasite prevalence of 36 (20.0%) was recorded in this study (P<0.05); parasite prevalence values of 25.0%, 18.3% and 16.7% were recorded for *Lutjanus*, *Mugil* and *Callinectes* respectively. A total of 61 parasites were isolated belonging to protozoa (*Hexamita* 16.4%), trematode (*Dactylogyrus* 9.8%), cestode (*Diphyllobothrium* 3.3%) and nematode (*Procamallanus* 70.5%). *Lutjanus* had the highest percentage for ash (1.44%), lipid (0.13%), fibre (15.37%) and carbohydrate (7.34%) while *Mugil* had the highest percentage for moisture content (71.28%) and protein (15.94%). Nickel, lead, chromium, cadmium and zinc values were below the WHO permissible limits.

**Conclusion:** Despite the absence of zoonotic parasites, good nutritional composition and low heavy metal concentrations, proper cooking and regular monitoring of edible aquatic organisms are essential for promoting public health and environmental sustainability.

Keywords: *Lutjanus*, *Mugil*, *Callinectes*, parasites, proximate analysis, heavy metals

**1. INTRODUCTION**

Edible aquatic organisms contain both macro and micro nutrients that are necessary for development and improvement of human health (Mishra, 2020). The consumption of edible aquatic organisms is rising due to increasing human population, high price and health risks of alternative sources of animal protein (Tavarez-Dias & Martins, 2017). These organisms can meet the nutritional needs of humans due to their high digestible energy content and good nutritional profile (Takon et al., 2020). The status of food security is sub-Saharan African (including Nigeria) is becoming less favourable due to disruptions in the global economy, population expansion, insecurity and changes in consumer behaviour (Wudil et al., 2022). The New Calabar River, situated in the Niger Delta region of Nigeria is a vital aquatic ecosystem supporting diverse aquatic organisms which play a significant role in the livelihoods of local communities by contributing to food security and economic activities. *Lutjanus* *campechanus* (Red snapper), *Mugil* *cephalus* (Mullet) and *Callinectes* *amnicola* (Blue crab) are some notable aquatic organisms in the New Calabar River. Anthropogenic activities (such as industrial discharge, agricultural runoffs and urban effluents) can introduce parasites and heavy metals into water bodies, posing risks to aquatic life and their human consumers. Understanding the prevalence of parasites in edible aquatic organisms is vital in safe guarding public health and preventing zoonoses. Also, proximate and heavy metals analysis of these organisms will provide necessary insights on their nutritional composition and potential contamination levels. Therefore, a study was conducted to evaluate the prevalence of gastrointestinal parasites, proximate and heavy metal analysis of *Lutjanus* *campechanus*, *Mugil* *cephalus* and *Callinectes* *amnicola* from New Calabar River, Rivers State, Nigeria.

**2. MATERIALS AND METHODS**

**2.1 Study Area**

The study was conducted at the New Calabar River, Rivers State, Nigeria (Figure 1). The New Calabar River is located on the eastern flank of the Niger Delta River System which lies at Longitude 4°30’ to 5°00’N and Latitude 6°30’ to 7°00’E as well as empties into some creeks and lagoons bordering the Atlantic Ocean (Nweke et al., 2018). At the Aluu sampling area, the river is fresh and tidal while downstream at Choba and Ogbogoro sections, the river is brackish (Nweke et al., 2018).



Figure 1: Map of New Calabar River

(Source: Nweke et al., 2018)

**2.2 Study Design**

A cross-sectional randomized study

**2.3 Place and Duration of Study**

Sites for sample collection were chosen using random sampling technique and three stations (Aluu, Choba and Ogbogoro) were mapped out along the New Calabar River to eliminate bias; the study was conducted from July to December 2024.

**2.4 Sample Collection and Analysis**

A total of 180 freshly caught aquatic organisms (60 red snappers, 60 mullets and 60 blue crabs) were randomly obtained from local fishermen, labelled appropriately, kept in sterile containers and conveyed to the laboratory for identification as well as analysis. The fish and crab samples were identified using appropriate taxonomic keys (Schneider, 1992; Idodo-Umeh, 2003). Specimens from the sampled aquatic organisms were grouped into two sub-specimens; gills and gastrointestinal tract (GIT). Extraction and identification of parasites from the sub-specimens was done using standard laboratory techniques (Eze et al., 2020; Ibrahim et al., 2020). Specimen digestion and proximate analysis were conducted using standard methods given by AOAC (1999) and Mansur et al. (2018) while concentration of heavy metals was determined by standard methods given by AOAC (2005) and Mansur et al. (2018). Laboratory tests of specimens were conducted in triplicates and recorded as mean values or percentages.

**2.5 Statistical Analysis**

All data generated were analyzed statistically by IBM Statistical Package for Social Sciences version 28.0 using student T test and analysis of variance (ANOVA) with Tukey’s HDS post Hoc as well as statistical results were considered significant at P<0.05.

**3. RESULTS**

An overall parasite prevalence of 20.0% was recorded (P<0.05); *Lutjanus*, *Mugil* and *Callinectes* had prevalence values of 25.0%, 18.3% and 16.7% respectively (Table 1).

Four parasite species (protozoa, trematode, cestode and nematode) were identified in this study with an abundance of 61; *Hexamita* (16.4%), *Dactylogyrus* (9.8%), *Diphyllobothrium* (3.3%) and *Procamallanus* (70.5%) (Table 2).

The proximate analysis in this study showed that *Lutjanus* had the highest percentage for ash (1.44%), lipid (0.13%), fibre (15.37%) and carbohydrate (7.34%) while *Mugil* had the highest percentage for moisture content (71.28%) and protein (15.94%) (Table 3).

The heavy metal analysis showed that nickel, lead, chromium, cadmium and zinc concentrations were all below the WHO permissible limits in the three sampled aquatic organisms (Table 4).

**Table 1: Overall Parasite Prevalence in the Study**

|  |  |  |  |
| --- | --- | --- | --- |
| **Samples** | **Number Examined** | **Number Uninfected (%)** | **Number Infected (%)** |
| *Lutjanus* | 60 | 45 (75.0) | 15 (25.0) |
| *Mugil* | 60 | 49 (81.7) | 11 (18.3) |
| *Callinectes* | 60 | 50 (83.3) | 10 (16.7) |
| **Total** | **180** | **144 (80.0)** | **36 (20.0)** |

**Table 2: Taxonomic Group and Distribution of Parasites in the Study**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parasite Species** | **Taxonomic Group** | **Location of Parasites** | **Frequency (%)** |
| *Hexamita* | Protozoa | GIT | 10 (16.4) |
| *Dactylogyrus* | Trematode | Gill | 6 (9.8) |
| *Diphyllobothrium* | Cestode | GIT | 2 (3.3) |
| *Procamallanus* | Nematode | GIT | 43 (70.5) |
| **Total** |  |  | 61 (100.0) |

**Table 3: Proximate Analysis of Sampled Aquatic Organisms**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameters (%)** | ***Lutjanus*** | ***Mugil*** | ***Callinectes*** |
| Moisture Content | 63.97 | 71.28 | 68.72 |
| Ash | 1.44 | 1.17 | 1.24 |
| Lipid | 0.13 | 0.08 | 0.06 |
| Protein | 11.75 | 15.94 | 13.14 |
| Fibre | 15.37 | 8.11 | 11.28 |
| Carbohydrates | 7.34 | 3.42 | 5.56 |

Values are mean ±SD from three replicates

**Table 4: Heavy Metal Analysis of Sampled Aquatic Organisms**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters (mg/kg)** | ***Lutjanus*** | ***Mugil*** | ***Callinectes*** | **WHO Limit** |
| Nickel | 0.014±0.06 | 0.007±0.02 | 0.010±0.05 | 0.6 |
| Lead | 0.162±0.02 | 0.121±0.01 | 0.138±0.03 | 0.5 |
| Chromium | 0.030±0.01 | 0.025±0.03 | 0.037±0.02 | 0.05 |
| Cadmium | 0.017±0.05 | 0.014±0.07 | 0.026±0.04 | 0.05 |
| Zinc | 12.039±0.01 | 9.027±0.01 | 10.011±0.01 | 100 |

**4. DISCUSSION**

An overall parasite prevalence of 20.0% was recorded in this study; this is comparable with the prevalence reported in some similar studies (Isah et al., 2024; Salami et al., 2025) but disagrees with other studies having higher parasite prevalence (Ambrose & Maikai, 2018; Afolabi et al., 2020; Saudaki et al., 2022). The influence of anthropogenic activities such as swimming, bathing, defecation and laundry may all contribute to the parasite prevalence of aquatic organisms in this study. Unhealthy human actions combined with unfavourable environmental conditions frequently expose aquatic organisms to parasites (Saudaki et al., 2022).

Parasites identified in this study belonged to four taxonomic groups (protozoa, trematode, cestode and nematode); this agrees with the findings of a similar research (Isah et al., 2024). The parasite with the highest abundance in the study was *Procamallanus* (a nematode) and this was also reported by Isah et al. (2024). Most parasites were found in the gastrointestinal tract (GIT) and this was also reported in several similar studies (Ambrose & Maikai, 2018; Afolabi et al., 2020; Saudaki et al., 2022; Isah et al., 2024; Salami et al., 2025). The large population of parasites in the GIT could be due to the presence of parasite ova or cysts in food particles ingested by the aquatic organisms; these parasites are released during intestinal digestion activities (Omeji, 2012).

The proximate analysis showed that the sampled aquatic organisms had good nutritional composition and are beneficial to humans when consumed. The discharge of domestic wastes and runoffs from agriculture (pesticides and fertilizers) into water bodies constitute a major threat to hydro-chemical and fauna characteristics (Isah et al., 2024).

The concentration of all heavy metals in sampled aquatic organisms were below the WHO permissible limits. However, regular monitoring of the heavy metal concentrations is essential for the safety of seafood consumers.

**5. CONCLUSION**

Despite the absence of zoonotic parasites, good nutritional composition and low concentration of heavy metals in the sampled aquatic organisms, these organisms should be properly washed and cooked before consumption.

**ETHICAL APPROVAL**

All authors hereby declare that principles of laboratory animal care (NIH Publication No. 85 – 23, revised 1985) were followed as well as specific National laws were applicable. All experiments have been examined and approved by the appropriate ethics committee.

**DISCLAIMER (ARTIFICAL INTELLIGENCE)**

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**ACKNOWLEDGEMENTS**

Authors thank the local fishermen that assisted in the collection of sampled aquatic organisms as well as Miss C. E. Onunwo and Miss P. O. Ilevba for their invaluable contributions during sample analysis.

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