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Hazards Associated with Plastic Wastes in the Communities of Niger Delta, Nigeria

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ABSTRACT: *The goal of this study was to investigate into the negative impacts that the presence of plastic waste in the communities located in the Niger Delta may have on the environment and human health. The following physico-chemical properties of the water, fish, sediment, and human blood samples were measured and analyzed: pH, electrical conductivity, total dissolved solids, temperature, dissolved oxygen, nitrate, and phosphate. Furthermore, an assessment of polycyclic aromatic hydrocarbons (PAHs) was included of the inquiry. Gas chromatography mass spectrometry (GC-MS) was used to measure the concentrations of polycyclic aromatic hydrocarbons (PAHs). The data was analyzed using the Statistical Package for the Social Sciences, Version 25.0. Standard deviation, mean, and percentage were among the descriptive statistical metrics used. Furthermore, inferential statistical techniques like Turkey's Test and Analysis of Variance (ANOVA) were used to determine the presence of this correlation within a 0.05 confidence interval. The study's findings showed that polycyclic aromatic hydrocarbon (PAH) congeners came in 10, 9, and 11 distinct varieties in fish, water, and human blood, respectively. Therefore, it is essential to conduct routine monitoring to assess the effects that waste plastic is having on the aquatic resources and the local people in the Niger Delta. This will help evaluate how these environmental risks are now manifesting and how they affect public health.*

KEYWORDS: Environment, Hazard, Plastic, Waste, Communities

INTRODUCTION

Within the larger category of polymers, plastics constitute a unique subgroup[1]. The Greek word "plasticos," which means "to be pliable" or "able to be molded by the application of heat," is where the word plastic gets its derivation. The use of plastic products has been steadily increasing, which

has caused an equal increase in the amount of plastic waste that accumulates worldwide. In 2020, Nxumalo et al. Plastics have a number of unique properties that make them an excellent material to use in the manufacturing of everyday items. In particular, their cost, durability, and lightweight design make them highly sought-after[2]. Plastics are abundant and widely used, which has led to a considerable amount of plastic pollution. Because plastics are persistent in terrestrial, aquatic, and marine ecosystems, they pose a serious threat to the environment[3]. The amount of solid waste that has accumulated worldwide has increased significantly, amounting to an astounding 9.1 billion tons. Plastic waste makes about 6.9 billion tons, or a significant amount, of this total[3].

The abundance of plastic waste, which is visible as litter on streets, rivers, and other public areas like parks and roads, has become a serious problem in developing nations. In addition, they raise environmental issues, obstruct socioeconomic growth, and affect infrastructure, tourism, biodiversity, and fisheries livelihoods[4]. In Nigeria, plastics have become a rapidly growing commodity with substantial economic significance. [5]State that it is a byproduct of the refining process of petroleum. The production of several domestic appliances, culinary utensils, packing materials, waste bins, water bottles, and certain electronic device components are only a few of the many products made from polyethylene terephthalate (PET)[6].The increasing amount of plastic found in various Nigerian environmental compartments might be ascribed to insufficient laws controlling the removal of plastic waste, careless dumping methods, and improper handling of plastic goods and waste. These substances have been seen to enter Nigeria's aquatic ecosystems, accumulate in sedimentary layers, and sometimes release nanoplastics into the atmosphere as a result of uncontrolled burning[7]. It is clear that plastics are not biodegradable, which means that they might potentially accumulate in the tissues of living things and the environment, which could have negative effects[8]. There is a considerable deal of concern about the effects of phthalates on human health due to their widespread use and ubiquity. A large body of research has shown a link between phthalate exposure and a variety of diseases, with reproductive issues being one of the most notable. In Benjamin et al.[8] did a research which revealed the following: a growing number of people worldwide are experiencing reproductive issues, such as hormone-dependent cancers, infertility, and decreased fecundity. Nigeria's substantial crude oil reserves make the Niger Delta area the center of attention for the country's oil and gas development[9].

This research work is aimed at examining the environmental hazard of plastic waste in the communities of Niger Delta, Nigeria. The specific objectives of the study are to:

1 Assess the level of PAHs contaminants in water of Niger Delta communities.
2 Establish the association between the levels of exposures to plastics contamination to the public health burden in the Niger Delta communities.

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MATERIALS AND METHODS

Study Area

Kuenzer et al. [9] have confirmed that the Niger Delta is the world's third largest mangrove forest. The landmass that makes up the Niger Delta is fan-shaped and covers an area of around 70,000 km^2. Nigeria's southern region is where the area is located. The two main rivers in the area are the Benue and Niger rivers, both of which empty mostly into the Atlantic Ocean. The area's ecological features are characterized by the existence of a sizable floodplain that is the consequence of sediments deposited and accumulated downstream by the Benue and Niger river[10]. According to [11]documentation, the Niger Delta area consists of a coastline length that spans around 450 kilometers. The United Nations Development Programme [12] estimates that there are around 30 million people living in the area. The wetland under issue is the largest in Africa and among the largest in the world, according to [13]. Nigeria's main hub for oil production is the Niger Delta region, which includes the states of Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Ondo, Imo, and Rivers [14]. The region in question makes up around 7.5% of the total land area of Nigeria. [15] indicate that the area in question consists of nine southern states in Nigeria and contains 186 Local Government Areas overall, home to more than 25 million people. The area in issue is well known for having suffered significant ecological devastation, primarily as a result of massive oil and gas production operations. The main issue facing the Niger Delta area and its people, according to [16], is the negative effects of hydrocarbon contamination.

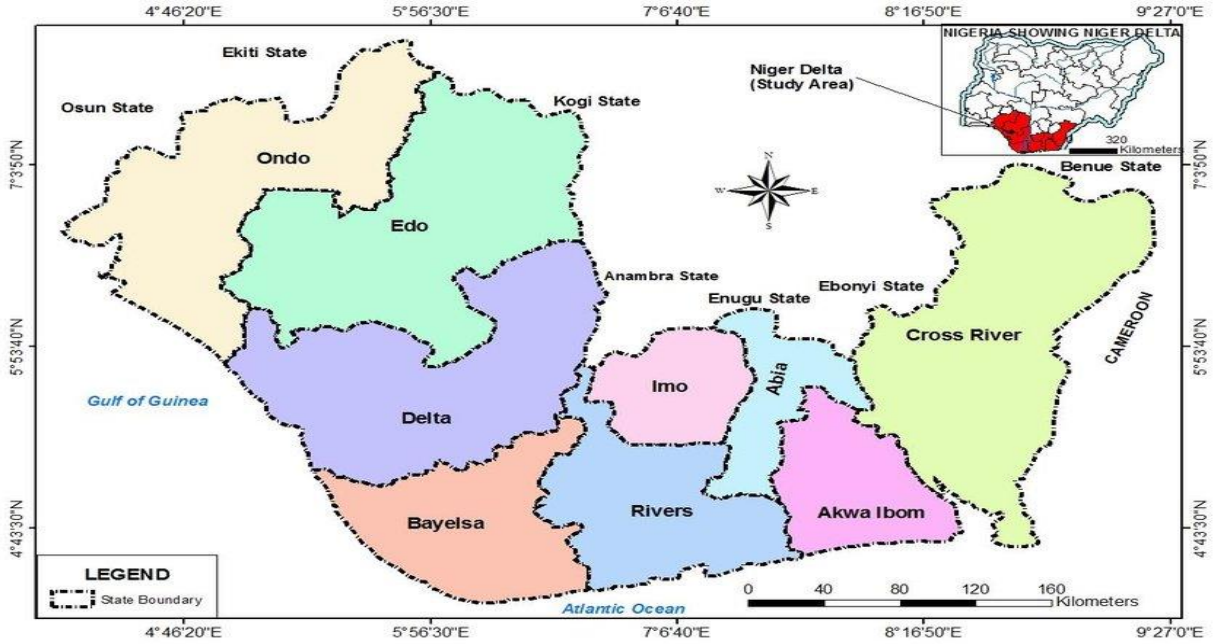

Fig. 1: Map of study Area

Experimental/Sampling Design
The research is an exposure research and a quantitative research. A total of four sampling stations in Port Harcourt, Niger Delta communities were used in the study.

Duration of the Study: This research was carried for six months, between January 2022 and June, 2022. Samples were collected once on monthly basis.

Data collection
Before commencing the sample process, a preliminary survey was undertaken at several study locations. The preliminary sample was carried out during the scouting visit with the purpose of acquainting ourselves with field methodology, familiarising ourselves with the sampling stations and equipment, and, of utmost importance, reducing any potential errors in sampling and handling. The process of collecting water samples was carried out for a duration of 6 months, adhering to the established methods specified by [17]. The geographical coordinates of the sample sites were determined in situ using portable GPS technology, namely the Garmin Extrex device. The GPS device was initialised at each station and allowed a duration of around 2-3 minutes to achieve a level of stability. The measurements were subsequently acquired from the device and recorded in accordance with the study done by [18].

Water sampling
The sampling of surface water and sediment was carried out following a previously established approach, with some modifications included (Changbo et al., 2018). In order to conduct surface water sampling, a total volume of thirty litres of water samples were collected from the uppermost layer, namely within the depth interval of 0 to 30 cm. The data collection was conducted utilising a well cleaned big flow sampler prior to the commencement of the study. The collected water was subjected to filtration using a stainless steel sieve with a pore diameter of 45 μm. The sediments that were found on the sieve were carefully rinsed into a glass container with a volume of 1 litre, using water that had been deionized. The selection of a preservation solution comprised of a 5% formalin concentration was made for this specific objective. At each sampling location, three replicate samples were collected. In order to decrease the risk of cross-contamination, the sampler and stainless sieve were thoroughly cleaned using deionized water throughout each sampling interval.

Isolation of Microplastics
In order to minimise the impact of organisms and sediments on the acquired samples, a methodology was implemented to separate the microplastics from the gathered specimens. The pre-processing of samples was carried out with a methodology recommended by the National Oceanic and Atmospheric Administration [19], but with some modifications. During the treatment of the surface water samples, a solution of hydrogen peroxide with a concentration of 30% (v/v) was utilised to eradicate visible organisms that were present in the samples. The catalyst used in this experiment was a solution of ferrous sulphate. The density separation procedure involved the

use of a zinc chloride solution with a density of 1.5 g/cm3 to selectively remove sand and minerals from the samples. In this study, a basic density separator was utilised. A metallic frame made of iron, together with a corresponding iron ring, was placed on the laboratory bench. A glass funnel was attached to a latex tube at the lower end of its stem. Furthermore, the implementation of a pinch clamp will be employed to control the liquid flow originating from the glass funnel. The supernatants were acquired by the use of a density separator and afterwards filtered using a GF/C filter with a particle size of 0.22 µm (Membrane Solutions LLC., Kent, WA, USA). In light of the possibility of filter curling during the process of natural air drying, it is regarded essential to utilise an alternate approach. As a result, all filters will undergo a drying process in an oven, which will be maintained at a temperature of 60°C.

Observation and Identification of Microplastics

The filters that underwent treatment were meticulously placed into a well sterilised Petri plate to enhance subsequent examination. The Petri dishes were placed underneath a stereomicroscope that was coupled with a digital camera in order to facilitate examination. The identification of particles that were thought to be present was predicated upon their morphological characteristics. The procedure of identification was dependent on the categorisation criteria that were created in previous study studies[20]. The researchers recorded the many attributes of the microplastics, encompassing their quantity, dimensions, morphology, and chromaticity. The microplastics were categorised into four discrete categories according to their size: A1 (<0.5 mm), A2 (0.5–1 mm), A3 (1–3 mm), and A4 (3–5 mm). Previous studies [21]conducted the classification of microplastics into four separate categories based on their physical characteristics. The aforementioned classifications encompass fibre, fragment, pellet, and film. In adherence to established academic norms, it is common to designate an elongated and thin structure with a narrow form as a "fibre." Fragments, however, are inflexible residues that originate from a split plastic item. Debris characterised by a thin coating is frequently denoted as "film." According to Changbo et al[22] microplastics that exhibit spherical and cylindrical shapes are frequently referred to as "pellets". After the conclusion of the microscopic examination, the microplastics that were detected were subjected to identification using a spectroscope. The laser's wavelength utilised in the experiment was set to 532 nm, as documented by Wang et al. (2018) and Zhang et al. (2016). The Raman spectra seen in this study spanned a range of 50 to 3500 cm−1. The quantification of microplastic content in water and sediment is conducted using measures of items per cubic metre (items/m^3) and items per kilogramme (items/kg), respectively [23].

Sample Collection

During the time spanning from January to April 2022, fishermen were recruited to gather fish samples by employing fishing netts from their boats. The identification and documentation of several fish species were conducted using the approach described in [24] study. The study involved the collection of a comprehensive sample of fish, consisting of more than 500 individuals from various species. Each pooled fish sample comprised 2-5 individual fish samples that had the same species classification. The samples that were gathered were classified into three unique groups

based on the specific habitat of the fish: benthic, pelagic, and migratory. The fish samples were wrapped in aluminium foil and stored in a portable cooler box, maintaining a temperature range of 0–4 °C. Following this, the collected samples were expeditiously conveyed to the laboratory and subjected to freezing at a temperature of -20 °C, as described by [25]. The measurements and documentation of fish data, including length, weight, and sex, were conducted prior to the dissection and grinding procedures. The musculature and organs of the fish were removed from the skeletal structure using a stainless-steel device, and afterwards homogenised in a blender. A amount above 30 grammes of homogenate was retained for the purpose of measuring microplastics. Subsequently, the collected samples were treated to freeze-drying and subsequently stored at a temperature of -20 °C until they were subjected to chemical analysis, as described [26].

Statistical Analysis

The statistical analysis was performed utilising the Statistical Package for Social Science (SPSS), Version 25.0. Descriptive statistical measures, namely the mean and standard deviation, were utilised to ascertain the average levels of plastic pollutants. The study employed inferential statistics, especially analysis of variance (ANOVA), with a significance threshold set at 0.05. The statistical analysis employed the Tukey test to determine the significance of the observed differences between the groups, with the aim of calculating the mean separation.

Quality Assurance and Quality Control

This study employed several measures to minimise the potential for background contamination during both the sample collection and laboratory processing phases. During the whole duration of the experimental procedures, the researchers wore cotton laboratory coats and nitrile gloves. Before use, all containers and experimental apparatus underwent a comprehensive cleansing procedure, which entailed three cycles of washing with ultrapure water. Furthermore, during periods of non-utilization, these objects were suitably shielded with aluminium foil. [27] conducted a series of four tests with the aim of examining possible contamination. The experiments encompassed the use of parallel processing techniques for both the samples and the background contamination levels originating from the laboratory. Nevertheless, a precise quantity of thirty litres of distilled water was meticulously filtered using a GF/C filter. Following this, the aforementioned filters were introduced into the laboratory setting, where they were left exposed for a period of 72 hours. After a duration of 72 hours, the filters were subjected to examination under a stereomicroscope to ascertain the existence or non-existence of microplastics and phthalates. The absence of microplastic present in the study shows that the researchers may have failed to consider the potential background contamination.

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RESULTS AND DISCUSSION

Polycyclic Aromatic Hydrocarbon (PAHs) in Water from Aleto, Woji, Bonny/Bille/Nember and iwofe Rivers, Rivers State, Niger Delta

This research was conducted with the intention of determining the concentrations of polycyclic aromatic hydrocarbons (PAHs) that were present in surface water samples taken from four different rivers in the Niger Delta city of Port Harcourt. According to the findings of the research, Aleto, Woji, Bonny/Bille/Nembe, and Iwofe are the four rivers in question. The findings of the inquiry demonstrated the presence of ten distinct polycyclic aromatic hydrocarbon (PAH) congeners. These congeners are as follows: naphthalene; acenapthene; acenapthylene; phenanthrene; anthracene; fluoranthene; pyrene; benzo(a)anthracene; and benzo(a)pyrene. The amounts of naphthalene that were detected at Stations 4 and 3, respectively, ranged within the range of 0.0120.001mg/L to 0.0280.001mg/L. There was a significant difference (P 0.05) in the amounts of naphthalene found at each of the research sites when compared to one another, according to the findings of the study. The acenapthene concentrations that were detected at Stations 2 and 3 ranged from 0.0130.001mg/L to 0.0320.002mg/L, respectively. This range was seen throughout both stations. When comparing the amounts of acenapthene at each of the different stations that were investigated for this investigation, a statistically significant split was seen (P less than 0.05). The concentrations of acenapthylene that were found in Stations 4 and 3 varied from 0.0110.002mg/L to 0.0260.012mg/kg. During the course of the study, a difference in the levels of acenapthylene that was considered to be statistically significant (P 0.05) was observed. The phenanthrene concentration in Stations 4 and 3 varied from 0.0100.001mg/L to 0.0260.012mg/L, with a standard deviation of 0.001 mg/L. The concentrations of anthracene at Stations 4 and 3 varied from 0.0100.001mg/L to 0.0270.012mg/L during the course of the study. At Station 4, the levels of benzo(a)pyrene ranged from 0.0120.001mg/L to 0.0240.001mg/L, whereas at Station 3, the values were between those two extremes. The amounts of benzo(a)pyrene in the several samples that were evaluated for the study showed a statistically significant disparity (P 0.05), as shown by the symbol. The following information may be found in the table that is following:

Table 1: Polycyclic Aromatic Hydrocarbon in Human Blood from Eleme and Port Harcourt Local Government Areas, Rivers State

	Eleme LGA			Port Harcourt		
PAHs	**Minimum**	**Maximum**	**Mean±SD**	**Minimum**	**Maximum**	**Mean±SD**
Naphthalene	.0307	.0501	.0404±0.0021	.0031	.0050	.0042±0.0010
Acenapthene	.0114	.1077	.1000±0.5050	.0041	.0141	.0132±0.0000
Anthracene	.0122	.0300	.0230±0.0083	.0141	.0151	.0142±0.0000
Dibenzo(a,h)anthracene	.0325	.0518	.0426±0.0000	.0035	.0059	.0042±0.0061
Benzo(g,h,i)perylene	.0714	.0920	.0807±0.0423	.0013	.0015	.0014±0.0000
Pyrene	.0062	.0095	.0077±0.0313	.0013	.0081	0.0055±0.0351
Benzo(k)fluoranthene	.0052	.0123	.0100±0.0000	.0001	.1011	.1101±0.0176
Benzo(a)pyrene	.0044	.0082	.0060±0.0052	.0000	.0010	.0010±0.0004
Benzo(a)anthracene	.0566	.0666	.0665±0.0000	.0145	.0260	.0152±0.0000

Levels of Phthalates in Water, Sediment and Fish in Niger delta, Nigeria

The results of this study reveal that the concentrations of phthalates in the Iwofe and Aleto rivers ranged from 36.40000±.100000mg/L to 54.2000±.5196 15mg/L, respectively. The sediment samples obtained from the Iwofe and Aleto regions had quantities that varied from 38.58667±.642910mg/kg to 56.48667±.318800mg/kg, correspondingly. The levels of phthalates in fish samples of P. monodon and T. guinensis obtained from the Iwofe and Aleto rivers exhibited a range of values, specifically ranging from 40.2133±0.00577mg/kg ww to 59.0770±0.10922mg/kg ww, respectively.

Table 2: Levels of Phthalates in Water, Sediment and Fish in Niger delta, Nigeria

Sample	Station	Mean	Std. Deviation	Minimum	Maximum
Water	Aleto River	54.2000	.5196 15	53.900	54.800
	Woji River	40.20000	.100000	40.100	40.300
	Bonny/Bille/Nembe River	44.70000	.100000	44.600	44.800
	Iwofe River	36.40000	.100000	36.300	36.500
Sediment	Aleto River	56.48667	.318800	56.200	56.830
	Woji River	53.14333	1.045674	52.120	54.210
	Bonny/Bille/Nembe River	48.05000	1.357092	46.620	49.320
	Iwofe River	38.58667	.642910	38.120	39.320
Fish	*Tilapia guinensis* (Aleto River)	59.0770	.10922	59.00	59.20
	Callinectes sp. (Woji River)	54.1700	.96379	53.29	55.20
	Liza grandisquamis (Bonny/Bille/Nembe River)	50.5567	2.27546	48.01	52.39
	Paeneus monodon (Iwofe River)	40.2133	.00577	40.21	40.22

Furans in Water, Sediments, and Fish from Aleto, Woji, Bonny/Bille/Nembe, and Iwofe Rivers

The findings of this investigation indicate that the amounts of furans varied between .00001±.00001mg/L and .00004mg/L in the Woji and Aleto areas, respectively. The concentration of furans in the sediment samples collected from Iwofe and Aleto varied from .00100±0.00000mg/L to .00233mg/L, respectively. In a correlated advancement, the concentrations of furans in the Iwofe and Aleto areas were seen to vary between .00300±.00000mg/L and .00600±.00100mg/L, respectively. The following items are observed in the table provided:

Table 3: Furans in Water, Sediments, and Fish from Aleto, Woji, Bonny/Bille/Nembe, and Iwofe Rivers

Sample	Station	Mean	Std. Deviation	Minimum	Maximum
Water	Aleto River	.00004	.00000	.001	.005
	Woji River	.00001	.00001	.000	.000
	Bonny/Bille/Nembe River	.00003	.00003	.000	.000
	Iwofe River	.00002	.00000	.000	.000
Sediment	Aleto River	.00233	.001155	.001	.003
	Woji River	.00100	.000000	.001	.001
	Bonny/Bille/Nembe River	.00133	.001528	.000	.003
	Iwofe River	.00100	.00000	.001	.001
Fish	*Tilapia guinensis* (Aleto River)	.00600	.00100	.003	.005
	Callinectes sp. (Woji River)	.00300	.00000	.003	.003
	Liza grandisquamis (Bonny/Bille/Nembe River)	.00533	.00058	.005	.006
	Paeneus monodon (Iwofe River)	.00500	.001000	.004	.006

Dioxin in Water, Sediment and Fish from Niger Delta

The results of Dioxins in the study shows that in water, dioxin ranged from .00005±.00003mg/L to .00009±.00002mg/L in Iwofe and Aleto rivers. Also, in sediment, dioxin ranged from .00100±.00100mg/kg to .00200±.00001mg/kg in Iwofe and Aleto respectively. In a related development, dioxin ranged from .00467±.000577mg/kg to .00767±.000577mg/kg in Iwofe and Bonny/Bille/Nembe river respectively.

Table 4: Dioxin in Water, Sediment and Fish from Niger Delta

Sample	Station	Mean	Std. Deviation	Minimum	Maximum
Water	Aleto River	.00009	.00002	.000	.000
	Woji River	.00002	.00003	.000	.000
	Bonny/Bille/Nembe River	.00008	.00004	.000	.000
	Iwofe River	.00005	.00003	.000	.000
Sediment	Aleto River	.00200	.00001	.002	.002
	Woji River	.00100	.00003	.001	.001
	Bonny/Bille/Nembe River	.00100	.00100	.000	.002
	Iwofe River	.00133	.000577	.002	.003
Fish	*Tilapia guinensis* (Aleto River)	.00667	.001528	.003	.006
	Callinectes sp. (Woji River)	.00267	.000577	.002	.003
	Liza grandisquamis (Bonny/Bille/Nembe River)	.00767	.000577	.007	.008
	Paeneus monodon (Iwofe River)	.00467	.000577	.006	.007

Degree of Contamination

The degree of contamination was 7.300 mg/kg, 11.940 mg/kg, 8.699 mg/kg, and 7.982 mg/kg in Stations 1, 2, 3, and 4 (Table 4.6).

Table 5: Degree of Contamination

Station	Degree of Contamination
Aleto River (Station 1)	7.300
Woji River (Station 2)	11.94
Bonny/Bille/Nembe River (Station 3)	8.699
Iwofe River (Station 4)	7.982

The presence of polycyclic hydrocarbons (PAHs) in fish

The study's findings indicate that polycyclic aromatic hydrocarbons (PAHs) are present in considerable quantities in two rivers in the Niger Delta region of Port Harcourt, Rivers State: the Aleto and Bonny/Bille/Nembe. The results of this investigation suggest that a variety of toxicological effects might occur. Additional sources of polycyclic aromatic hydrocarbons (PAHs), which may be to blame for the potential contamination of seafood in the region, include pipeline leaks, vandalism, and artisanal refining. The aforementioned activities, namely those occurring in the Bonny/Bille/Nembe and Iwofe rivers, possess the capability to be a contributing cause to the existence of polycyclic aromatic hydrocarbons (PAHs) in seafood. The amounts of polycyclic aromatic hydrocarbons (PAHs) discovered in this research are in line with the findings of an earlier investigation conducted by Adeigbe and [28]. Research has shown that after being ingested, polycyclic aromatic hydrocarbons, or PAHs, tend to cluster in the adipose tissues of fish. This phenomenon may be explained by the lipophilic characteristics inherent in PAHs. The author recommends that while examining the potential health risks associated with hydrocarbons, the development of cancer should be the main area of worry. The research's conclusions suggest that there could be a relationship between the group that was the subject of the study's measurable quantities of polycyclic aromatic hydrocarbons (PAHs) and rate of cancer. [29] previous study has a striking resemblance to this occurrence. The premise from that previous study was that exposure to polycyclic aromatic hydrocarbons (PAHs) increases the risk of developing cancer in a number of body tissues, including the skin, stomach, bladder, and lungs. Additionally, there are many similarities between this phenomena and a previous study conducted by [30]. [31]state that the specific way in which this risk manifests depends on the kind of exposure and the specific PAH species involved. [32] found a similar correlation between polycyclic aromatic hydrocarbons (PAHs) in seafood and higher cancer rates among residents living near oil fields compared to residents living farther away from such areas.

This seems to have something to do with a previous research that Obara and E conducted. [33] states that it is considered inadequate to evaluate polycyclic aromatic hydrocarbon (PAH) contamination in food just based on benzo[a]pyrene as a marker. According to Nangih, this is due to the insufficiency of depending only on benzo[a]pyrene. For assessing the total amount of polycyclic aromatic hydrocarbons (PAHs) in food, it has been shown that a composite of benzo[a]pyrene, benzo[a]anthracene, chrysene, and benzo[b]fluoranthene—collectively known as PAH4—is a more suitable metric. There is greater acceptance for this parameter. The establishment of maximum regulatory limits for the content of polycyclic aromatic hydrocarbons (PAH) in food has also been based on this cumulative study. These limitations are the product of the assessment's findings. Polycyclic aromatic hydrocarbons (PAHs) typically have a baseline content of 0.01 to 1 g kg1 (micrograms per kilogramme) in unprocessed foods like fish.
Since a significant portion of the indigenous population's overall protein intake comes from fish eating, the findings of this study have significant implications for the area of food safety studies in the Niger Delta. These consequences have significant implications for the current state of this field's study. The primary objectives of the inquiry are to ascertain the presence of polycyclic

aromatic hydrocarbons, or PAHs, and evaluate any possible health hazards that these substances may provide to people. The transportation of seafood from the above-mentioned places to other parts of the country that are situated within Nigeria may expose the larger Nigerian populace to the chronic pollution. Studies of this kind have been published in relation to this assertion, and they indicate that the importance of guaranteeing seafood safety in the context of international fish trade cannot be overstated, particularly given the industry's recent surge in popularity [34]. This claim's documentation is based on this research. People all throughout the world depend heavily on fish for their nutrition, but this is particularly true in Nigeria, a nation that is now experiencing substantial socioeconomic transformation. Approximately forty percent of Nigeria's protein intake comes from fish, with an average annual per capita consumption of thirteen and a half kilogrammes, or thirty-nine and a half grams per person, each day. The stated amount of consumption is much more than the average worldwide of 20,3 kg per person year. The Niger Delta's coastal artisanal small-scale fisherman contribute significantly to Nigeria's domestic fish supply, according to the [35]. These fishermen are in charge of almost 80% of the nation's total fish production, indicating that they make up a significant chunk of the sector. The occurrence of polycyclic aromatic hydrocarbons (PAHs) in various food and environmental matrices has been the subject of much research. But research into their presence, particularly in seafood, has gotten much less attention[36].

CONCLUSION

The results of this research show that the presence of plastic waste and other waste products produced by humans has a detrimental effect on the surface waters that are the subject of the examination. These results suggest that plastic waste may have a negative impact on water quality, which may have health consequences for people. This research also shows that plastic and other hydrocarbon-based materials from gas and oil sources have polluted the waterways. The physical sample collection revealed this pollution, suggesting that the water is now dangerous for the local populace. According to THQs and HI, the non-carcinogenic risk assessment of the current investigation, eating fish has no appreciable detrimental effects on health. The levels of polycyclic aromatic hydrocarbons (PAHs) were higher than allowed.

Recommendations

The following suggestions are offered on the basis of the results of this study:

1. The government and Rivers State ministry of environment should regulate the spate of plastic waste disposal and monitor and enforce standards to curb this ugly trend.
2. Regular water quality monitoring should be carried out on both surface and underground water sources in the Niger Delta in order to evaluate the impact of the indiscriminate disposal of plastic wastes in the environment and possible consequences on the health of the people as provided by regulatory authorities.
3. There should be fish cash and environmental toxicology studies as part of the environmental management plan for assessment of health implications of plastic wastes in the Niger Delta.

4. Students and other researchers should carry out long-lived research on various health aspects of the residents of the area and beyond in order to ascertain the change that have occurred over the years as a results of impropoer plastic wastes disposal in the various aquatic ecosystems in the Niger Delta.

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