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OIL SPILL AND SURFACE WATER POLLUTION IN SOME COMMUNITIES OF DELTA STATE, NIGERIA

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ABSTRACT

Oil exploration in the Niger Delta and specifically in Delta State over the years has brought a lot of environmental degradation deterioration leading to surface water pollution. This work addresses surface water pollution status in some oil producing communities. In order to achieve this, data was collected using a survey and experimental design as well as questionnaires to elicit information from respondent on some effect of water quality. Samples were collected from Six (6) oil producing communities of Tebu, Tisun, Okpail, Emedadja, Ote-Do, and Okpara. Sample were collected using purposive and systematic techniques. A total of two hundred (200) questionnaires was administered and analyzed using simple percentage and presented in charts and tables. It was discovered from the analysis that they were various sources leading to oil spillage such as pipe line vandalization, well blow out, sabotage, and spills from loading of oil vessels. It was also discovered that some communities had a high level of water alkalinity above the recommended WHO standard as well as total soluble solutes which were also above the recommended standard for WHO/DPR. Also, total dissolved oxygen in all the communities is greater than the recommended WHO/NAFDAC. A BOD greater than 10mg/l was also discovered which indicates the presence of effluents. It was therefore recommended that they should be drilling of massive boreholes in the various communities for potable water for domestic and agricultural use by NGO's and government.

Keywords: Oil spills; potable water, pollution status; biological oxygen demand and total suspended solids.

1. INTRODUCTION

In most countries of the world especially the developing ones, oil exploitation has led to several devastating environmental problems in the form of water pollution (Mogborukor, 2014). The surface water polluted can either be for domestic, industrial and for agricultural purpose. Delta State as part of Nigeria, is one of the largest oil producing (Wogu, 2000) and generate over 90 percent of the nation's foreign exchange earnings.

Since the 1970s, Nigeria's socio-economic and political fortune have been intricately linked with oil explorations, with petroleum oil providing about 95 percent of exports earnings and accounting for over 80 percent of government revenue as well as generating over 40 percent of the GDP. It is revealing to note that the oil that generate these numerous benefits to Nigeria come solely from the Niger Delta region. However, the paradox is that while oil from Niger Delta has generated massive economic and social transformations of many parts of the country

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on the one hand, it has resulted into unparalleled damage to the Niger Delta environment thus inducing a multifaceted problem in the region (Sajini, 2015).

The exploration and production of petroleum (oil and gas), and its subsequent transportation and distribution in the Niger Delta have led to degradation and subsequent pollution of aquatic habitats with serious threats to associated flora and fauna (Akinjide,1997). Oil spills in the Niger Delta have been a regular occurrence, and the resultant environmental degradation of the surrounding environment has caused a significant tension between the people living in the region and the multinational oil companies operating there (Ibama & Eyenghe, 2015). Oil spill has also destroyed farmlands, polluted ground and drinkable water and caused drawbacks in fishing in the coastal area. Spills which are the major challenge in the exploration and exploitation of petroleum affect the ecosystem in several ways. Fishes and other aquatic organisms use the food-rich estuary and creeks as breeding, nursery and feeding grounds and spend their adulthood in the nearby ocean, but the oil spills have reportedly driven them away (Ibama & Eyenghe, 2015). Hunting is also impacted because the affected vegetation and the depleted environment may adversely affect survival rates of wildlife. Hunters in the affected areas usually complain that their occupation is negatively affected by spills. The basic activity of the people is fishing and farming. Therefore, the spill and its effects will linger for a long time especially with the thorns and thistles all over oil spill affects the amenity value of the area in several ways. Contamination of coastal amenity areas is a common feature of many oil spills leading to disquiet and interference with recreational activities such as bathing, boating, angling and diving. The spills also affect household income. The terrestrial life and the aquatic life in the impacted areas are substantially destroyed. Apart from spending money to buy basic foodstuffs from other farmers, it is also evident that peoples' diets are also prone to serious adjustment. The vegetation is indicative of the unproductive nature of the soil. It is possible that it would take as long as 15 years or more for spill-impacted soils to regain fertility. Due to the high effects of oil spills in Warri South Local Government Area of Delta, living condition of the people in the area is increasingly becoming unbearable; they continue to groan under the degrading impacts of oil spills which have affected both the land and water bodies in the area. A study conducted by Ugbomeh (2012) revealed that oil industry within the study area constitutes a potential hazard to the surrounding farm lands of Ubeji and Ekpan area of Warri South by way of contributing to the presence and increase concentration of heavy metals in the soil areas sampled. Also, Atubi (2015) inserted that the oil producing communities in Delta state thus is under increasing pressure from rapidly deteriorating ecological and economic conditions, social dislocation and tension in communities which are not being addressed by current policies and behaviour patterns. It is based on these identified challenges in oil producing communities in Delta State that this study tends to empirically evaluate the resultant consequences of the impact of oil spill on surface water in selected oil producing communities in Delta State.

2. MATERIALS AND METHOD

Study area

Warri is located between Latitude 5”30 and 5^{0}33’N and Longitude 5”29 and 5”48’E (Fig 1).

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Fig 1.1 Delta State map showing Local Government Area.
Source: Field work, 2024

It is a coastal town within the oil rich region of Nigeria. Its population was 280,000 in 1981. Which grew rapidly to over 500,000 in 1991 (National Population Commission 1991) as a consequence of urbanization results from oil exploration and petroleum refining activity within the area. The topography is a flat terrain with an average height of about 0.6 above sea level. These flat and low relief features often encourage water stagnation after rain events, climate is equatorial type with annual mean rainfall greater than 3000mm and mean temperature of about 28^0C (Iloeje, 1981). The area is drained by the tide-influenced River Warri and two creeks that empty into Rivers Forcados. The study area is directly underlain by a Quaternary formation, the somebreiro-Warr Deltaic plain sand (Olobaniyi and Owoyemi, 2004). This formation consists of a fine to medium and coarse gained unconsolidated sands with occasional intercalations of gravely beds, peat or lenses of plastics clay. The sandy and gravely horizons constitute prolific aquifers that are tapped by shallow wells in the area. This formation is generally in excess of 100 metres in thickness. Below the Somebreiro-Warri Deltaic Plain sands are the three stratigraphic units that constitute the Niger Delta. These include the Benin, Agbada and Akata formations in order of increasing age. These characteristics had led to overland flow immediately after every rain event.

Water samples was collected in the study area of (Tebu, Tisun, Okpaile, Emedadja, Ote-Do, Okpare, Benikrukru and Kokodiagbene) for laboratory analysis. Out of Eight (8) Oil Producing communities, only six (6) local government areas were selected for this study which is home to several oil producing communities in the area of study; these are Tebu (Warri South), Tisun

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(Warri North), kokodiagbene (Warri South West), Benikrukru (Warri South North), Okpaile (soko North), Emedadja (Udu), Okpare (Udu), Ote-Do (Udu) (See Fig. 1.2

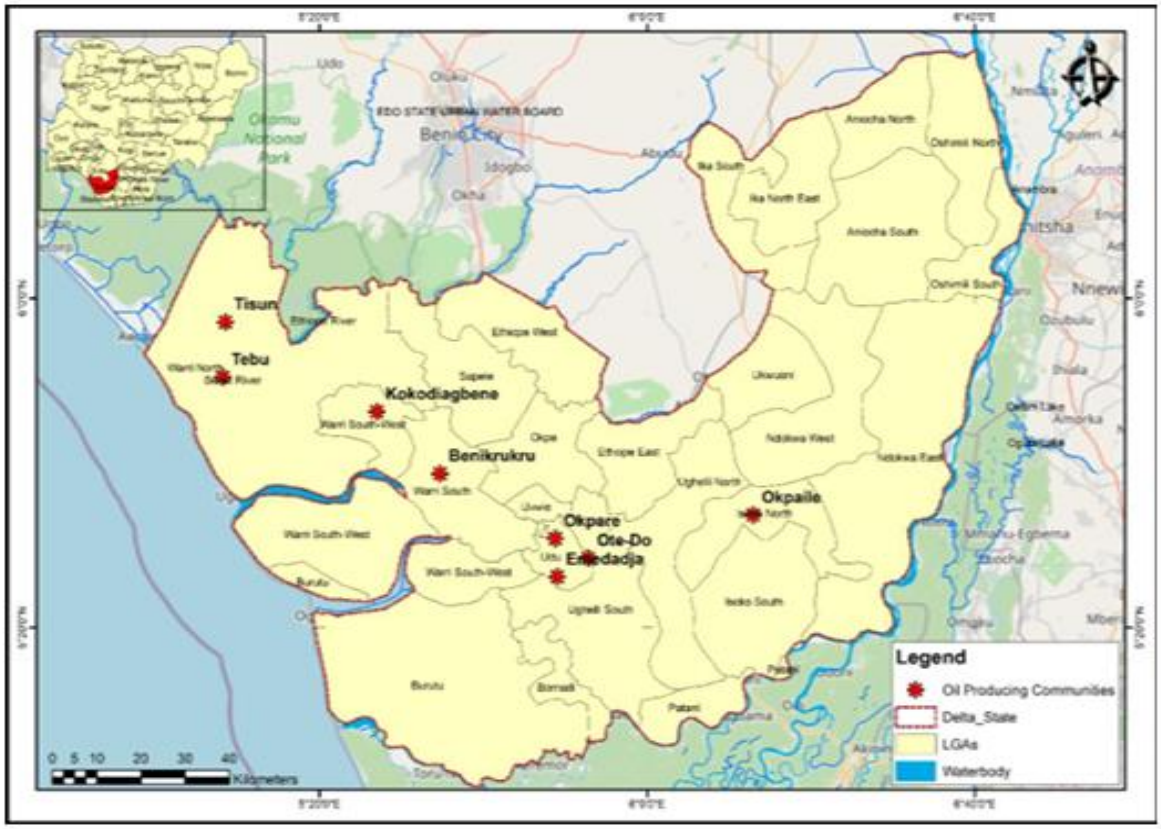

Fig. 1.2: Map showing selected Oil producing communities
Source: fieldwork, 2022

The researcher employed a propulsive sampling technique in the eight (8) Oil Producing Communities in the six (6) LGAs selected. In order to get equal representation, 25 respondents were selected randomly from each of the selected oil producing communities to make a total sample size of 200 respondents used for the study. Also, six sampling points were selected and identified for water quality status using the systematic sampling technique. These six (6) sampling points include; Tedu (Warri South), Tisun (Warri North), Benikrukru (Warri South North), Okpaile (Isoko North), Okpare and Ote-Do (Udu) along with random sampling technique which was employed in the administration of questionnaire. Twenty five (25) structured questionnaires were administered to each of the selected communities. In all, two hundred (200) copies of questionnaires were administered to the eight oil producing communities selected from the state respectively.

The questionnaires were administered to household heads employing the simple random technique. However, if any household is not literate enough interpreters were employed to use vernacular. To ensure an even distribution of the questionnaire a systematic sampling technique of an interval of every seven (7) houses in each street to one respondent was used. Samples of

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surface water was collected using the grab sampling method. The samples were collected using 5 liter plastic containers, which were rinsed with distilled water before collection. The water were put in a container and titled sample A-F after which it was taken directly to the laboratory for water analysis. The measurements were taken for a period of one week considering transport cost and locality of the environment.

3. RESULTS AND DISCUSSION

Data obtained from the field was through administration of questionnaire and analysis of surface water impacted. This is presented and discussed below:

Demographic Characteristics of Respondents

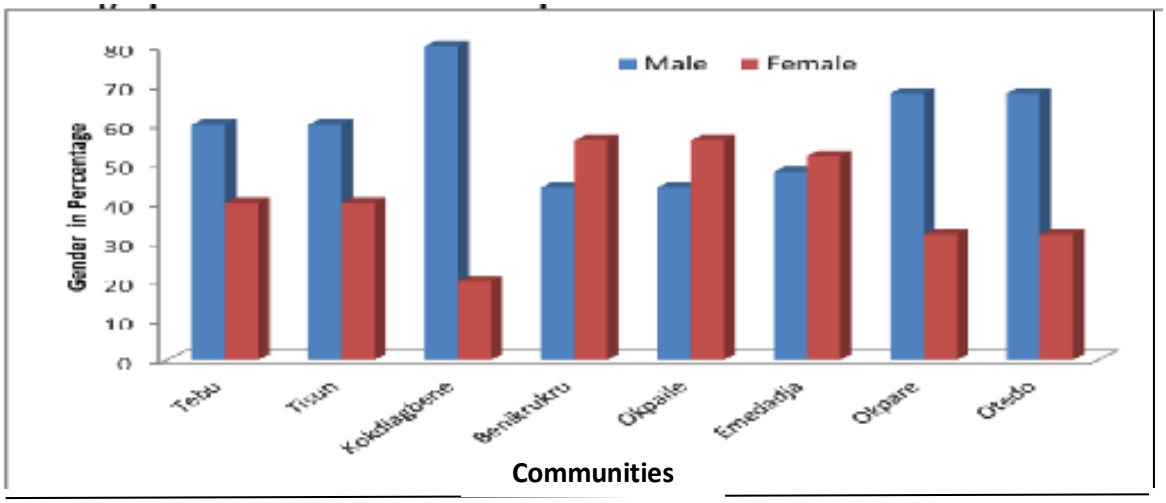

Fig 1.3 Bar Chart showing Gender Distribution of Respondents by Communities

The data presented in above Fig 1.3 showed explain the sex distribution of respondents in the various communities. The graph indicated that Tebu and Tisun communities comprised of 60% male respondents and 40% female respondents respectively as compared to the respondents from Kokodiagbene who comprised of 80% males and 20% females. Similarly, respondents in Benikuru and Okpaile were made up of 44% males and S6% females respectively. In the same vein, respondents from Emedadja had 48% males and 52% females as compared to respondents from Okpare and Otedo had 68% males and 32% females each. It could be observed that a total of 59% of the respondents from the various oil producing communities are males while 41% are female. The inference drawn from the questionnaires indicate that more male responded to the question raised than their female counterpart.

Occurrence of Oil Spillage in the Area

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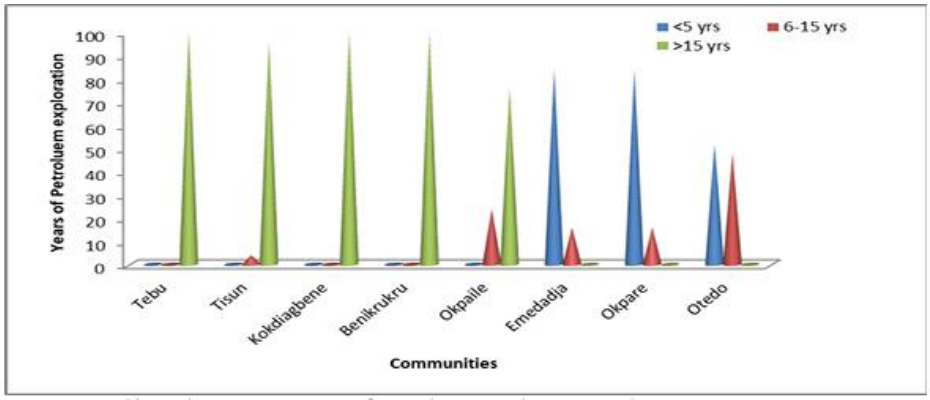

Fig 1.4 Bar Chart showing Duration of Petroleum Exploration in Communities

Fig. 1.4 shows the duration of oil exploration and extraction in the various communities. In Tebu, Kokodiagbene and Benikrukru, all of the respondents (100%) agreed that there had been oil exploration above 15 years. For Tisun, only 4% of the respondents said it has been between 6-15 years while 96% respondents indicated above 15 years. Okpaile community had 76% respondents who agreed that it was over 15 years while 24% said it was between 6-15 years, Similarly, respondents (84%) from Emedadja and Okpare communities agreed it was less than 5 years while 16% agreed it was for between 6-15 years respectively. Ote-do community showed that 52% respondents agreed exploration has been on for less than 5 years, 48% greed it has been on for 6-15 years.

From the above, it can be deduced that 27% believed oil exploration has been on for less than 5 years, 14% submits oil exploration has been on for about 6-15 years, while 59% believed the extraction of oil has been on for more than 15 years hence, the resultant effect of oil spill on surface water in the areas.

Vulnerability of Oil spillage

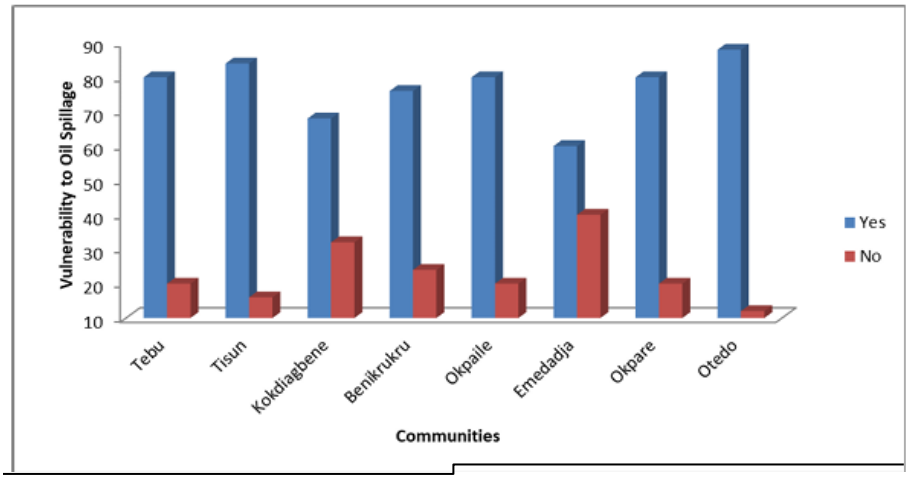

Fig 1.5 Bar Chart showing Vulnerability of Oil spillage

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In Fig 1.5 indicate the respondent's opinion on vulnerability to spillage in the communities. Majority of the respondents in the different oil producing communities agreed that they were all vulnerable to oil spillage which devastated their natural environment and have serious effect on surface water. Data revealed evidence-based occurrence of oil spillage in these munities with a minimum of 2-3 years interval in at least three communities (Tisun kokodiagbene and Benikrukru) and in other communities having reported prevalence of monthly, quarterly and yearly oil spillage.

Frequency of Oil Spillage in Selected Communities

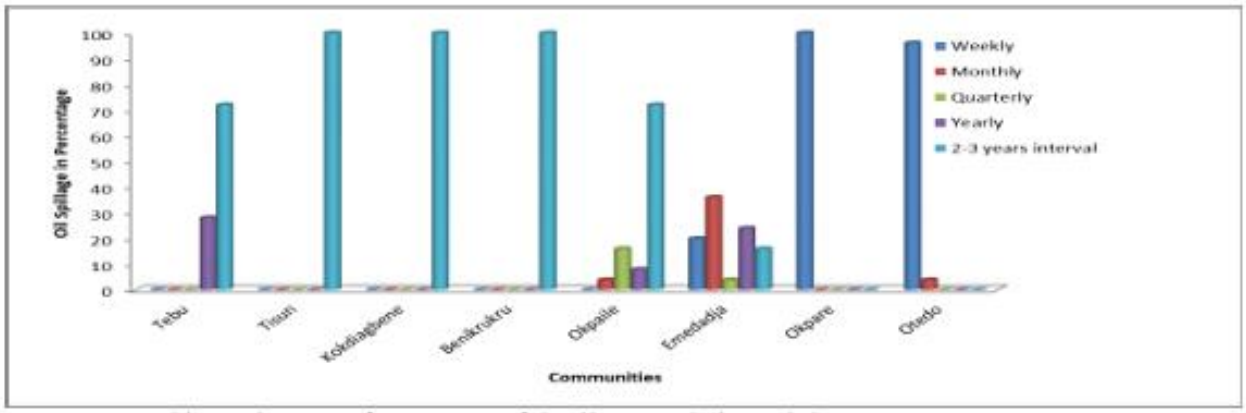

Fig 1.6 Bar Chart showing frequency of Spillage in Selected Communities

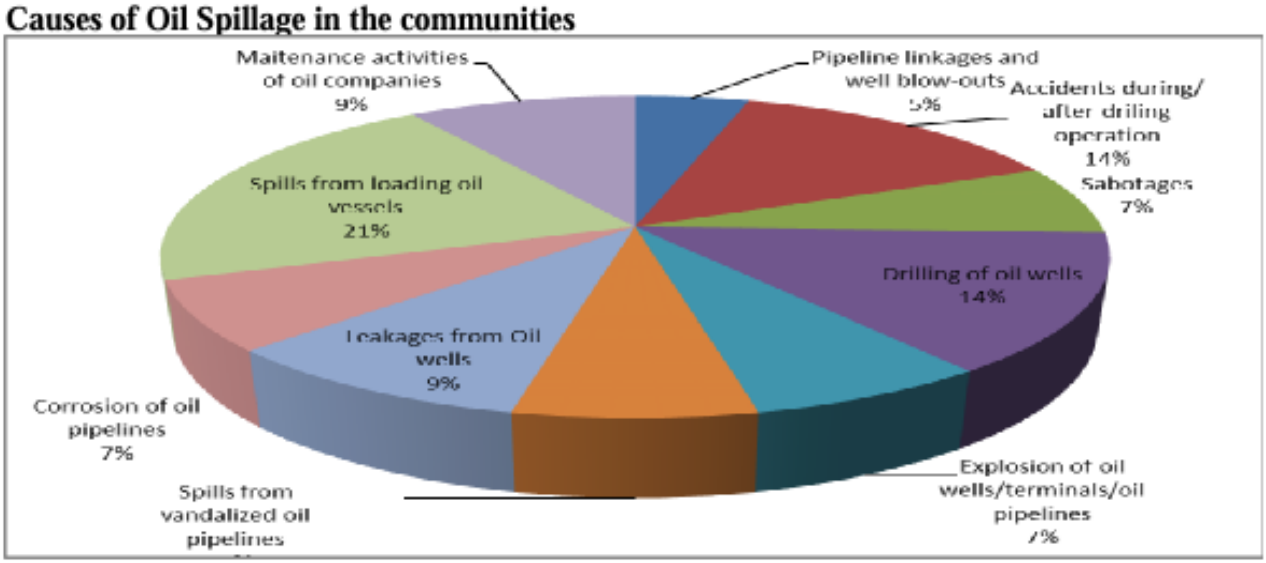

Fig 1.7 Pie Chart showing causes of Oil Spillage

Data presented in Fig 1.7 show the response on the causes oil spillage in the various communities which were linked to different reason across the communities of which about 2% of

the respondents indicated that pipeline leakages and well blow out as the major causes of oil spillage in the different communities within delta state (Okpale, Tebu, Tistun, Benikruknu,

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Kokodiagbene, Okpare, and Otedo) Also, 6% of the respondents said accidents during and after drilling operation, 3% mentioned sabotages 6% said drilling of oil wells. 3% said explosion of oil terminals and wells, corrosion of oil pipelines, and spills from Vandalized pipes respectively are the cause oil spillages in the area, while 4% attributed leakages and maintenance by oil companies were ascribed to causes of oil spillage. 9% of the respondents also attributed spills from loading of oil vessels. 57% the analysis above, was able to deduced that the identified cases of oil spillage in these communities were not different from those that have been previously reported to be leading causes of oil spill which as contributed to issues of environmental degradations in the Niger Delta Region.

Impact of Oil spillage on Community Health

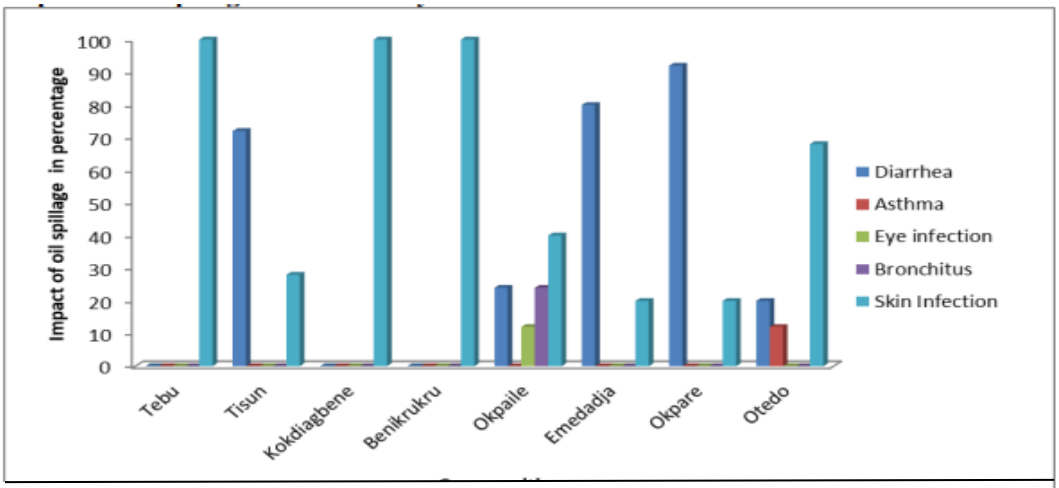

Fig. 1.8 Bar Graph showing Impasct of Oil Spill on Community Health

Fig. 1.8 presents the responses on the impact of oil spillage on community health. Data presented in the table and graph reveals that the most prevalent ailment or health challenge was skin infection which was 100% prevalent in Tebu, Kokodiagbene and Benikruku Communities. Also, 68% respondents of Otedo community and 28%, 20% and 28% respondents and Tisun, Okpaile, Emedadja and Okpare communities had skin infection. Diarrhea was another most prevalent ailment as 12% respondents in Tisun, 24% respondents in Okpaile, 80% respondents in diarrhea. Put together, there were 12 persons amounting to 36% of the entire population with diarrhea, 1% having asthma, 2% having eye infection and 39% with bronchitis. From the analysis above, about 58% of the respondents had skin infection while 36% had Diarrhea, 2% are Asthmatic patients and have and eye infection respectively, and 3% had Bronchitis diseases resulting from oil spillage effects. These manifestations are in tandem with the study of Sako (2017) in a community based study in Koluama reported that data provided by respondents on illness echoed the increased negative effects of oil pollution on the health which in Emedadja, has been previously reported by other studies on the acute and long-term health effects of exposure to oil-related pollution of which Solomon and Janssen (2010) reported that common human health effects of oil spills include nausea, vomiting, dizziness, headaches, and respiratory problem

Quality of Surface Water in the study area relative to WHO and NAFDAC standard

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Table 1.1: Average analytical result of Surface Water in selected oil producing communities

Sample Location	pH	EC (Uscn)	TSS (Mg/I)	TS (Mg/I)	DO (Mg/I)	COD (Mg/I)	BOD (Mg/I)
Okpare	7.2	34.23	23.8	93.6	6.00	20.2	17.67
Tebu	9.2	26.60	23.67	98.67	5.27	19.33	15.67
Kokodiagbene	8.9	24.23	23.25	93.6	4.00	20.2	17.67
Otedo	8.3	18.60	23.67	98.67	5.27	19.33	15.67
Tisun	8.4	14.23	19.5	93.6	6.00	20.2	17.67
WHO/NAFDAC	**6.5-8.5**		**10-15**	**45**	**>3**	**10**	**10**

Source: fieldwork, 2024

Table 1.3 shows the average analytical result of Surface Water in selected oil producing communities within Delta State. From the table, Tebu community was identified with the highest level of water pH which was 9.2 while Okpre had the least pH which was 7.2. The standard water pH for drinking water as recommended by WHO/NAFDAC ranges between 6.5-8.5 which indicates that Tebu community with 9.2 and Kokodiagbene community with pH of 8.9 is above the recommended safe water by WHO which means that the water is highly alkaline and not safe for drinking. This may be accountable for poor health status of the indigenes occasioned by high rate of skin infections and Diarrhea amongst the community indigenes. The surface water electrical conductivity shows that Okpare has the highest with (3423) followed by Tebu (26.23) Kokodiagbene (24.23) Otedo (I 8.6) and Tisun (14.23) compared to community had the least. Put together the electrical conductivity in the communities ranged between 14.23-34.23 and was not above the WHO recommended EC of 400LS/cm. From the table total soluble solutes in the communities indicate that they were higher than the recommended 10-15mg/l recommended by WHO and DPR standard. Therefore, the result indicate a high level of polluted water by total suspended solid (TSS) which are solid materials (Organic and Inorganic) in the water. The TSS observed in this study shows that TSS for oil-impacted water was higher than that of the permissible limit of 30mg/L as stated in FEPA (1991) and this confirms the presence of pollution in oil impacted waters.

The table reveals that the total solutes of surface water in the oil communities ranged between 93.6-98.67mg/l with Otedo having the highest and Kokodiagbene having the least. Comparing it to the WHO/DPR standard, this was way higher than the recommended 45mg/l increase in TSS and TS could be attributed to the ability of oil to attract particulates. The table also shows that the total dissolved oxygen in all the communities in greater than the recommended WHO, NAFDAC of >3 which ranged between 4-6.0mg/l and is indicative of the safety of the water environment for aquatic animals. The dissolve oxygen is an indicator of the amount of carbon dioxide present in water and an increase is indicative of toxicity. The table also indicated the biological oxygen demand in surface water samples from oil impacted communities. This ranged between 15.67-17.67mg/l in across the communities and this outscores the WHO, NAFDAC permissible limit of 10mg1. A BOD greater than 10mg/l as in this study is indicative of the presence of several effluents that needs greater time to be broken down by biological substances present in water. This high trend is justifiable because the biological organisms needed more oxygen to breakdown the crude oil pollution in the oil impacted area.

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4. CONCLUSION AND RECOMMENDATIONS

The study empirically evaluated the resultant consequences of the impact of oil spill on surface and ground water in selected oil producing communities in Delta State. The study was inspired by the persistent evidence of the government of Nigeria's economic gain from the Niger Delta region owing to the heavy presence of oil multinationals since about 1972. As it stands today, oil contributes over 40% of the nation's GDP and the increased and persistent contribution of this region to our economic patrimony has not reflected in the lives and development of the region. The Niger Delta region before the oil exploration and exploitation regime has been known to be one of the world's richest rain forests that is endowed with abundant fish species, arable land for farming and a couple of significant medicinal plants and food for the sustenance of the people and economic gain. The discovery of oil and the onset of oil exploration has not come with only its economic gains but a total alteration and subjugation of the Niger Delta economy and way of life. Owing to the influx of foreigners, there has been gradual population rise in the region and has led to serious stress on the various basic economic potentials such as food and shelter needed for their survival. The occurrence and reoccurrence of oil spill and gas flares from oil pipelines and oil rigs in the region have not only altered the Niger Delta ecosystem but have also led to serious stress to availability of their once large mass of arable lands for farming, fresh water for drinking and the various economic potentials attached to them.Various fishes and agro faunas are said to be gradually going into extinction and the future generations of the Niger Delta region may not have anything to live on.

The study shows that exploration of oil has imparted in surface water quality and as a result, to achieve portability there should be constant monitoring and evaluation of companies involved in exploration and this can be achieved if government agencies and parastatals responsible for monitoring oil spill to ensure they carry out their duties efficiently. The individuals and inhabitants of the areas affected should be sensitized of non-governmental agencies as to the effect of oil spill in order to avoid pipeline vandalization. As an alternative, government should provide safe boreholes for the inhabitants for their domestic water consumption. Lastly, in case of spills, there should be clean up of the surface water and other boreholes with the vicinity of the communities in the study area.

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