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Aims and Scope
Sagbama Journal of Science and Technical Education (SAJOSTE) is a publication of the School of Science and Technical Education of Isaac Jasper Boro College of Education, Sagbama, Bayelsa State. It is a peer review academic journal committed to the publication of high quality research papers with emphasis on all areas of Science and Technical Education.

The Sagbama Journal of Science and Technical Education (SAJOSTE) is meant to encourage the conduct of research in the physical sciences and technical education geared towards the advancement of technical knowledge. The articles in the journal are original works of contributors and are written in scholarly acceptable language and focused on issues and challenges confronting humanity and society in the emerging world system. The Journal is published bi-annually, June and December.

This journal is an international journal and scope is not confined by the boundary of any country or region.

The Journal welcomes contributions from a wide range of disciplines, especially as they relate to Science and Technical Education, including: Biology, Chemistry, Physics, Mathematics, Integrated Science, Physical Education, Fine and Applied Arts, Engineering, Bio-Chemistry, Geology, Zoology, Technical Drawing, etc.

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Implementation Plan of the Journal

1. **Frequency of Publication:** Sagbama Journal of Science and Technical Education (SAJOSTE) is a bi-annual journal, June and December with two (2) issues published annually. A minimum of five (5) peer reviewed articles will be accepted and published in each of the issues.

2. **Manuscript Submission:** The journal will call for submission of scholarly researched papers from contributors. A period of four weeks will be allowed for submission of articles from scholars. However, if at the close of the four weeks, the submitted articles do not make up the required number, a two weeks' extension window will be allowed.
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3. **Review Period:** All researched articles will be subjected to open peer review. This period is expected to last for two weeks. All reviewed articles will be returned to the correspondent author(s) for appropriate corrections within two weeks. Only articles that meets the SAJOSTE standard that will be considered for publication. The decision for publication of articles in SAJOSTE will be collectively taken by the Editorial Board.

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FOREWORD

Provost

Welcome to the second issue of the Sagbama Journal of Science and Technical Education (SAJOSTE). SAJOSTE is a publication of Issac Jasper Boro College of Education, Sagbama, Bayelsa State. The journal is supported financially by TETFund. It is a peer reviewed, multidisciplinary journal in the fields of science and technical education. SAJOSTE aims to provide cross-disciplinary and international forum for researchers to showcase their high quality research studies. We intend to establish SAJOSTE as a flagship journal in science and technical education with a focus on innovative research works in engineering technology, building technology, Chemistry, Physics, Medical and Biological Sciences, Agricultural Science and other academic fields in technical education. We seek to present cutting-edge innovations in the various research areas in science and technical education and seek to maintain the highest standard of excellent.

All manuscripts considered for publication in this issue, volume 2, Issue 1 were subjected to a rigorous peer reviewed process and were considered by reviewers to be of vital interest to our esteemed readers. This issue of SAJOSTE contains 11 outstanding articles which shed light on contemporary research questions in science and technical education.

As a practice, the number of articles accepted for publication is controlled by a team of editors and the focus of the journal. The articles included in this edition are drawn from disciplines in medical science, mathematics, fine and applied arts, office management technology, technical drawing, agricultural science, and management science.

I must thank the members of the Academic Journals Publication Committee and Editorial Board for their dedication and commitment to ensuring the success of this outstanding project of the College. I hope you will enjoy reading the inaugural issue of Sagbaman Journal of Science and Technical Education (SAJOSTE)

Ebitimi P. Berezi PhD

RELATIONSHIPS BETWEEN WATER PHYSICO-CHEMICAL PARAMETERS AND BENTHIC MACRO INVERTEBRATES OF THE MIDDLE REACHES OF ORASHI RIVER, NIGER DELTA

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ABSTRACT

Orashi River is one of the major rivers that drain the River Niger through the Niger Delta into the Atlantic Ocean. The relationship between the physio-chemical properties of the river water and benthic macro invertebrates were studied between October 2017 and September 2018. Monthly samples of the river surface water and macro invertebrates were collected at five sampling stations using standard methods. Means and standard deviation of the water parameters were determined and correlated with the macro benthos to determine their relationship.Oligochaeta was represented by 9 species; Crustacea had 3 species while 2 species were identified under Insecta. Temperature (^{0}C) ranged between 27 ^{0}C and 29.4^{0}C. Conductivity fluctuated between 18 – 48.4µS/cm and pH was from 6.10 – 7.96. Salinity and turbidity ranged between and 0 – 0.02 and 8.50 – 107.7 NTU respectively. Total dissolved Solids (TDS) was from10 – 25.18 mg/L, Biological oxygen demand (BOD) 6.01 – 7.88 mg/l, Chloride 1.05 – 6.42mg/l, total alkalinity 3 – 9 mg/l and total hardness 2.29 – 9.93 mg/l. Nitrate, sulphate, Chromium, Iron and Zinc were between 0.05 – 0.95 mg/l, 2.10 – 10.31 mg/l, 0.003 – 0.08 mg/l, 1.542-4.966mg/l and 0.003-0.338 respectively. Correlation between macro benthos was positive with sulphate and DO but negative with Zinc, turbidity and BOD.There is need for effective monitoring of the river system to be able to detect environmental changes that could be corrected for a sustainable ecosystem.

Key words: positive, macro benthos, species, stations, water

INTRODUCTION

Orashi River is known to share similar natural features and environment characteristics with many other flood plain river systems in the central Niger Delta. The nutrient load of the river system is rich and provides good habitat for a biodiversity of species (Seiyaboh, *et al*, 2016). The area is rich in aquatic plants distribution that provides special biotic structural components in a fluvial ecosystem. The aquatic vegetation of Orashi River, though not utilized directly as food items by fish and other benthic communities (except aquatic mammals), has various ecological values for fish and other aquatic dwellers. The values include provision of refuge, shade, good environment for spawning and support for aquatic vertebrates and invertebrates,

and as dietary requirement for fish. The aquatic flora of Orashi River has a high diversity profile due mainly to the presence of many amphibious plants, most of which are located on the emergent bank of the river.

The aquatic floating and submerged plants of the study area are restricted to few species such as *Nymphaea lotus* (water lilies), *Salvinia hastate* (water fern), *Pistia stratiotes* (water lotus), *Echhornia crassipes* (water hyacinth), *Azolla nilotica*, *Ceratophylum demersum* and the rooted herbs, shrubs, grasses and sedges. The effect of dry season condition around the study area was so obvious that it resulted to formation of large component of decaying vegetation, which was restricted to the dried-up littoral margins.

Water is essential natural resource abundant on the surface of the earth that exists in three states: solid, liquid and gaseous (Strahler & Strahler 1984) and occur as both surface and underground water bodies. The most common natural fresh water bodies are the fresh waters of the swamps, ponds, lakes, streams, rivers etc. Natural fresh water bodies have the ability to support life and the ability to dissolve substances naturally than every other liquid and often contain nutrients that living organisms need for survival (Clegg, 1974).

Plants and animals need good water quality for development, growth and productivity. The study of the physical and chemical characteristics of water is important since it may directly affect the quality and sustainability for use and productivity of aquatic organisms (Moses**,** 1982**).** Physical and Chemical characteristics of water determines the species composition, distribution and abundance of organisms of any water body (Atobatele & Ugwumba, 2008).This study is hence aimed at assessing the relationships between water physico-chemical parameters and benthic macro invertebrates.

MATERIALS AND METHODS

The study was conducted along the middle reaches of Orashi River, at the eastern section of the lower Niger Delta between October 2017 and September 2018. The study area lies between longitude 6^0 26’ 32.5” to 6^0 30’ 05.0” E and latitude 5^0 26’32.5” to 5^0 08’ 24.6” N (figure1). The sampling points were OdiekeUgbobi station 1, Odiobor station 2, Mbiama station 3, Akinima station 4 and Oshiobele, station 5.

Fig. 1: Map of Niger Delta showing the middle riches of Orashi River

The field sample collection lasted for twelve months to cover both dry and wet seasons. Samples were collected once each month, between the hours of 8.00 am and 12 noon at points where human activities does not interfere with sample quality.

DO, turbidity, pH, conductivity and temperature were measured in-situ in the field using Extech water checker Model DO: 700 and Model Turb: 400.

Biochemical oxygen demand (BOD) was analyzed using the BOD test adapted from APHA (1998). Nitrate measurement was by Brucine Method while Total hardness was determined by EDTA titrimetric method of (APHA, 1998).Chloride and sulphate were determined by the Argentometric titration and turbidimetric methods respectively (APHA-AWWAWEF,1998).Phosphate determination was by the stannous chloride method (APHA-WE,1998). Total Hydrocarbon Content (THC) was determined with standardized spectrophotometer.

Total Alkalinity**:** The ions such as bicarbonate, carbonate, and hydroxide present in water were analyzed through hydrolysis of solutes. Cadmium, Chromium, Lead, Iron and Zinc were determined using an Atomic Absorption Spectrophotometer (AAS) as described in APHA, (1998).

Statistical analysis was conducted to determine the mean and standard deviation. Multiple linear correlation analysis was carried out on the water parameters and benthos, in order to verify if there is any significant relationship.

RESULTS AND DISCUSSION

Correlation of benthos with surface water physicochemical parameters of the middle reaches of Orashi River between October 2017 and September 2018 is presented in Tables 3 and 4. Analysis indicates a negative relationship between Crustaceans represented by *Macrobrachium vollenhovenii*, *Macrobrachium macrobrachion* and *Macrobrachium felicinum* and Temperature. This finding confirms those of Marioghae(1982), who reported that *Macrobrachium vollenhovenii*, *Macrobrachium macrobrachion* and *Macrobrachium felicinum* were found in water temperature of between 27^0C- 29.4^0C.

Positive correlation of Oligochaeta with temperature in the dry and wet seasons shows that Oligocheta (Table 1) can strive well in temperature range of between 27^0C- 29.4^0C except, *Eiseniellate tetraedra, Ophidonais serpentina, Dero obtusa and Paranais sp.* Insecta(Table 1) on the contrary cannot tolerate the temperature range except *Chironomus ablabiesmyia* in the wet season. The positive correlation during the wet season could be due to a reduction in human activities in the study area as the degree or condition of heat or coldness of a substance affects object or body of living organisms at a given time or place (Lucinda & Martin, 1999).

Table 1: Macro benthos of the middle reaches of Orashi River (October 2017 – September 2018)

Species	Family	Sub-class/Class
Lumbricilus sp *Eiseniellate tetraedra*	Lumbricidae	Oligochaeta
Chaetogaster diatropus *Dero obtusa* *Ophidonais serpentina* *Nais sp.* *Paranais sp* *Stylaria lacustris* *Uncinais uncinata*	Naididae ” ” ” ” ” ”	
Chironomus ablabiesmyia *Nepa cinerea*	Chironomidae Nepidae	Insecta
Macrobrachium felicinum *Macrobrachium macrobrachion* *Macrobrachium volenhoveni*	Penaeidae ”	Crustacea

Difference in the reports could be due to the anthropogenic activities in the study area that has led to migration of the crustaceans (Powell, 1982).There was positive correlation of Crustaceans with pH and Total Alkalinity which could be attributed to the pH range (6.10-7.96) that falls within the range from 6.0-8.5 suitable for aquatic life (Tucker & D'Abramo, 2008) and Total Alkalinity 3-9 that falls (Table 2) within the acceptable value (Seiyaboh *et al.*, 2016).

Table 2: Seasonal range, mean, and standard deviation in surface water parameters of the middle reaches of Orashi River (October 2017 – September 2018)

Parameter	Dry Range, Mean ±SD	Wet Range, Mean ±SD
Temp (^{O}C)	27-29.4	27-29.3
	28.12±0.64[a]	27.58±0.43[b]
pH	6.1-7.92	6.2-7.96
	7.04±0.58 [a]	7.26±0.38 [b]
Sal (psu)	0.01-0.02	0.01-0.02
	0.01±0.00[a]	0.01±0.00[b]
Cond.(µS/cm)	22.8-36.8	18-48.8
	31.76±3.03 [a]	24.66±7.15 [b]
TDS (mg/l)	12.3-19.5	10-25.18
	15.94±1.98 [a]	13.13±3.3 [b]
Turb (Ntu)	8.5-39.1	10.6-107.7
	25.61±5.89 [a]	35.62±19.41 [b]
DO(mg/l)	6-7.86	6.02-7.88
	7.06±0.6 [a]	6.81±0.49 [b]

Parameter	Dry Range, Mean ±SD	Wet Range, Mean ±SD
BOD (mg/l)	2.06-21.18	2.04-3.98
	2.87±2.72 [a]	2.91±0.66 [a]
THC (mg/l)	0-3.82	0-4.3
	0.35±0.9 [a]	0.71±1.22 [a]
T.alk (mg/l)	3-9	3-9
	4.2±1.85 [a]	4.4±1.82 [a]
Cl (mg/l)	1.76-6.42	1.05-2.92
	3.24±0.9 [a]	1.72±0.46 [b]
T.Hards (mg/l)	2.29-5.9	3.53-9.93
	3.96±0.91 [a]	5.45±1.59 [b]
NO_3(mg/l)	0.1-0.95	0.05-0.65
	0.5±0.22 [a]	0.33±0.12 [b]
SO_4(mg/l)	2.1-7.51	2.55-10.31
	4.21±1.45 [a]	4.93±1.85 [b]
Cd(mg/l)	0-0	0-0
	NA	NA
Cr(mg/l)	0.003-0.053	0.051-0.08
	0.02±0.02 [a]	0.07±0.01 [b]
Fe(mg/l)	1.542-4.966	2.205-3.989
	3.45±0.52 [a]	3.39±0.4 [a]
Zn (mg/l)	0.017-0.322	0.003-0.338
	0.11±0.09 [a]	0.05±0.04 [b]

Means with different superscripts a, b, c, d in the same column are significantly different at p=0.05 (Tukey HSD)

Correlation of Oligocheta and Insecta with pH was positive except *Lumbricillus sp* and *Chaetogaster diatropus* could be due to dilution of the river water by the seasons that year not conducive for *Lumbricillus sp* and *Chaetogaster diatropus* during the dry season.Oligocheta and Insecta negative correlation with Total Alkalinity could be attributed to the volume of water discharged into the river during the wet season.

Negative correlation of Oligocheta, Insecta and Crustacean in the study with electrical conductivity could be caused by the low range of EC (18 – 48.8µS/cm) reported which is against 50-1,500 µS/cm recorded by Izonfuo & Bariweni (2001) for most freshwater in Nigeria. The positive correlation of *Nepa cinerea* (Insecta) with Electrical conductivity during the dry season could be attributed to seasonal variation of conductivity in surface water in Niger Delta (George, 2008).

Correlation of Crustaceans and insects with TDS was positive during the dry seasons but negative during the wet seasons. The negative estimate could be due to the rains, which diluted totality of all the dissolved substances from organic and inorganic materials present in the water below the level of concentration suitable for the crustaceans. Similarly, Oligocheta correlation with TDS was negative in both dry and wet seasons, suggesting that the organisms will find it difficult to survive in TDS range of 10.0-25.8mg/l (Table 2).

Crustaceans,Oligocheta and Insecta correlation was negative with turbidity, indicating that turbidity range of 8.50 – 107.7Ntu was not suitable for macro benthos in middle reaches of

Orashi River. This could be caused by a change in the amount of particle materials held in suspension within the water system (such as silt, clay, organic matter, plankton and other inorganic materials) as a result of erosion resulting, wind action, surface water run-offs, algal bloom and human activities, depending on water source, type and seasonality.

Table 3: Dry season correlations of benthos and surface water physicochemical parameters of the middle reached of Orashi River (Oct.2017-Sept.2018)

	Lum.sp	E.tetra	O.serp	C.diatr	Derop	Naissp	Paranа	Stylari	Uncina	C.abla	Nepac	M.voll	M.mac	M.feli	TEMP	pH	Ec	TDS	TURB	DO	BOD	THC	T.ALK	Cl	T.HARI	NO3	SO4	Fe	Zn
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E.tetrahydra	-.945*	1																											
O.serpentina	-.967**	.989**	1																										
C.diatrophus	0.703	-0.83	-0.75	1																									
Deropbtusa	-.975**	.922*	.963**	-0.58	1																								
Naissp	-0.75	0.682	0.706	-0.38	0.815	1																							
Paranaissp	-.902*	.992**	.977**	-0.82	.894*	0.65	1																						
Stylarialacustris	-0.55	0.35	0.404	-0.04	0.605	.889*	0.281	1																					
Uncinaisuncinata	-0.22	-0.05	0.063	0.453	0.329	0.583	-0.1	0.853	1																				
C.ablabiesmyia	-.895*	.989**	.965**	-0.85	.881*	0.685	.995**	0.316	-0.1	1																			
Nepacinerea	-0.13	-0.06	0.006	0.114	0.038	-0.39	-0.13	-0.19	0.046	-0.2	1																		
M.vollenhovenii	-.912*	.918*	.920*	-0.67	.936*	.914*	.900*	0.658	0.267	.920*	-0.28	1																	
M.macrobrachion	-0.85	.962**	.954*	-0.77	0.857	0.57	.988**	0.178	-0.16	.972**	-0.12	0.844	1																
M.felicinum	-.936*	.977**	.983**	-0.72	.956*	0.792	.975**	0.475	0.111	.974**	-0.17	.966**	.950*	1															
TEMP	0.558	-0.69	-0.67	0.698	-0.49	0.045	-0.72	0.387	0.581	-0.67	-0.32	-0.36	-0.77	-0.57	1														
pH	-.901*	0.794	0.874	-0.38	.934*	0.62	0.763	0.487	0.373	0.718	0.337	0.75	0.754	0.82	-0.53	1													
Ec	0.192	-0.11	-0.11	-0.04	-0.27	-0.77	-0.07	-0.85	-0.67	-0.15	0.626	-0.48	0.021	-0.25	-0.63	-0.03	1												
TDS	-0.37	0.338	0.414	-0.1	0.372	-0.2	0.347	-0.3	-0.14	0.254	0.726	0.055	0.427	0.274	-0.74	0.637	0.723	1											
TURB	0.511	-0.43	-0.44	0.232	-0.57	-.937*	-0.39	-.915*	-0.63	-0.45	0.538	-0.75	-0.29	-0.56	-0.35	-0.33	.941*	0.518	1										
DO	-0.04	0.126	0.198	0.158	0.143	-0.28	0.205	-0.45	-0.2	0.115	0.295	-0.08	0.345	0.141	-0.55	0.368	0.635	0.808	0.54	1									
BOD	0.69	-0.59	-0.58	0.658	-0.53	-0.17	-0.5	-0.12	0.112	-0.49	-0.63	-0.38	-0.43	-0.44	0.603	-0.57	-0.28	-0.47	-0.02	0.107	1								
THC	-0.22	0.295	0.222	-0.64	0.026	-0.38	0.266	-0.52	-0.72	0.253	0.492	-0.05	0.255	0.083	-0.71	0.058	0.674	0.403	0.506	0.023	-0.75	1							
T.ALK	-.943*	0.85	.894*	-0.5	.975**	.910*	0.808	0.766	0.487	0.81	-0.04	.946*	0.746	.909*	-0.29	.879*	-0.46	0.199	-0.72	-0.03	-0.47	-0.11	1						
Cl	.885*	-0.8	-.884*	0.369	-.940*	-0.64	-0.79	-0.48	-0.37	-0.74	-0.25	-0.77	-0.79	-0.85	0.532	-.993**	0.058	-0.62	0.346	-0.42	0.48	0.01	-.881*	1					
T.HARDS	-0.82	0.69	0.748	-0.3	.886*	.959**	0.644	.899*	0.681	0.655	-0.13	.885*	0.574	0.794	-0.03	0.784	-0.65	0.03	-0.84	-0.14	-0.29	-0.35	.963**	-0.79	1				
NO3	.891*	-0.82	-0.83	0.596	-.895*	-.954*	-0.77	-0.81	-0.43	-0.81	0.213	-.962**	-0.68	-0.87	0.175	-0.71	0.61	0.062	0.842	0.291	0.442	0.091	-.956*	0.708	-.935*	1			
SO4	-.953*	0.874	.908*	-0.66	.900*	0.537	0.823	0.37	0.125	0.794	0.404	0.748	0.785	0.823	-0.68	.918*	0.074	0.592	-0.26	0.175	-0.83	0.405	0.829	-.881*	0.67	-0.73	1		
Fe	0.476	-0.43	-0.42	0.546	-0.31	0.183	-0.37	0.248	0.36	-0.33	-0.76	-0.11	-0.35	-0.25	0.739	-0.44	-0.63	-0.67	-0.4	-0.16	.922*	-.883*	-0.19	0.357	0.032	0.108	-0.69	1	
Zn	.953*	-.928*	-.972**	0.606	-.966**	-0.64	-.914*	-0.39	-0.16	-.880*	-0.18	-0.84	-.906*	-.930*	0.679	-.958*	0.011	-0.58	0.336	-0.34	0.595	-0.19	-.885*	.962**	-0.74	0.76	-.941*	0.47	1

**. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).

The positive correlation of the macro benthos with DO could be due to the convenient range of DO (6.01-7.88) recorded during the study period which agrees with Andem *et al*(2012) that aquatic life cannot survive below DO of 4mg/l.

Negative macro benthos correlation with BOD throughout the study period could be attributed to the high range (2.06-3.97) recorded. BOD level of 1.0 to 2 mg/l is clean, 3.0 mg/l is fairly clean, and 5.0 mg/l is doubtful whereas, value of 10.0 mg/l and above, is highly polluted and bad (Chindah, *et al.,* 1991). Levels below 2.04 mg/l is considered reasonable safe for macro benthos.

Table 4: Wets season correlations of benthos and surface water physicochemical parameters of the middle reached of Orashi River (Oct.2017-Sept.2018)

	Lum.sp	E.tetra	O.serp	C.diatr	Deropb	Naissp	Paranai	Stylari	Uncina	C.abla	Nepac	M.voll	M.mac	M.feli	TEMP	pH	SAL	Ec	TDS	TURB	DO	BOD	THC	T.ALK	Cl	T.HARD	NO3	SO4	Cr	Fe	Zn
Lum.sp	1																														
E.tetrahydra	.922**	1																													
O.serpentina	0.746	.829*	1																												
C.diatrophus	.876**	.922**	0.715	1																											
Deropbtusa	.962**	.954**	.850*	.892**	1																										
Naissp	.895**	.948**	.914**	.829*	.973**	1																									
Paranaissp	.960**	.945**	0.665	.948**	.931**	.851*	1																								
Stylarialacustris	.992**	.949**	0.741	.924**	.966**	.900**	.985**	1																							
Uncinaisuncinata	.912**	.967**	.859*	.859*	.975**	.991**	.893**	.925**	1																						
C.ablabiesmyia	.834*	.952**	.925**	.896**	.933**	.956**	.846*	.865*	.944**	1																					
Nepacinerea	0.183	-0.07	-0.42	0.169	0.014	-0.17	0.228	0.186	-0.08	-0.24	1																				
M.vollenhovenii	0.338	0.173	-0.26	0.42	0.205	0.029	0.449	0.374	0.13	0.01	.943**	1																			
M.macrobrachion	0.517	0.289	-0.13	0.452	0.363	0.186	0.56	0.523	0.277	0.093	.922**	.949**	1																		
M.felicinum	0.613	0.438	-0.06	0.526	0.457	0.278	0.687	0.626	0.374	0.208	0.749	.839*	.921**	1																	
TEMP	0.368	0.574	0.525	0.239	0.433	0.579	0.348	0.368	0.583	0.508	-0.59	-0.44	-0.3	-0.07	1																
pH	0.456	0.127	0.129	0.29	0.345	0.16	0.353	0.404	0.138	0.11	0.536	0.433	0.556	0.494	-0.55	1															
SAL	-0.25	0.037	0.169	-0.27	-0.11	0.088	-0.25	-0.24	0.062	0.086	-.844*	-.763*	-0.74	-0.56	.781*	-.829*	1														
Ec	-0.5	-0.61	-0.62	-0.62	-0.51	-0.57	-0.5	-0.52	-0.58	-0.61	0.028	-0.11	-0.1	9E-04	-0.35	0.168	-0	1													
TDS	-0.42	-0.56	-0.58	-0.56	-0.44	-0.52	-0.43	-0.45	-0.53	-0.56	0.076	-0.06	-0.03	0.072	-0.37	0.259	-0.07	.995**	1												
TURB	-0.57	-0.6	-0.49	-0.38	-0.6	-0.69	-0.49	-0.55	-0.72	-0.5	0.007	-0.08	-0.25	-0.22	-0.68	0.214	-0.27	0.546	0.542	1											
DO	0.449	0.222	0.057	0.389	0.276	0.074	0.452	0.432	0.082	0.127	0.458	0.447	0.506	0.602	-0.4	.807*	-0.71	0.098	0.182	0.399	1										
BOD	-.772*	-0.66	-0.56	-0.57	-0.67	-0.58	-0.71	-0.74	-0.56	-0.56	0.031	-0.04	-0.24	-0.47	-0.31	-0.53	0.168	0.142	0.065	0.118	-0.72	1									
THC	-0.25	-0.02	0.435	-0.18	-0.02	0.182	-0.33	-0.25	0.09	0.217	-.843*	-.828*	-.842*	-.876**	0.385	-0.51	0.683	-0.2	-0.25	-0.16	-0.7	0.312	1								
T.ALK	0.178	-0.17	-0.11	-0.16	0.024	-0.12	0.014	0.085	-0.16	-0.24	0.317	0.105	0.294	0.313	-0.38	.825*	-0.53	0.472	0.538	0.283	0.689	-0.52	-0.45	1							
Cl	.879**	.911**	.804*	0.703	.915**	.938**	.825*	.867*	.939**	.848*	-0.21	-0.03	0.183	0.37	0.722	0.12	0.212	-0.39	-0.34	-0.71	0.11	-0.7	0.071	0.009	1						
T.HARDS	-0.19	-0.35	-0.71	-0.19	-0.36	-0.54	-0.07	-0.17	-0.47	-0.51	0.594	0.543	0.487	0.583	-0.5	0.347	-0.48	0.614	0.642	0.557	0.586	-0.1	-.845*	0.444	-0.39	1					
NO3	0.273	0.347	0.681	0.243	0.43	0.576	0.138	0.252	0.514	0.505	-0.35	-0.33	-0.26	-0.43	0.334	-0.14	0.241	-0.6	-0.61	-0.62	-0.52	0.131	0.717	-0.32	0.382	-.951**	1				
SO4	0.062	-0.12	-0.54	-0.01	-0.12	-0.32	0.158	0.067	-0.24	-0.32	0.625	0.607	0.616	0.752	-0.36	0.44	-0.49	0.541	0.587	0.373	0.666	-0.3	-.909**	0.508	-0.13	.964**	-.894**	1			
Cr	0.376	0.149	-0.14	0.063	0.242	0.099	0.338	0.33	0.137	-0.04	0.357	0.317	0.514	0.709	0.032	0.53	-0.26	0.537	0.598	-0.03	0.554	-0.58	-0.65	0.699	0.351	0.618	-0.53	.775*	1		
Fe	0.108	-0.2	-0.42	-0.11	-0.08	-0.28	0.081	0.062	-0.25	-0.35	0.576	0.445	0.548	0.63	-0.45	0.707	-0.59	0.604	0.666	0.379	.755*	-0.43	-.804*	.842*	-0.1	.839*	-0.72	.891**	.848*	1	
Zn	-0.5	-0.38	0.137	-0.52	-0.37	-0.22	-0.62	-0.54	-0.33	-0.17	-.822*	-.938**	-.943**	-.938**	0.115	-0.31	0.551	0.155	0.104	0.291	-0.4	0.204	.822*	-0.04	-0.24	-0.5	0.334	-0.62	-0.46	-0.41	1

**. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).

Macro benthos correlation with Total hydrocarbon was negative in wet season but positive in the dry season for crustaceans and insects. This might be as a result in reduction in "kpo-fire" (illegal crude oil refining) in the area. Hydrocarbons are compounds made up of hydrogen and carbon elements that could be separated into petroleum and natural gas (biologically degradable). The negative correlation could be due to toxicity of hydrocarbon as it is severe on most aquatic organisms even at very low exposure (Vandermeulem *et al*., 1985).

Correlation with Chloride was negative during the study period suggesting that Oligocheta, Insecta and Crustaceans cannot survive above 6.42mg/l CL concentration. The positive correlation recorded for Oligocheta wet season shows that the concentration was suitable for the macro benthos to survive at a maximum concentration of 2.92mg/l

Positive correlation recorded of macro benthos with Total Hardness indicates that the range of 2.29-9.6 was suitable for their survival. Negative correlation for Oligochetes in wet season might be due to seasonal variation of Total Hardness in the middle reaches of Orashi River.

Concentration of NO_3 from 0.05-0.95mg/l does not favour survival of the macro benthos, but favoured Oligochetes and insects only during the wet season. This might be as a result of the heavy water discharge into the river. Positive correlation suggests that Oligocheta, Insecta and Crustaceans can withstand levels of SO_4 from 2.1-10.31mg/l, except for Oligochetes in the wet season, which might be as a result of the heavy rains. The concentration of 0.003-0.338mg/l

Zn was negative correlation suggesting that the level of concentration does not support survival of Insects, Oligochetes and Crustaceans.

CONCLUSION

Correlation analysis between macro benthos and physio-chemical properties of the Orashi River studied indicates positive and negative correlation between classes and species with different water parameters from October 2017-September 2018.It is therefore pertinent for baseline studies and monitoring along the river system to detect environmental changes or alterations and be remedied to sustain the ecosystem goods and services.

REFERENCES

American Public Health Association (APHA, 1998). Standard methods for the examination of water and wastewater. 20th edition, Washington DC, USA.

Andem, A.B., Okoroafor, K.A.,Udofia, U., Okete, J.A.,&Ugwumba, A.A. (2012).The Composition, Distribution and Diversity of Benthic *Macro-invertebrate of Ona* River, Southwest Nigeria. *Euro. J. Zoological Resources* 1(2), 47-53.

Atobatele, O.E. &Ugwumba, O.A. (2008). Seasonal Variation in the Physico-chemistry of Small Tropical Reservoir (Aiba Reservoir, Iwo, Osun, Nigeria). *African Journal of Biotechnology*,7,1962-1971.

Chindah, A.C., Braide, S.A. & Onwuteaka, J.N. (2005). Vertical distribution of Periphyton on woody substrate in the brackish wetland embayment of Bonny River, *Niger Delta. Biologia*, 5, 97-108.

Chindah, A.C., Hart, A.I. & Atuzie, B. (1991). A preliminary investigation on the effects of municipal waste discharge on the Macro fauna associated with Macrophytes in small fresh water stream in Nigeria. *Journal of Ecology,* 2,23 - 29.

Clegg, J. (1974). Fresh water life. Fredeik Warne and Company Limited, 283.

George, A.D.I. (2008). The ecology of swimming crab (*Callinectes amnicola)* in Okpoka Creek, off upper Bonny River, Niger Delta, Nigeria. Thesis, Rivers State University of Science and Technology, Port Harcourt, Nigeria.

Izonfuo, L.W.A.,& Bariweni, A.P.(2001).The effects of urban runoff water and human activities on some physico–chemical parameters of the Epie Creek in the Niger Delta. *Journal of Applied Sciences*. (1), 47 – 55.

Lucinda, C. and Martin, N. (1999). *Oxford English Mini-Dictionary*. Oxford University Press Incorporated, New York.

Marioghae, I.E.(1982). Note on the biology and distribution of *Macrobrchium vollenhovenii and M. macrobrachion* in Lagos Lagoon (Crustacea Decapoda, Paleamonidae)..*Review de Zoologie Africaine*, 96(30): 493-508.

Moses, B.S. (1982). *Introduction to tropical fisheries*. Ibadan University Press, Ibadan.

Powell, C.B.(1982). Fresh and brackish water shrimps of economic importance in the Niger Delta. *In Proceeding 2nd Annual Conference of Fisheries Society of Nigeria*. Calabar 25-27, January 1982, 254 – 285.

Seiyaboh, E.I. Ogamba, E.N. & Utibe, D.I. (2013).Impact of dredging on the water quality of Igbedi creek, upper nun river, Niger Delta, Nigeria. *IOSR Journal of Environmental Sciences, Toxicology and Food Technology*, 7(5), 51 – 56.

Seiyaboh,E.I., Tariwari, C.N.A. & Blessing, C.O. (2016). Physicochemical Quality Assessment of River Orashi in Eastern Niger Delta of Nigeria. *Journal of Environmental Treatment Techniques,* 4,143-148.

Strahler, N.A. & Strahler H.A. (1984).*Elements of physical agaeography*.3rdedition. John Willey and Sons. 538.

Tucker, C.S., & D'Abramo, L.R. (2008). *Managing high pH in freshwater ponds*. South Regional Aquaculture Centre; Stoneville, USA

Uyi, H., Ngodigha, S.A., & Deekae, S.N.(2022).Wet and Dry season water quality parameters of the middle reaches of Orashi River, Niger Delta. Sagbama Journal of Science and Technical Education, 1, (1), 47-54

Vandermeulen, J. H., Foda, A.,& stuttered, C. (1985).Toxicity vs mutagen city of some crude oils, distilleries and water-soluble fractions. *Water research* 19, 1283 – 1289.

ANTIBACTERIAL PROPERTIES OF *CARICAPAPAYA* (PAWPAW) LEAF EXTRACT ON SOME PATHOGENIC BACTERIA OF PUBLIC HEALTH IMPORTANCE

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Abstract

This study investigated the antibacterial activity of *Carica papaya* leaf extracts against pathogenic bacteria, aiming to explore the potential of natural remedies in combating bacterial infections. The rising global concern of antibiotic resistance necessitates the exploration of alternative therapeutic options. *Carica papaya* leaves, known for their traditional medicinal use contain bioactive compounds with potential antimicrobial properties. The study employed in vitro assays to assess the antibacterial effects of *Carica papaya* leaf extracts against a range of pathogenic bacteria, both Gram-positive and Gram-negative. The assays revealed substantial zones of inhibition, indicating the ability of the extracts to impede bacterial growth. Minimum inhibitory concentration (MIC) values further underscored the potency of the extracts. These findings align with earlier studies identifying alkaloids, flavonoids, and phenolic compounds in *Carica papaya* leaves with antibacterial attributes. However, challenges such as variability in bioactive compound composition and lack of in vivo data warrant further research. Mechanistic studies, clinical trials, formulation development, and safety assessments are recommended to advance the understanding and potential application of *Carica papaya* leaf extracts as an alternative antibacterial treatment. Integrating traditional knowledge with modern scientific methodologies holds the promise of addressing the pressing issue of antibiotic resistance.

Key words: Antibacterial, Leaf extract, *Carica papaya*, Pathogenic bacteria, Sagbama, Bayelsa State

INTRODUCTION

In recent years, the emergence and spread of antibiotic-resistant bacteria have become a significant global health concern. Traditional antibiotics are becoming less effective in treating bacterial infections, leading to an urgent need for alternative strategies to combat pathogenic bacteria.The use of medicinal plants has been welcomed in several countries as an alternative to synthetic drugs due to their innate antimicrobial properties (Epidi *et al.*, 2016). According to World Health Organization, close to 80% of the world population utilize medicinal plants to treat human diseases (Ayoola*et al.*, 2010) The main source of antimicrobial agents has been plants in recent times (Karpagam and Nagalakshmi, 2014). Natural products have gained considerable attention as potential sources of novel antimicrobial agents due to their diverse chemical composition and complex biological activities.

One such natural product is pawpaw (*Carica papaya*), a tropical fruit wi2dely known for its nutritional and medicinal properties (Silva *et al.*, 2020). *Carica papaya* leaves have long been used in traditional medicine for their potential antibacterial properties. They contain various bioactive compounds, including alkaloids, flavonoids, and phenolic compounds, which have been reported to possess antimicrobial activities against a wide range of pathogenic bacteria (Silva, *et al.*, 2020). The *Carica papaya* plant is a nutritionally abundant source of vitamins A, B and C and also a fair source of calcium and iron (Orhue and Momoh, 2013). It contains enzyme papain, which helps in digestion and used to treat ulcers and in some microbial diseases where it is specifically effective against gram-negative bacteria at higher doses (Bibitha*et al.*, 2002).

MATERIALS AND METHODS

Sample procurement

Triplicate samples of the *Carica papaya* used in this study were obtained from Sagbama Town in Sagbama Local Government Area of Bayelsa State, Nigeria.

Sample preparation

Triplicate leave samples of *Carica papaya* were dried at room temperature. Thereafter, they were macerated using sterile pestle and mortar. The samples were further blended using electric blender to obtain fine power.

Sterilization of bench top and equipment

Materials/ equipment such as beakers, McCartney bottles, test tubes, filter papers, spatula, forceps etc used in this study were sterilized using hot air oven. The working benches were disinfected with 96% ethanol during and after working.

Extraction method

The extraction was carried out using soaking method previously described by Doherty et al. (2010) and Chiejina and Ukeh (2012), Kigigha*et al.*, (2015), Kigigha*et al.*, (2018a,b), Izah et al. (2019a,b), Izah*et al.*, (2018a,b) with slight modifications. Water, methanol and ethanol water were used for the extraction. 5g of the blended samples were extracted using 10ml of the ethanol, aqueous and methanol separately. The samples were soaked for 3 days, thereafter they were filtered with muslin cloth and the extract was collected in a conical flask. The leave extracts were further filtered using what man filter paper. The resultant filtrates were concentrated.

Source and Preparation of organisms

The microorganisms used in this study were obtained from a stock culture at the Federal Medical Centre's Microbiology and Parasitology Unit in Yenagoa, Bayelsa State, Nigeria. Following the methods previously described by Cheesbrough (2004), Benson (2002), before the sensitivity analysis, the purity of the bacteria was checked by sub culturing. The *Staphylococcus aureus* was characterized by plating on Mannitol salt Agar which showed

yellow pigmentation. It was further, grown on Nutrient Agar; the resultant growth on the Nutrient agar was subjected to coagulase test using the guide of Cheesbrough (2004).
Similarly, the *Escherichia coli* used in the study was also streaked on MacConkey agar and Levine's eosin Methylene Blue (EMB) Agar. After 24 hours of aerobic incubation at 37º C, the presence of greenish metallic sheen with small nucleated colonies in plates containing EMB (Eosine methylene blue) agar indicated the presence of *Escherichia coli* (*Pandy et al.,* 2016; Benson, 2002), while, the growth on the MacConkey agar with pinkish red growth having a metallic sheen or reflection confirmed the presence of *E. coli*. Other confirmation tests carried out include Indole, Methyl red, catalase test using the guide provided by Benson (2002) and Cheesbrough (2004). Also, the *Klebsiella* and *Micrococcus* species used in this study was confirmed by conducting some biochemical tests on the organisms including Urease, oxidase, citrate and indole using the scheme of Benson (2002) and Cheesbrough (2004).

Antimicrobial screening of the extract

Agar diffusion method was employed for the antimicrobial testing using the scheme of Lino and Deogracious (2006), Kigigha*et al*., (2015, 2016), Epidi*et al*. (2016a,b), Doherty *et al*., (2010) with slight modification by Agu and Thomas (2012), Kigigha*et al*., (2015), Kigigha*et al*., (2018a,b, c, d), Izah and Aseibai (2018), Izah*et al*., (2019a,b), Izah*et al*., (2018a,b) was employed for the sensitive assessment of the aqueous, *methanol* and ethanolic extract of *Carica papaya.* About 20ml of the autoclaved nutrient agar was poured on sterile Petri dish and allowed to solidify. Approximately 0.4ml of the test organisms was place on the agar plates and was spread over the surface using spreader. Sterilized cork borer was used to make holes approximately 6mm in the agar plates, three wells per plate (each being for the different solvents used in the study). The plates were placed inverted and labeled showing the different concentrations placed in each of the wells. About 200µl (0.2 ml) of the extract was dispensed into the agar wells made. The plates were masked with tape to avoiding shifting (disarrangement of the varying concentrations). Positive controls were established i.e. known antibiotics (1% ampiclox). All the plates were incubated at 37ºC for 24 hours under aerobic conditions. The resultant zones of inhibition were recorded in triplicates.

Statistical analysis

Statistical Package for Social Sciences (SPSS) software version 25 was used to carry out the statistical analysis. The data were expressed as Mean ± standard deviation. A one-way analysis of variance was carried out at P = 0.05, and Tukey Honestly Significant Difference (HSD) Test was used form multiple comparison between means of each of the organisms as well as based on solvents.

RESULTS

Table 1 shows the zone of inhibition exhibited by aqueous, acetone and ethanolic extracts of *Carica papaya* leaf. The zone of inhibition for *Escherichia coli, Pseudomonas species, Staphylococcus aureus* and *Proteus species* was 8.00mm, 8.00mm, 8.67mm and 9.00mm, respectively for aqueous extracts, 9.33mm, 9.00mm, 11.67mm and 10.00mm, respectively for acetone extracts, and 13.00, 11.33mm, 13.33mm and 12.00mm, respectively for ethanolic

extracts. There was no statistical variation (P > 0.05) in the zone of inhibition across the various isolates for each of the extracts.

Figure 1 shows the zone of inhibition exhibited by *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas* and *Proteus* species when exposed to aqueous, acetone and ethanolic extracts of *Carica papaya* and Ampiclox. The zone of inhibition of test isolates when exposed to aqueous, acetone and ethanolic extracts of *Carica papaya* and Ampiclox were 8.00mm, 9.33mm, 13.00mm and 24.67mm, respectively for *Escherichia coli*, 8.67mm, 11.67mm, 13.33mm and 23.33mm respectively for *Staphylococcus aureus*, 8.00mm, 9.00mm, 11.33mm and 23.67mm respectively for *Pseudomonas* species, and 9.00mm, 10.00mm, 12.00mm and 21.00mm, respectively for *Proteus species*. Statistically, there was a variation (P < 0.05) in the solvents and Ampiclox comparison for each of the test isolates. Furthermore, Tukey Honestly Significance difference test statistics showed that mean value of Ampiclox were the predominant source of the variation observed.

DISCUSSION

Based on Table 1 and Figure 1, *Carica papaya* extracts has antibacterial activities. This is in consonance with previous works. Ebana, *et al.*,(2016) reported that petroleum ether, aqueous and ethanolic extracts of *Carica papaya* is potent against *Escherichia* coli, *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Achi (2006) also reported that cold water and ethanol extracts of *Carica papaya* are potent against *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa*. Though, the zone of inhibition exhibited by the test organisms used for this study is different from the ones previously reported by authors. The variation could be due to the differences in concentration of the extracts, solvents used for extracts, physical condition i.e. age of the plant material, strain of the microbial isolates among other factors (Chiejina and Ukeh, 2012).

Authors have variously reported that the medicinal potentials of plants including Caricar papaya is due to the presence of bioactive components (Agu and Thomas, 2012 ; Benson, 2002). Several phytochemicals are found in *Carica papaya*. Achi (2006) reported the presence of tannins and glycoside and absence of include alkaloids, saponin, flavonoids and antraquinones in ethanol and cold water extracts of *Carica papaya* extract. Ebana, *et al.*,(2016) reported the presence of reducing compounds (polyphenols, phlobatannins, anthraquinones and (hydroxymethyl) anthraquinones, alkaloids, flavonoids, glycoside).

Isolates	Water	*Methanol*	Ethanol
E.coli	10.67±0.58a	11.33±1.15a	12.00±1.00a
Micrococcus species	9.33±0.58a	10.33±0.58a	11.33±0.58a
Staphylococcus aureus	11.00±1.00a	12.00±1.73a	11.67±0.58a
*Proetus*species	10.67±1.15a	12.67±0.58a	11.00±1.00a

Table 1: Zones of Inhibition (mm) of hot water, *methanol* and ethanol water leave extracts of *Carica papaya*

NOTE: Data is expressed as mean ±Standard *Deviation*; the same letters represent significant difference (P<0.05) according to Tukey Honestly Significant Difference statistics

Leaf extracts	*E.coli*	*Micrococcus* species	*Staphylococcus aureus*	*Klebsiella* species
Hot water	10.67±0.58a	9.33±0.58a	11.00±1.00a	10.67±1.15a
Methanol	11.33±1.15a	10.33±0.58a	12.00±1.73a	12.67±0.58a
Ethanol	12.00±1.00a	11.33±0.58a	11.67±0.58a	11.00±1.00a
Ampiclox	24.67±2.08b	23.67±4.04b	23.67±3.51b	23.00±3.61b

Table 2: Zones of Inhibition (mm) exhibited by *E.coli, Staphylococcus aureus, Micrococcus* and *Klebsiella* species when exposed to hot water, *methanol* and ethanolic leave extracts of *Psidiumguajava*

NOTE: Data is expressed as mean ±Standard *Deviation*; the same letters represent significant difference (P<0.05) according to Tukey Honestly Significant Difference statistics

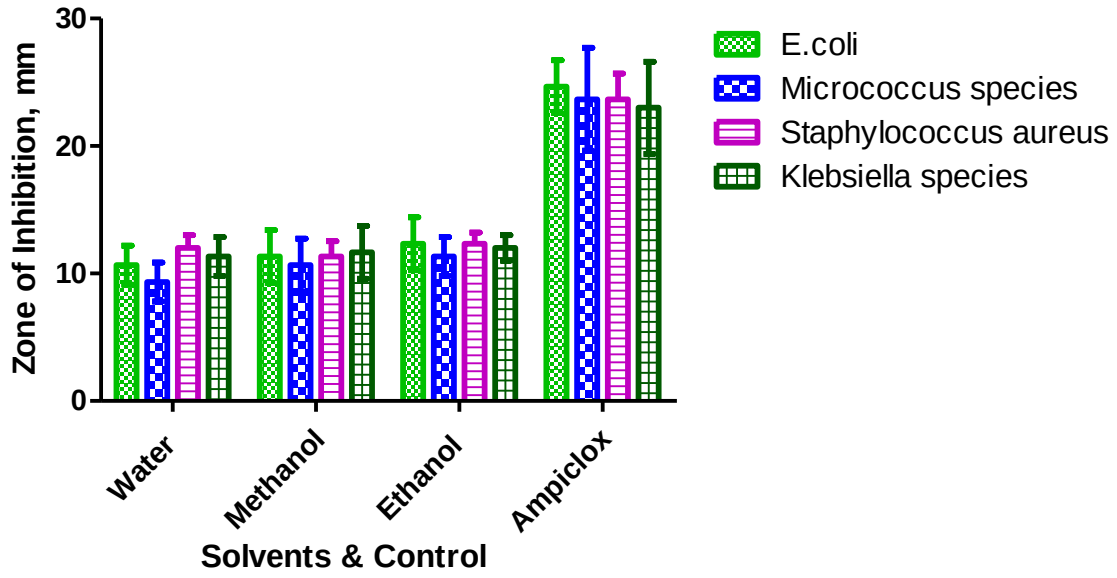

Figure 1 : Zones of Inhibition (mm) exhibited by *E.coli, Staphylococcus aureus*, *Micrococcus* and *Klebsiella* species when exposed to hot water, *methanol* and ethanolic leave extracts of *Carica papaya*

CONCLUSION

In conclusion, the investigation into the antibacterial activity of papaya leaf extracts against pathogenic bacteria has provided valuable insights into the potential of this natural remedy as an alternative or complementary therapeutic agent against bacterial infections. The findings of this study contribute to the growing body of research on the antimicrobial properties of medicinal plants and reaffirm the significance of traditional knowledge in modern scientific applications.

The results obtained from the experiments indicate that papaya leaf extracts possess substantial antibacterial effects against a range of pathogenic bacteria. The zones of inhibition observed in the assays suggest that the extracts have the ability to impede bacterial growth, and the minimum inhibitory concentration (MIC) values further emphasize the potency of the extracts in halting bacterial proliferation. These outcomes align with earlier studies that have identified

bioactive compounds in papaya leaves, such as alkaloids, flavonoids, and phenolic compounds, which have demonstrated antibacterial properties.

REFERENCES

Achi, O. K. (2006) Composition and Antibacterial Activities of *Tetrapleuratetraptera*Taub. Pod Extracts. *Res J Microbiol,* 1, 416-422.

Agu, G. C. and Thomas, B. T. (2012).Antibacterial Activities of Ethanol and Aqueous Leave extracts of Five Nigerian Medicinal Plants on Some Wound Pathogens.*Nature and Science,* 10(*2*):78-84.

Ayoola, P. B., Adeyeye, A. and Ogunlana, B., (2010). Phytochemical and nutrient evaluation of *Carica papaya*(pawpaw) leaves. *IJRRAS* 5(*3*), 11-18.

Benson, H. J. (2002). *Microbiological Applications:* Laboratory Manual in General Microbiology. complete version, 5th edition. McGaraw-Hill.

Bibitha B, JishaVK, Salitha CV, Mohan S, and Valsa, A.K (2002). Antibacterial activity of different plant extracts. Short Communiaction.*Indian J. Microbiol*. 42, 361-363.

Cheesbrough, M. (2004).*District Laboratory Practice in Tropical Countries.*Low price Edition part 2.Cambridge press.

Chiejina, N. V. and Ukeh, J. A. (2012).Antimicrobial Properties and Phytochemical Analysis of Methanolic Leaf extracts of *Aframomummelegueta* and *Zingiberofficinale* on Fungal Diseases of Tomato Fruit.*Journal of Natural Sciences*, 2(*6*): 10 – 15.

Doherty, V. F., Olaniran, O. O. and Kanife. U. C. (2010). Antimicrobial activities of *Aframomummelegueta* (Alligator pepper).*International Journal of Biology*, 2(*2*),126 – 131.

Ebana, R. U. B., Edet, U. O., Ekanemesang, U. M., Ikon, G. M., Etok, C. A. and Edet, A. P. (2016). Antimicrobial Activity, Phytochemical Screening and Nutrient Analysis of *Tetrapleuratetraptera* and *Piper guineense*. *Asian J Med Health*. 1: 1-8.

Epidi, J. O., Izah, S. C., Ohimain, E. I and Epidi, T. T. (2016b).Antibacterial and synergistic potency of tissues of *Vitexgrandifolia. Biotechnological Research*, 2(*2*), 69-76.

Epidi, T. T., Nwani, C. D. and Ugorji, N. P., 2016. Prevalence of malaria in blood donors in Abakaliki Metropolis, Nigeria. *Scientific Research and Essay*: 3(*4*): 162-164.

Epidi. J. O., Izah, S. C. and Ohimain, E. I. (2016a). Antibacterial and synergistic efficacy of leave extracts of *Alstoniabooneit*issues. *British Journal of Applied Science,* 1(1): 21 – 26.

He, X., Ma, Y., Yi, G., Wu, J., Zhou, L., and Guo, H. (2017).Chemical composition and antifungal activity of *Carica papaya*Linn.seed essential oil against *candida* spp.. *Letters in Applied Microbiology*, 64(*5*), 350–354.

Hernandez-Mendoza, A., González-Cortazar, M., Vallejo-Galland, B., Moreno-Hidalgo, M. A., López-Mendoza, M. C., and Campos-Montiel, R. G. (2018). Antibacterial activity of extracts of *Carica papaya* leaves and seeds against some human pathogenic bacteria. *Revista Argentina de Microbiología*, 50(*3*), 296-302.

Izah, S. C. and Aseibai, E. R. (2018).Antibacterial and Synergistic Activities of Methanolic Leaves Extract of Lemon Grass (Cymbopogoncitratus) and Rhizomes of Ginger (*Zingiberofficinale*) against *Escherichia coli*, *Staphylococcus aureus* and *Bacillus subtilis*. *Acta Scientific Microbiology* 1(*6*), 26-30.

Izah, S. C., Etim, N. G., Ilerhunmwuwa, I. A. and Silas, G. (2019b). Evaluation of crude and ethanolic leave extracts of *Capsicum frutescens var*. minima fruit against some common bacterial pathogens. *International Journal of Complementary and Alternative Medicine.* 12(*3*),105–108.

Izah, S. C., Etim, N. G., Ilerhunmwuwa, I. A., Ibibo, T. D. and Udumo, J. J. (2019a). Activities of Express Leave extracts of Costusafer Ker–Gawl. [Family COSTACEAE] Against Selected Bacterial Isolates.*International Journal of Pharmaceutical and Phytopharmacological Research*, 9(*4*), 39-44.

Izah, S. C., Uhunmwangho, E. J. and Dunga, K. E. (2018b). Studies on the synergistic effectiveness of methanolic extract of leaves and roots of *Carica papaya* (papaya) against some bacteria pathogens. *International Journal of Complementary and Alternative Medicine*, 11(*6*):375–378.

Izah, S. C., Uhunmwangho, E. J. and Etim, N. G. (2018a). Antibacterial and synergistic potency of methanolic leaf leave extracts of *Vernonia amygdalina* L. and *Ocimum gratissimum* L. *Journal of Basic Pharmacology and Toxicology*, 2(*1*),8-12.

Izah, S. C., Uhunmwangho, E. J., Dunga, K. E. and Kigigha, L. T. (2018c) Synergy of methanolic leave and stem-back extract of *Anacardiumoccidentale* L. (cashew) against some enteric and superficial bacteria pathogens. *MOJ Toxicology*, 4(*3*),209–211.

Izah, S. C., Zige, D. V., Alagoa, K. J., Uhunmwangho, E. J. and Iyamu, A. O (2018d). Antibacterial Efficacy of Aqueous Extract of *Myristicafragrans*(Common Nutmeg*).EC Pharmacology and Toxicology*. 6(*4*): 291-295.

Karpagam, T. and Nagalakshmi, P.K.(2014). Isolation and characterization of phosphate solubilizing

Microbes from agricultural soil. *International Journal of Current Microbiology and Applied Science*,3, 601-614.

Kigigha, L. T. Izah, S. C. and Ehizibue, M. (2015). Activities of *Aframomummelegueta*Seed Against *Escherichia coli*, *Staphylococcusaureus*and *Bacillus* species. *Point Journal of Botany and Microbiology Research*, 1(*2*),23 – 29.

Kigigha, L. T., Biye, S. E. and Izah, S. C. (2016).Phytochemical and antibacterial activities of*Musangacecropioides* tissues against *Escherichia coli*, *Micrococcus aeruginosa Staphylococcus aureus, Klebsiella* and *Bacillus* species. *International Journal of Applied Research and Technology*, 5(*1*), 100 – 107.

Kigigha, L. T., Izah, S. C. andUhunmwangho, E. J. (2018a). Assessment of hot water and ethanolic leaf leave extracts of *Cymbopogoncitratus*(Lemon grass) against selected bacteria pathogens. *Annals of Microbiology and Infectious Diseases*, 1(*3*), 1- 5.

Kigigha, L. T., Selekere, R. E. and Izah, S. C. (2018b). Antibacterial and synergistic efficacy of *methanol* leave extracts of *Garcinia kola* (Bitter kola) and *Buchholziacoriacea*(Wonderful kola). *Journal of Basic Pharmacology and Toxicology*, 2(*1*):13-17.

Lino, A. and Deogracious, O. (2006).The invitro antibacterial activity of *Annonnasenegalensis, Sacuridaccalongi-pendiculata* and *Steganotaeniaaraliacea.(*Uganda medicinal plant). *Journal of African Health Science*, 6(*1*): 31 – 35.

Orhue, P.O. and Momoh, A.R. (2013). Antibacterial activities of different solvent extracts of *Carica papaya* fruit parts on some gram positive and gram negative organisms. *International Journal of Herbs and Pharmacological Research*,**2**(4), 42-47.

Pandey, P., Garg, F.C. and Tripathi, L.K. (2016). Screening of antimicrobial activity of crude extracts of leaf against pathogenic bacteria. *World Journal of Pharmaceutical Carica papaya Research*, 5(*1*), 1005-1014.

Silva, F., Ferreira, S., Duarte, A., Mendonça, D. I., Domingues, F. C., and Domingues, M. R. (2020). Antibacterial potential of plant extracts against multi-drug resistant pathogens. *Industrial Crops and Products*, 148, 112-120.

MENTAL HEALTH STATUS AND ACADEMIC PERFORMANCE OF AUTOMOBILE TECHNOLOGY STUDENTS IN UNIVERSITIES IN SOUTH-SOUTH, NIGERIA

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Abstract

The study sought to determine the effect of multiple stress management intervention on mental health status and academic performance of university Automobile Technology Education students in South-South, Nigeria. 2 purposes with corresponding research questions were generated, answered and tested respectively. The study employed quasi-experimental design. The population for the study was 97 first year Automobile students in South-South, Nigeria. The instruments used for data collection were validated by 3 experts and has overall reliability coefficients of 0.77. Data analysis was carried out using mean and standard deviation. The findings revealed significant effect of the intervention on student's health status and improved academic performance. It was therefore recommended among others that multiple stress management intervention should be integrated in Automobile technology education and other engineering/technology based programmes to foster effective stress management practices among students. Also, there is the need for stress management training for all levels of Automobile students with involvement of capability within the university.
Key Words: Automobile Technology Education, Academic Performance, Mental Health Status and Multiple Stress Management Intervention.

Introduction

Helping students to manage stressful academic lives has been a goal of counseling practitioners, the concerns of Psychologists and Automobile Lecturers. Automobile is a self-propelled vehicle used for transportation of goods and passengers on the ground. The goal of Automobile Technology Education in Nigerian universities including South-South Universities is to produce Automobile Technology teachers and technologists with sound theoretical and practical knowledge who can test, diagnose, service and repair faults relating to Automobile assembly main units and systems to the manufacturers specification (Poripo, 2023). The achievement of this goal requires adequate provision of learning facilities, stress free and conducive learning environment, qualified and skilled Automobile lecturers who will facilitate students learning. In addition, the Automobile students optimal performance would be possible if the students have good mental health.

Automobile Technology is one of the trades offered as an option in technical education in the tertiary institutions in Nigeria. Automobile Technology Education involves the application of scientific knowledge in the design, selection of materials, construction, operation, maintenance and pedagogical skills acquisition of automobiles (Poripo, Ede, Nwaodo &Youdiowei, 2020; Poripo&Youdiowei, 2014). The programme of Automobile Technology in tertiary institutions including universities in South-South Nigeria is designed to produce competent

graduatestechnologists in various Automobile trades despite the stressful nature of the university education (Poripo, 2023), Poripo, Ede, Nwaodo&Youdiowei, 2020).

Literature however, revealed that students with high stress level face various negative consequences of stress including sleeping problems (Akerstedt, 2006), burnout (Maslach& Leiter, 1997), increased risk of depression and anxiety (Melchior, Caspi, Milne, Danese, Poulton& Moffitt, 2007), suicide thoughts and anger (Elgard&Arlett, 2002; Al-Qaisy, 2011), risky health behaviours and poor dietary patterns (Lee, Ahmed, Pathirana&Papier, 2016)). This is an indication that stress would most likely have negative consequences among universities students especially with no multiple stress management intervention (MSMI), which may result in dangerous mental or psychological health risks and poor academic performance of Automobile Technology Education students. Thus, students at this level require expert's assistance to be able to cope with and handle their stressful experiences (boujut, Koleck, Bruchon-Schweitzer, & Bourgeois, 2009). Compass, Connor-Smith, Saltzman, Thomsen and Wadsworth (2001) asserted that a wide range of psychological interventions for the treatment and prevention of detrimental outcomes of stress should be designed to enhance the motivation and coping skills of Automobile Technology Education students to avoid being stressed.

Stress is the adverse reaction students have in excessive academic pressure. Stress is a holistic transaction between the Automobile Technology student and a stressor. According to Lazarus and Folkman (1984), stress is a particular relationship between a student and the environment that is appraised by the student as tasking or exceeding his or her resources, and endangering his or her well-being. Chinaveh (2013), Hage (2000) and Al-Qaisy (2011) indicated that large percentage of higher institution students are feeling overwhelmed, sad, hopeless, and so depressed that they are unable to function. Students in Universities in South-South, Nigeria are among those experiencing such situation (Chinaveh, 2013; Unger, Johnson, Gong, Chen, Trinidad, Tran, and Lo, 2001). Hence, students who are daily exposed to unavoidable stressors may experience high level of stress impact (Heber, Lehr, Ebert, Berking, Cuijpers and Riper, 2016). According to Karabay, Akyuz and Elci, (2016) and Hudson (2016), stress is the adverse reaction students have in excessive academic pressure or other types of demands either physical or mental based on students cognitive appraisal that causes unpleasant emotional stress or even feeling of fear, anxiety, terror, anger, annoyance, dread, irritation, sadness, discomfort, grief and depression and can have an adverse effect on student's psychological and physical well-being, with negative impact on students' academic performance (Tosevski, Milovancevic& Gajic, 2010).In this study, stress implies events or psychological difficulties which Automobile Technology students encounter during the course of study as a result of combining multiple demands which include academic, personal, social, economic, and workshop practice that poses serious threat and challenges to their mental health.

Mental health is a very vital aspect of human make up that determines overall human performance. Mental health may be strongly influenced by exposure to stress and affected by ways of coping with stress. Mental health is described as a state of well-being in which an individual realizes personal potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make contributions to the community (Oku, Oku,

Owoaje & Monjok, 2015). However, mental health, emotional and physical wellbeing of university students are reported to be affected by stress as seen in negative emotions, anxiety and depression, and a host of health problems which include lack of appetite and sleep, low stamina and energy levels, headaches and low academic performance (Adewuya, Ola, Olutayo, Mapayi &Oginni, 2006; vergara, Smith &Keele, 2010; Nerdrum, Rustoen & Ronnestad, 2006; Wei, Heppner, Mallen, Ku, Liao & Wu, 2007).

Academic performance is the measure of students' success. Students' success implies meeting up with the set academic standard and cut-off demands prescribed by the school. Academic performance points to the extent to which Automobile students have gained from a particular curriculum, subject or task based on relatively standardized experiences, such as a class test (Akinade, 2001). Effective learning and sound academic performance are said to constitute an integral part of the goal of schooling for students' optimal performance (Hassan 2006). Student's academic performance however, have high tendency to be drastically affected or influenced by academic stressors manifestation which include lack of concentration in the classroom, absence from lectures, examination tension, fear of failure and academic grading system, inability to complete multiple assignments, inadequate study equipment, work apparatus, and facilities for practicals, limited time for practical activities among others (Nkem 2015, Bataineh2013, Awino and Agolla, 2008). This implies that, if the stresses experienced by Automobile Technology students are not properly managed, it could affect their academic performance. Vergara, Smaith, Keele(2010), Al-Qaisy (2011), noted that stress, concomitant with limited coping resources, render students unable to meet academic demands and can lead to academic decline, poor relationships with peers and overall dissatisfaction with life. Pariat, Rynjah, and Kharjana (2014) asserted that stressors have an impact on the academic performance of student. However, effects of stress on students' performance may be reduced if students acquire higher level of motivation and coping skills and also provide appropriate responses during stressful events and conditions. The reduction of stress and addition of stress coping skill can be made possible through student motivation and stress management. In this study, academic performance means the total or overall output of an Automobile Technology student after assessment for participating in required academic activities at the end of the session. Automobile students need intervention, such as MSMI.

MSMI is a structured psycho-educational therapy in form of a training programme. The MSMI approach is a face-to-face training which, according to Heber, Lehr, Ebert, Berking, Cuijpers and Riper (2016), is the most effective method of stress management therapy. MSMI has higher tendency to improve students stress management skills (Chinaveh, 2013). Automobile Technology students would most likely use appropriate motivation and coping mechanism to prevent the gross negative consequences of stress and may improve their mental health and academic performance (Bataineh, 2013; Stevenson & Harper, 2006; Chang, 2007). Therefore, carrying out this intervention study could be a life time opportunity for students in overcoming the defects of stress in their entire life. However, if Automobile students are not exposed to stress management treatments especially at this early stage of their university life before adult life, stress may jeopardize their academic ambition, force them to adopt maladaptive behaviours. Thus, it becomes imperative to investigate the effect of MSMI on

level of stress, motivation, mental health and academic performance of Automobile students in South-South Nigeria.

Statement of the Problem

The Automobile Technology graduates in South-South Nigeria prove to be ill equipped and lack interest in Automobile activitiesas most companies and industries spend money in training and retraining the graduates of Automobile Technology in South-South Nigeria in other to meet the standard required by the companies and industries, instead of starting work immediately (Poripo, Ede, Nwaodo&Youdiowei, 2020). However, literatures have shown that automobile students are prone to series of stress. In order to prevent severe psychological effects and its implications among the Automobile Technology students, effective stress management intervention is needed which could help or assist the students in handling stressful academic events appropriately, thereby reducing its harmful effects which could affect or jeopardize student's academic performance and future working ambitions.

Purpose of the Study

The general purpose of this study is to determine the mental health status and academic performance of automobile technology education students in universities in southern Nigeria.

Research Questions

The following research questions were answered in the study:

1. What is the effect MSMIon mental health status of Automobile Technology Education students?
2. What is the effect of MSMIon academic performance of Automobile Technology Education students?

Methodology

Quasi-experimental design was adopted for this study. The study was conducted in South-South, Nigeria. The populationfor this study consists of 97 students of Automobile Technology in South-South, Nigeria. A structured questionnaire was used as instrument for data collection.The instrumentwas validated by three experts from the University of Nigeria, Nsukka. Statistical Package for Social Sciences (SPSS) version 20.0 was used to analyzed the data collected from the respondents. Cronbach alpha reliability coefficient index was used to determine the internal consistency of the instruments. The overall reliability index for the instruments was 0.77. The data collected from the administration of both pre-test and post-test, were analyzed and interpreted using mean (X) and standard deviation (SD).

Presentation of Results

Research Question 1

What is the effect of MSMI on mental health status of automobile technology education students?

Table 1: Pretest/Posttest Mean scores of Students on the effects of MSMI on mental health status of automobile technology education students

Groups		Pretest		Posttest			
	N	$\bar{x}$	SD	$\bar{x}$	SD	Mean Gain/Loss	Remarks
Experimental	51	18.57	5.02	12.29	1.60	-6.28	Decrease
Control	46	14.00	1.85	17.63	3.62	3.63	Increases

The results presented in Table 1 shows the mean difference between the pretest and posttest responses of students in the experimental and control groups on mental health status among Automobile Technology students in Universities in South-South Nigeria. Theresults show that MSMI had more positive effect on mental health status of Automobile Technology Education students in Universities South-South, Nigeria in the experimental group more than the control group.

Research Question 2

What is the effect of MSMI on academic performance of automobile technology education students?

Table 2: Pretest/Posttest Scores of Students on the effect of MSMIon academic performance of automobile technology education students

Groups		Pretest		Posttest			
	N	$\bar{x}$	SD	$\bar{x}$	SD	Mean gain	Remarks
Experimental	51	53.57	4.39	58.14	4.18	5.54	Increases
Control	46	50.60	3.99	56.14	3.38	4.57	Increases

The results presented in Table 2 shows the mean difference between the pretest and posttest responses of students' academic performance in the experimental and control groups among Automobile Technology students in Universities in South-South Nigeria. This results show that the MSMI seems to effectively influence the marginal increase in the academic performance of the Automobile Technology students in universities in South-South Nigeria in the experimental group compared to those students in the control group with no stress management experience or absence of MSMI therapy among Automobile students.

Discussion of Findings

The findings in Table 1 on mental health status among Automobile Technology Education students in South-South Nigeria corroborate the position of Chinaveh (2013) and Al-Qaisy (2011) who established that integrative theoretical models or effective stress intervention would aid prevention of psychological difficulties and detrimental outcomes; and Heber et al., (2016) who agrees that a stress management intervention like the MSMI with a face-to-face training approach is the most effective method of stress management therapy.

The findings in Table 2 complement previous studies that an educative assistance such as MSMI on stress management would most likely help Automobile students use appropriate coping mechanism to prevent the gross negative consequences of stress most especially on mental health and to be motivated for academic performance (Bataineh, 2013; Stevenson & Harper, 2006; Cahng, 2007). This finding is in consonance with the position of Hudson (2016),Chinaveh (2013) and Al-Qaisy (2011) who established that integrative theoretical models or effective stress intervention would aid prevention of psychological difficulties and detrimental outcomes; Heber et al., (2016)and Moos (2004) who agrees that a stress management intervention like the MSMI with a face-to-face training approach is the most effective method of stress management therapy.

Conclusion

Based on the findings, this study concludes that MSMIwill be effective in training Automobile students in stress management thereby limiting and reducing the detrimental effects of stress among students. The results show that MSMI had more positive effect on mental health status of Automobile Technology Education students in Universities South-South, Nigeria in the experimental group more than the control group. Also, the findings show that the MSMI seems to effectively influence the marginal increase in the academic performance of the Automobile Technology students in universities in South-South Nigeria in the experimental group compared to those students in the control group with no stress management experience or absence of MSMI therapy among Automobile students.

Recommendations

Based on the findings of this study, the following recommendations were made: MSMIshould be integrated in Automobile Technology Education and other engineering/technology based programmes to foster effective stress management practices among students.There should be stress management training for all levels of Automobile Technology Education students with involvement of professional therapists and educational stakeholders to improve students stress management capability within the university education.

References

Adewuya, A., Ola, B., Olutayo, O., Mapayi, B., &Oginni, O. (2006). Depression amongst Nigerian University students: Prevalence and socio-demographic correlates. *Psychiatry Epidemiology, 41, 674-678.*

Agolla, J. E. (2009). Occupational stress among Police Officers: The case of Botswana police service. *Resources Journal of business Management, 2 (1), 25-35.*

Aheme, D. (2001). Understanding students stress: A qualitative approach. *Irish Journal of Psychology, 22, 176-187.*

Akerstedt, T. (2006).Psychosocial stress and impaired sleep. *Scandinavian Journal of Work, Environment & Health, 32 (6), 493-501.*

Al-Qaisy, L. M. (2011). The relation of depression and anxiety in academic performance among group of university students. *International Journal of Psychology and Counselling, 3 (5), 96-100.*

Awino, J. O., &Agolla, J. E. (2008). A quest for sustainable quality assurance measurement for universities: case of study of the University of Botswana. *Education Research Revolution, 3 (6), 213-218.*

Bataineh, M. Z. (2013). Academic stress among undergraduate students: The case of education faculty at King Saud University. *International Interdisciplinary Journal of Education.2 (1), 82-88.*

Boujut, E., Bruchon-Schweitzer, M., &Dombrowski, S. (2012). Coping among students; development and validation of an exploratory measure. *Psychology, 3 (8), 562-568.*

Boujut, E., Bruchon-Schweitzer, M., &Reascle, N. (2004). Stress and health in a student population: a transactional model perspective. *Psychology and Health, 19, 25-26.*

Boujut, E., Koleck, M., Bruchon-Schweitzer, M., & Bourgeois, M. (2009). La santé mentales chez les etudiants: enqueteaupres d' une cohort de 556 etudiants de lereannee. *Annals Medico-Psy-chologiquees, 167, 668.*

Chan, D. (2008). Emotional intelligence, self-efficacy, and coping among Chinese prospective and in-service teachers in Hongkong. *Educational Psychology, 28, 397-408.*

Chang K., L. U. (2007). Characteristics of organizational culture, stressors and wellbeing: the case of Taiwanese organizations. *Journal of management psychology, 22 (6), 549-568.*

Chen, H., Wong, Y., Ran, M., & Gilson, C. (2009). Stress among Shanghai university students: The need for social work support. *Journal of Social Work, 9 (3), 323-344.*

Chen, k. L. (2009). A Study of stress sources among college students in Taiwan. *Journal of Academic and Business Ethics, 2 (14), 1-8.*

Chinaveh, M. (2013). The effectiveness of multiple stress management intervention on the level of stress, and coping responses among Iranian students. *Procedia Social and Behavioural Sciences, 84, 593-600.*

Chinaveh, M., Ishak, N. M., &Salleh, A. M. (2010). Improving mental health and academic performance through multiple stress management intervention; Implication for diverse learners. *Procedia Social and Behavioural Sciences,7 (C), 311-316.*

Compass, B. E., Connor-Smith, J. K., Saltzman, H., Thomsen, A. H., & Wadsworth, M. E. (2001). Coping with stress during childhood and adolescence: Problems, progress, and potential in theory and research. *Psychological bulletin, 127 (1), 87-127.*

Elgard, J. F., &Arlett, C. (2002). Perceived social inadequacy and depressed mood in adolescents. *Journal of Adolescence, 25, 301-305.*

Folkman, S. & Lazarus, R. S. (1984). If it changes it must be a process: Study of emotion and copign during three stages of a college examination. *Journal of Personal Social Psychology, 48 (1), 150-70.*

Garret, J. B. (2001). Gender differences in college related stress. *Undergraduate Journal of Psychology, 14, 25-34.*

Grant, K. E., Compas, B. E., Thurm, A., McMahon, S. D., &Ey, S. (2000). *Stress and developmental psychopathology: Moving form markers to mechanisms of risk* (Unpublished manuscript). De Paul University, Chicago.

Grebot, E., &Barumandzadeh, T. (2005). L'acce' a l'universite: Une situation stressante a I'origine de certaines strategies d' ajustementdysfornctionnelles. (French). *Annales Medico Psychologiques, 163, 561-567.*

Heber, E., Lehr, D., Ebert, D. D., Berking, M., Cuijpers, P., & Riper, H. (2016). Internet-and mobile-based stress management for employees with adherence-focused guidance: efficacy and mechanism of change. *Scandinavian Journal of work, Environment and Health, 42 (5), 382-394.*

Hicks, T., & Miller, E. (2006). College life style, life stressors and health status: differences along gender lines. *Journal of College admission, 192, 22-29.*

Hiebert, B. (2002). Relaxation in the classroom: A win-win life skill. *Guidance & Counselling, 17 (3), 73-81.*

Lazarus R. S., &Folkman S. (1987). Transactional theory and research on emotions and coping. *European Journal of Personality. 1, 141-169.*

Lee, P. C., Ahmed, F., Pathirana, T., T., &Papier, K. (2016). Factors associated with stress among first-year undergraduate students attending an Australian university. *Food Nutrition Report, 1(3). 17-24.*

Mills, R. C. (1995). *Realizing Mental Health: Toward a new Psychology of Resiliency.* Sulzberger & Graham Publishing.

Oku, A., Oku, O., Owoaje, E., &Monjok, E. (2015). An assessment of mental health status of undergraduate medical trainees in the university of Calabar, Nigeria; A cross-sectional study. *Open access Macedonian journal of Medical Sciences, 3 (2), 356-362.*

Ongori, H., Agolla J. E. (2008). Occupational stress in organizations and its effects on organizational performance. *Journal of Management Resources, 8 (3), 123-135.*

Poripo, J. (2023).Impact of Multiple Stress Management Intervention on Motivation and Academic Performance of Automobile Technology Education Students in Universities in South-South, Nigeria. *Sagbama Journal of Science and Technical Education, 1 (2), 46-54.*

Poripo, J. (2021).Effect of multiple stress management intervention on stress, motivation, mental health status and academic performance of automobile technology education students in universities in South-South, Nigeria. Ph.D Thesis, University of Nigeria, Nsukka.

Poripo, J., Ede, E. O., Nwaodo, S. I. &Youdiowei, B. T. (2020).Effect of multiple stress management intervention on stress and academic performance of automobile technology education students in universities in South-South, Nigeria. *Eng. Applied Sci., 15 (9): 2121-2127***.**

Poripo, J. &Youdiowei, B. T**. (**2014**).** Assessment of utilization of instructional facilities in the teaching and learning of automobile technology in tertiary institutions in South-South Nigeria. *Journal of Vocational Education and Technology. 11(1&2),77-90.*

Stanley, N., &Manthorpe, J. (2001). Responding to students' mental health needs: Impermeable systems and diverse users. *Journal of Mental Health, 10, 41-52.*

Stevenson, A., &Harpern, S. (2006). Workplace stress and the student learning experience. *Quality assurance Education, 14(2), 167-178.*

Tosevski, D. L., Milovancevic, M. P., & Gajic, S. D. (2010). Personality and psychopathology of university students. *Current Opinion Psychiatry, 23 (1), 48-52.*

Towbes, L. C., & Cohen, L. H. (1996). Chronic stress in the lives of college students: scale Development and prospective prediction of distress. *Journal of Youth and Adolescence, 25, 199-217.*

GROWTH PERFORMANCE AND ECONOMICS OF PRODUCTION OF WEANER PIGS FED GRADED LEVELS OF PLANTAIN PEEL MEAL SUPPLEMENTED WITH CORN PAP CHAFF.

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Abstract

This research was carried out to investigate the effect of graded levels of plantain peel meal supplemented with corn pap chaff on the growth performance and economics of production of weaner pigs. Plantain (Musa paradisiaca) is a fruit crop which produces about 30-40% peels in the form of agricultural by-products (wastes). These peels (ripe and unripe) have been harnessed as animal feed or feed ingredients.Twenty-four (24) weaner pigs of either sex of the large white hybrids were procured froma reputable farm in Yenagoa, Bayelsa State. The weaner pigs which weighed 4-5kg initial body live weight were distributed into four (4) treatments of six (6) pigs per treatment and replicated three times with two (2) weaner pigs per replicate in a completely randomized design (CRD). The plantain peel meal was served at 45kg, 30kg, 15kg and 0kg in T_1(Control), T_2, T_3 and T_4 respectively.Corn pap chaff was served to supplement the pig's ration.Proper farm management practices and routine medications and vaccinations were strictly observed. Cool water and feed were supplied ad libitum. The experiment lasted for eighty-four (84) days. All data was subjected to a one-way analysis of variance (ANOVA). Under growth performance indices, the parameters measured were the initial weight, final weightand feed intake. The weight gain, feed conversion ratio and mortality were calculated. Results on performance indicate that T_2 and T_3 were significantly ($P<0.05$) better in final live weight, feed intake and feed conversion ratio; while feed intake increased linearly from T_3-T_4. The economics of production shows that the cost of production for all the treatment groups were similar; as there were no significant ($P>0.05$) differences in the total cost of production. It was therefore concluded that weaner pigs can be fed between 15% and 30% graded levels of plantain peel meal (PPM) supplemented with corn chaff without causing any deleterious effects on the performance and economics of production.

Keywords: Plantain peels, Cornpap chaff, Weaner pigs, Growth performance, Economics of production.

INTRODUCTION

There is a sharp increase or demand for animal protein on the diets and the dinning table of so many persons/families. Dave (2003), reported that the gap between supply and demand could be due to increasing population, improving technology and increasing incomes. It is true that pig production is gaining centre stage in the livestock sub-sector/industry. This is because pigs are very prolific with a birth size of between 8-22 piglets per farrow; and a short gestation period of three months, three weeks and three days or (114-115 days). Other facts about the pigs are:They are omnivorous and indiscriminate eaters who can subsist on every cooked and uncooked farm wastes from the dinning hall, hotels, kitchens and parties. They are incredibly social and very clever animals. Pigs can recognize their names from four weeks.Shows sign to their young piglets (baby pigs) while breast feeding. Pigs can dream. Theirgenetic make-up is similar to man. They can swim very well. Pigs produce live weight gain, from a given weight of feed, than any other class of meat animals. The small intestines of the pig are used to make the catgut, a suture material.

Adamu et al (2017), reported the proximate composition of both the unripe and ripe plantain peels.Thus, unripe plantain peels: moisture (33.53), crude protein (2.93), either extract (6.00), crude fibre (2.53), ash (6.30), and carbohydrate (84.01). Ripe plantain peels: moisture (53.30), crude protein (6.69), either extract (5.37), ash (6.30) and carbohydrate (28.60). Plantain peels have been shown to possess so many anti-oxidant, anti-fungal, anti-bacterial, anti-cancer, anti-septic, aphrodisiac and other pharmacological activities.The value of plantain peel can also be seen in its food, exports, industrial,medicinal and as livestock feeds. (FDAFS, 2000). Unripe plantain peels has been processed into plantain peel fuofuo and eaten (swallowed) by man. Peels are properly washed to remove dust, sand, insect eggs and larva, cut into pieces, put in a blender and blended, cooked/baked in a pot and served,(Rasheed, 2003). Pigs can eat both ripe and unripe plantain peels with or without any supplementation or fortification.

Maize or corn pap chaff is the end product of milling maize. Wet corn chaff can be swallowed outrightly, while some others prefer to dry it, ground and sieve to get a finer product. It is usually served farm animals wet or dried.Health benefits of corn pap chaff is that it contains fibre, which is good to ease constipation and improve digestion. It protects the body against colon cancer, diabetes, and cardiovascular illness. It can be mixed with other feed ingredients and fed to livestock, Ponka et al, (2005).

Fokeu, (2005), reported the nutritional values of corn pap chaff as moisture (67.9 $\pm$2.24), ash (4.30$\pm$ 0.88), protein (11.7 $\pm$ 1.42), lipid (17.6 $\pm$ 2.93), fibre (3.18 $\pm$ 0.48), and carbohydrates (63.2 $\pm$ 2.56).

Major Phytochemicals in corn chaff include Alkaloids, Tannins, Fluminoids, Saponins, Glycocides, Stroids and anthraquinones (Lawal et al, 2015).

Plantain peels (ripe and unripe) and corn chaff (wet or dry) are totally being consumed by both ruminant and non-ruminant animals. As a result of the increasing population of pigs and their fast growth rate. It has become imperative to source for alternative sources of agro-industrial by-products like the plantain peels and corn chaffs. The objectives of this study is to evaluate the response of pigs to the bioactive components of plantain peels and cornchaff and yet predict the possibilities of maximizing profit in the committee of pig farmers.

MATERIALS AND METHODS

Study Area:

This study was carried out at the piggery unit of the Teaching and Research farm, Isaac Jasper Boro College of Education Sagbama, Bayelsa State. Sagbama is situated within the South-South ecological zone of Nigeria and lies along the co-ordinates of latitude $40^{0}58^{1}\ 13^{11}$ North, and longitude $60^{0}\ 6^{1}\ 33^{11}$East of the equator. The climate has two seasons; the dry and the wet. Annual rainfall record stands at 2800-3000mm. temperature records indicate 27-32^{0}C, and relative humidity is 75-87% ABS, (2016).

Source of Experimental Materials

The experimental materials, plantain peels (unripe and ripe), were collected from women roasting plantains. Corn pap chaff were also collected from large scale pap (Akamu) producers using maize. These waste products were weekly collected for the study.

Experimental Weaner Pigs.

Twenty-four (24) weaner pigs of either sexes weighting about 4-5kg were procured from a reputable farm in Yenagoa, the Bayelsa State Capital. Two weeks of pre-experimental period were allowed for all of them to acclimatize themselves to their new environment beforethe commencement of the experiment.

Experimental Design

Twenty-four (24) weaner pigs were randomly assigned to four treatments and three replications with six (6) weaner pigs per treatment, and with two pigs per replicate, in a Completely Randomized Design (CDR).

Housing and Management

The weaner pigs were allotted their pens in their various treatment and replications. The housing was to provide shelter from the rains, predators and hot weather. Feed and water were supplied ad libitum. Cool and clean water was also served. Routine medication and vaccinations were strictly followed.

Duration of the experiment

The experiment lasted for eighty-four (84) days

Experimental Model

The experimental model used was:

$Yij = U + T_1 + Eij$

Where,

Yij = Individual observation

U = Overall mean

T_1 = Treatment effect

Eij = Random error assured to be independently identically and normally distributed with zero means and constant variances.

Data collection

At the end of the study, data was collected on the growth performance and economics of production.

Statistical Analysis

All data was subjected to a one-way analysis of variance (ANOVA) in a completely randomized design (CRD) as prescribed by AOAC (2005) were significant ($P<0.05$) differences are noticed, means were compared using the Duncan's New Multiple Range Test (DNMRT) as outlined by Obi (2001). The SPSS (2012) statistical package for social sciences, verse 20, was used to carry out all the statistical calculations.

Results

Table 1. Composition of Experimental Diets

Ingredients	T_1	T_2	T_3	$_4$
Plantain peel meal (PPM) (kg)	4	53	01	50
Corn pap chaff (CPC) (kg)	0	1	53	54	5
	4	54	54	54	5

Table 2: Proximate Composition of the Experimental Diets

Parameter (IDM)	T_1	T_2	T_3	$_4$	SEM
Dry matter	92.14	91.62	19.25	91.12	0.2
Crude protein	15.50	16.09	16.48	17.15	0.01
Crude fibre	17.67	16.68	15.82	15.58	0.06
Either extract	2.97	3.42	3.29	2.74	0.01
Nitrogen free extract	46.52	48.66	49.73	50.35	0.02
Ash	7.81	6.58	6.45	5.91	0.01
Energy (mj/kg DM)	1.56	1.68	1.68	1.70	0.01

RESULTS AND DISCUSSION

RESULT

Table 3: Growth Performance of Weaner Pigs Feed Plantain Peel Meal Supplemented with Corn Pap Chaff.

Parameter (IDM)	T_1 45 kg	T_2 30 kg	T_3 15 kg	T_4 0 kg	SEM
Initial live weight (kg)	4.8	15.0	14.7	85.0	30.01
Final live weight (kg)	8.22^{bc}	19.15^{a}	8.96^{b}	8.24^{bc}	0.2
Weight change (kg)	3.41^{c}	4.14^{b}	5.18^{a}	3.21^{d}	0.1
Feed intake (kg)	131.28^{c}	134.25^{a}	133.14^{b}	130.96^{d}	0.8
Feed conversion ratio	38.5^{c}	32.55^{b}	31.8^{a}	40.8^{d}	0.4
Mortality	0.00	0.00	0.00	0.00	0.0

abcd: means within the same row with different superscripts are significantly (P<0.05) different.
SEM: Standard Error of Means.
NS: Not Significant.

Under growth performance, the initial live weight of the weaner pigs was similar and the same across all the treatment groups, T_2-T_4; including T_1 (control) group (P<0.05). However, the final live body weight was significantly (P<0.05) affected in T_2 and T_3 by the plantain peel meal supplemented with corn pap chaff diets than the T_1 (control group) and T_4 which never had any supplementation. From the table, it was shown that weight gain was significantly (P<0.05) higher in T_2 and T_3 than the other treatment groups.

Feed intake was also better (P<0.05) in T_2 and T_3. T_4 was the least (P<0.05). The feed conversion ratio was best (P<0.05) for T_3 (31.8) with the least values. The poorest in feed conversion ratio was T_4 with 40.8. Mortality records indicate that there was no one case or incidence of deaths. (P<0.05).

Table 4: Economics of Production of Weaner Pigs Fed Plantain Peel Meal (PPM) Supplemented with Corn Pap Chaff. (CPC)

PARAMETER	T_1 45kg	T_2 30kg	T_3 15kg	T_4 0kg	SEM
Initial live wt (kg)	4.81	5.01	4.78	5.03	0.01
Final live wt (kg)	8.22^{c}	9.15^{a}	8.96^{b}	8.24^{c}	0.1
Total weight gain (kg)	3.41c	4.14b	5.18a	3.21c	0.1
Gain (Kg)					0.8
Total feed intake	131.28c	134.25a	133.14b	130.96d	0.2
Total feed cost (₦)	45,000d	47,000c	49,000b	50,000a	0.2
Cost of feeding (₦)	15,000	15,000	15,000	15,000	
Daily feed cost (₦)	803.6d	1,071.4c	1,339.2b	1,607.1a	2.64
Total cost of production (₦)	60,000d	62,000c	64,000b	65,000a	0.6
Cost/kg wt gain (₦)	13,196.5d	14,492.8b	14,478.8c	28,037.3a	0.4

abcd: means within the same row with different superscripts are significantly ($P<0.05$) different.
SEM: Standard Error of Means.
NS: Not Significant.

This experimental animals in T_2 (9.15kg) performed better than the rest of the treatment groups in terms of final live body weight. But T_1 (the control) had the least values (8.22kg) in T_3 total weight gain was highest ($P<0.05$) with the values as (5.18kg).

Total feed intake was highest ($P<0.05$) in T_2 (134.25 kg) and T_3 (133.14 kg) than T_1 (131. 28kg) and T_4 (130.96 kg).

Total feed cost for the period of field experimentation revealed that T_1 (the control) (₦ 75,000) was the cheapest, ($P<0.05$) which t4 (₦80,000) was the costliest ($P>0.05$). The total feed intake per pig times cost per kg feed (₦) equals o total feed cost pig hairs.

The cost per kilograms weight farm in Naira was a function of total feed cost per pig divided by the weight gain in kilogram. Results showed that of will take ₦78,037.3 to produce a one-kilogram weight of muscle with this feeding regime.

Total cost of production in naira during the feed under review (56 -days), revealed in following values. T_1 (₦60,000), T_2 (₦75,000), T_3 (₦75,000) and T_4 (₦80,000), respectively

DISCUSSION

All the weaner pigs for the study were sharing an average weight of 4.05-5.5kg, Agbabiake et al (2013), posited that this could be as a result of the fact that they were either born by the same parents, or were farrowed at about the same age brackets and nursed under similar environmental conditions.

The result obtained on the final live weight by the weaner pigs indicate that the animal converted the by-products they have eaten to muscle. Omu, (2012), reported that plantain and banana peels can serve as good sources of nutrients in the preparation of animal feeds as they are high in starch, proteins, lipid, ash and essential mineral contents.

Plantain and banana peels have attracted attention in recent times. This is because, they serve as a very good source of dietary fibre and anti-oxidants. Plantain peels has been investigated as feed and feed materials for Poultry, (Ironkwe and Oruwari, 2012); Fish, (Agbabiaka et al, 2013); and Snails, (Omole et al, (2015).

Akande and Agbateryi (2019), reported that the depressed weight change in experimental animals could have been as a result of the presence of anti-nutritional factors in their ration. In a related development, Garcie et al (2019), observed that the poor weight gain of finisher birds would have been due to poor nutrient utilization as a result of the presence of anti-nutritional factors.

Feed intake was better in T_2 and T_3. This may be due to the fact that low quality bulky feeds is compensated by the inclusion of concentrates in the diets. This is to check any form of negative influence on animal health.

Plantain is larger, starchier and less sweet than the smaller bananas. The proximate composition of plantain peels indicate that they are rich in total dietary fibre (64.33g/100g), Vitamins (Folic Acid) (33.12mg/100g); and minerals (Potassium) (35.61mg/100g). This may be why $T_1 – T_3$ had higher intake than T_4.

Results obtained in this study indicate that pigs in T_3 (31.8), had a better feed conversion ability thin all the other groups. But T_4 (40.8) showed the least feed conversion ratio. The explanation to this is that treatment groups with the smallest feed conversion ratio values has the highest capacity to convert feed to flesh. This result agrees with the findings of Afoleyan et al (2009), who reported that dietary energy level is a major factor influencing feed intake and feed conversion ratio.

During the period of the field work, no deaths were recorded. Mortality rate was zero.This could be attributed to the meticulous farm management practices that were observed; and the routine medications and vaccinations of the animals. Garicie et al (2013), reported that balanced and adequate feeding is synonymous with sound health for all farm animals. The purpose of feed analysis is to enable farmers and farm advisors to monitor feed to meet the nutritional requirements of animals. Feeds are usually classified into two broad categories: concentrates and forages. Concentrates are high in energy contents. While protein varies from 2 – 80%, forages have a much lower range in protein content, from 2 – 22%.

Forages or roughages are low in net energy per unit weight, usually because of the high fibre content. Such products include all type of peels, seed coats, peels, brans, etc. the quantity and quality of good feed served is directly proportional to a disease free and healthy body.

The final live body weight from this study revealed that 1,T_2 with 9.15 kg and 8.96kg and better performance than T_1 (the control) and T4. The results obtained indicates that the plantain peel meal supplemented with corn pap chaff improved general performance of the weaner pigs. This work corroborates the findings of Iyegha-Eraakpotobor (2010) who worked on protein and energy partitioning for growth by rabbits feed soyabeans cheese waste diet and lablabhay. It was confirmed that the mix or supplementary feed had superior performance.

Antibiotics, chemotherapeutic appendix, microbial supplements (Prebiotics and probiotics), Enzymes and other feed additives are often added to swine diets to increase the rate and efficiency of gain improve digestibility and other purposes; but they are not considered as nutrients (Nsidinanya, et al 2020).

For total weight gain, that had the respectively. T_2 and T_3 had supplementation whereas, T_1 and T_4 had no supplementation.

Adegbola (2002), reported that when poor gravity roughages ad fed to ruminants without supplementation, this could cause consideration weight loss and finally death during the dry season.

According to Omu, (2023) the level of feeding plantain peel meal (PPM) to weaner pigs was borne cut primary from the desire to investigate cheap and alternative feeds for livestock and yet maximize profit.

As population is increasing, the quantity of corn pap chaff available for possible use in livestock feed in constantly increasing (FAO, 2010).Although, there are many studies on the use of plantain peel as a source of weaner pig meal, there is scarcity of information on the incorporation of plantain peel meal and corn pap chaff. The objective of this study was therefore to evaluate the growth performance and economic of production or feeding of weaner pigs of graded levels. Dietary supplementation increases production, increases fertility, improves growth, improves skeletal developments and maximize profit (Robert et al, 2020).Dietary fibre supplementation in the diets of gestating grows has beneficial effects on their gut microbiota, immunity, welfare, colostrum production, physiology, and overall performance. The utilization of plantain peel meal and corn pap chaff as individual ingredients and/or as a mix has been a long-time practice by the rural pig farmer. Agbabiaka and Okoriye, (2013).

The same authors stated that these two feed resources find an excellent supplement as both protein and energy source in the diets of pigs and catfish. Similarly, Sogunle et al (2009) reported that dietary supplementation has capacity to influence feed intake. Total feed cost indicates that T_1 (₦45,000). Was the least. The feed cost per treatment followed an ascending trend. The reason for T4 having the highest values could better explained as perhaps. Due to the rush in sourcing for the corn pap chaff by different stock farmers, and the transport fare

paid to access the chaff. The benefits of dietary supplements include but not limited to these only: close nutritional gaps, regulate nutrient absorption, and avoid costly health problems. Raynolds et al (2012). The same authors stated that generally,feed nutrients perform three main functions. They provide energy contribute to body structure, and/or regulate chemical processes in the body.

Animal feeds are classified concentrates and roughages. The concentrates which are high in energy value include fat, cereal grains, and their by-products, such as barley, corn, rye, wheat, etc. They are also high in protein and include oil meals or cakes such as soya bean, canola, cottonseed, peanut and their by-products from the processing of sugar beats, sugarcane, animals and fish. Meanwhile roughages include – pasture grasses, hays, silage, root crops, straw, stover (corn stalks), and peels. They are usually rich in fibre.Total cost of production shows there was a linear increase from T_1 to T_4 in the values of ₦65,000, ₦75,000 and ₦80,000 respectively.

Oh et al, (2019): stated that fibre is made up of the indigestible parts or compounds of plants, which pass relatively unchanged through the stomach and intestines. Fibre is mainly a carbohydrate. The main role of fibre is to keep the digestive system healthy, blood cholesterol, weight control, stabilizing glucose, reducing other health challenges.

Dietary fibre is found in the indigestible parts of cereal, fruits and vegetables. A diet high in fibre keeps the digestive system healthy.Health conditions linked to a low fibre diet include: constipation, irritable bowel syndrome (IBS), haemorrhoids, diverticulitis, heart disease and some forms of cancers. Fayet et al, (2018).

CONCLUSION AND RECOMMENDATIONS

Conclusion

1. From the results obtained in this study, it is concluded that plantain peel meal supplemented with corn pap chaff has the potential to be used to feed weaner pigs.
2. Plantain peels posses medicinal properties that can be (have been) used to prevent, control and treat all kinds of diseases and improve efficiency.
3. This study has revealed that the often-undervalued plantain peel and corn chaff are found to contain substantial amount of nutrients mineral elements, phytochemical properties and many vitamins.
4. Pigs have the ability to convert agricultural wastes and by-products like plantain peels and corn chaff into muscles.
5. The study concluded that weaner pigs have the ability to convert plantain peel meal(PPM) based diet supplemented with corn pap chaff (CPC) to enhance growth performance, and without compromising economic gain.

Recommendations:

1. Weaner pigs can be served plantain peel meal (PPM) supplemented with corn pap chaff (CPC).
2. It is hereby recommended that the inclusion rates of 30kgPPM and 15kg CPC,and 15kg PPM and 15kg CPC should be maintained.
3. Further research should also be carried out using different inclusion rates.

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REFERENCES

Adebiyi, O.A and Oshinowo, O.A (2017): Effect of Replacing Concentrates with Plantain Peels and Maize Stake on Performs and Serum Biochemistry of weaner pigs. Negelan Journal of Animal Sciences 44 (1): 203-207.

Adegbola, A.A (2002): Nutrients Intake, Digestibility and Rumen Metabolites in Bulls Fed Rice Straw with or without Supplements. Nigeria Journal of Animal Production. 29:40-46.

Agbabiaka, L R; Okorie, K.C (2013): Plantain Peels as Dietary Supplement in Practical Diets for African Catfish (Clarias Gariepinus Burchell) Fingerlings.

Akinbola A (2022): Feed Conversion Ratio. Key to Pig Farming Songai Farms Benin Republic.

AOAC (2015): Association of Official Analytical Chemists. Critical Methods of Analysis. 18th edition. Washington DC, U.S.A.

Balogun, F.T (2001): Swine Production in Nigeria: Problems and Prospects. Nigerian Journal of Agricultural Extension Pp. 32-37.

FAO (2010): Food and Agricultural Organizations. How to Farm Pigs: Feeding. www.thepigsite.com

Foryet-Moore, F; Cassellari, T, and Tuck, K. (2018): Dietary Fibre Intake in Australia. Paper II: Comparative Examination of Food Sources of Fibre Among High and Low Fibre Consumers. Nutrients Vol. 10. No9. Pp 1223.

Garicie, A; CamenoYusing and Jayden, Ly (2013): The Effect of Sun-Dried Plantain Peel Meal as a Replacement for Maize in the diets of Clarias Genepinus Cuban Journal of Agricultural science. 47 (1): 51-53.

Ninh Thi Lem; Jan, Eri; and Lingberg, Brain Ogie (2008): Effect of Dietary Fibre Level on the Perfroamcne and Carcass Traits of Mong Cai, Fl Crossbred Yorkshire and Land Race Pigs. Asian-Australie Journal of Animal Science. 21(2): 245-251. Doi.10.37 13/jes. 208. 60598.

Nsidinanya, N.O; Ezimoha, C.O, and Ibeawuch, J.A (2020): Growth and cost of producing Red Sokoto Goats Fed Breweries Dried Grain and Malted Sorghum Sprouts in andopogon Tectorum Hay Meal Based Diet. Nigeria Journal of Animal Sci. Vol. 22 (2): 277-286.

Obi, I.U. (2002): Statistical Methods of Detecting Differences Between Treatment means in Research Methodology: Issues in Laboratory and Field Experiments. A.F. Coy Ltd, Enugu.

Oh, H; Kim, H; and Lee, D (2019); Different Dietary Gibre Sources and Risks of Colorectal Cancer and Adenoma; A Dose response meta-analysis of Prospective Studies British Journal of Nutrition. Vol. 122 No 6. PP. 605-615.

Omu, P.B. Soroh, A.E; Konyefa. B.J, Amaechi, I.C; Beketin T.O; Wozi, E.E and Patani I. (2024): Effect of Plantain Peel meal Supplemented with Concentrate Feed on Growth Performance, Carcass Characteristics and Economics of Production on finisher Broiler Birds.

Raynolds, A.N; Akermen, A; and Kumar, S (2022): Dietary Fibre in Hypertension and Cardiovascular Disease Management: Systematic Review and Meta-Analysis. BMC Medicine. Vol 2; No.1. Pg. 139.

Robert, A.N; Ayuk, A.A; Ozung, P.O; and Harry, B.J. (2020): Growth Performance, Nutrient digestibility and Cost of Production of Weaned Rabbits Fed Processed Unripe Plantain Peel Meal Based Diets. Pakistan Journal of Nutrition. Vol. 19 Issue 6. Pg. 303-308. Doi: 10.3923/pin. 2020.

Sogunle, O.M; Fanimo, A.O; Abiola. S.S; and Bamgbose, A.M (2009): Performance of Growing Pullets Fed Cassava Peel Meal Diet Supplemented with cashew nut reject meal. Archivos De Zootecnia. 58(221): 23-31.

SPSS (2012): Statistical Package for Social Sciences (SPSS). Version 21. Inc. 233. Saith Wecker Dumm. 11th Floor. Chicago. 1.L60606-6412.

EVALUATION OF SOIL NUTRIENT AND FERTILIZATION PLAN OF CASSAVA FARM, NAOC (NIGERIANAGIP OIL COMPANY), OMOKU, RIVER STATE.

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ABSTRACT

The impact of oil exploration on soil fertility in Nigeria is hindering the efforts toward soil improvement. Crude oil induced pollution on soil environment is an increasing trend into the environment. There is the need to evaluate soil nutrient and fertilization plan for the cassava farm of NAOC (Nigerian AgipOil Company)in omoku, River State,Nigeria. Three cassava farms, largely cultivated was purposely chosen. Soil samples were taken from 0-30 cm depth at 12 meters intervals along transverses cut at 120 m apart. The samples were air-dried at room temperature, crushed and made to pass 2 mm sieve. Soil pH, organic matter (OM), total nitrogen (TN), available phosphorus (P), Exchange potassium (K), electric conductivity (EC) and Acidity (H + AI) were measured.The result obtained from soil in farm 1, 2 and 3 shows that the soil type is loamy (49%) silt (58%) and sandy (53%) respectively. soil from farm 1, has high OM (3.020) and total nitrogen (0.151%), low available P (11.00ppm) and K (70.00ppm), normal in EC (0.011 Ms/cm/), with a pH (6.4) partly salty and acidic. Farm 2 recorded low OM (1.590), TN (0.080%), P (12.00ppm) and K (90.00ppm) and normal EC (0.086 Ms/cm/), and a pH (6.2) partly salty and acidic. Soil from farm 3, was almost similar with farm 1, except having pH (6.600) neutral. It recorded high OM (3.090), high TN (0.155%), low P (10.00ppm), low K (66.00ppm) and normal EC (0.065 Ms/cm/). The fertilization status and plan for a standard application of NPK at 15:15:15 at the rate of 333kg/ha, at about 8 WAP, in a ring of about 10cm away from the cassava plant 6 cm deep required a fertilizer plan of 111kg of SSP/83kg MOP, 65kg of SSP/50kg MOP and 111kg of SSP/50kg MOP to meet up N and K recommended plan to farmer in the studyarea for farm 1, 2 and 3 respectively.

Key words: Soil nutrient, Fertilizer plan, Cassava farm

Introduction

Cassava tuber and its derivatives are the primary food in Sub-Saharan Africa, accounting for 50% of food intake and approximately 1000 calories per capita per day. Ojeniyi et al. (2009) state that it is also an industrial crop. Nigeria produced more than 31 million tons of cassava in 1996, making it the world leader in this regard. However, the fertility quality of the soil limits the amount of cassava that can be produced, which means that both organic and inorganic fertilizers must be used (Ojeniyi et al., 2009). This is particularly true in Southeast Nigeria, where a lack of land space makes bush fallowing impractical. About 55 kg/ha N, 132 kg/ha P, and 112 kg/ha K are removed by cassava (Howeler, 1991). According to studies by Ezekiel et al. (2009a; 2009b) and Ojeniyi et al. (2009), N, P and K fertilizer boost the yield of cassava productionand output.It was also observed that farmyard manure with NPK fertilizer increased yield of cassava relative to manure or fertilizer alone (Agbaye and Akinlosotu, 2004). It was recorded that cassava fertilization practice depends on soil type and season.

One of the most important natural resources for farming is soil, which is also the most impacted by human activity. Due to modifications in its biological, chemical, and physical characteristics, human use of land degrades its quality. Oil drilling has rendered fertile fields that were used to produce enough food crops barren, which has made farming extremely difficult and endangered the communities' ability to produce food sustainably (Godson-ibeji et al., 2016). (O Rourke and Connolly, 2003). Hydrocarbon contamination from oil and gas exploration and exploitation is one of the biggest environmental issues facing society today.As the demand for liquid petroleum increases, the release of this essential energy source into the environment becomes inevitable and has caused devastating consequences to marine/coastal waters, shorelines and land as well (Macaulay and Rees, 2014). Pipelines that travel through farming villages carry large amounts of oil, and leakage do occur. According to Ewetola (2013), the oil has the ability to block soil particles, limiting water infiltration and raising bulk density, both of which prevent root penetration. In addition to inhibiting the activities of starch phosphorylase, which lowers starch assimilation, it can build a film on planting materials that delays the absorption of water and oxygen (Oyem&Oyem, 2013).

One of the phases of oil exploration, gas flaring, produces a great deal of heat, scorching the nearby soils and leaving the flora looking parched (Giwa et al., 2014). Crops growing in this kind of environment would undoubtedly exhibit signs of dryness and chlorosis in the leaves. Ukegbu and Okeke (2007) claim that the flow stations in the area caused a decrease in crop growth and yield. Changes in soil composition brought about by substances put into the surrounding environment during oil exploration can significantly lower the soil's potential for productivity (Achi, 2003). Crude oil might hinder metabolic activities by decreasing microorganisms' ability to mineralize carbon.It can alter soil chemical properties by increasing acidity and in this condition, nitrogen fixation and organic matter decomposition are hindered (Osuji and Nwoye, 2007).

The government of Nigeria is investigating ways to increase agricultural productivity in order to end hunger as a result of the recent decline in prices. The areas of improved variety provision, fertilizer supply, and agricultural extension agent training are the focus of current efforts (Irhivben and Omonona, 2013). Despite the fact that soil fertility is the foundation of agriculture, not much research has been done on the subject. Particularly in Nigeria, where cassava is a major crop, the impact of the soil nutrient and fertilization plan of cassava farms near oil firms has not gotten enough scientific attention. Fertilizer application would replenish any form of nutrient loss and also enhances the effect of oil exploration on the soil (Kingston, 2002; Evans et al., 2004; Xia et al., 2007).

It has been well researched and established that adding nutrients can maximize the pace at which petroleum hydrocarbons degrade in soil (Sarkar et al., 2005; Agarry et al., 2013). The source of the nutrients, which are primarily inorganic forms of nitrogen and phosphorus, might be either. By encouraging the growth of remediating microorganisms, inorganic nutrient sources including NPK, K2HPO4, and NO3-N have been shown to be effective in the cleanup of crude oil on land and in water (Kingston, 2002; Evans et al., 2004; Xia et al., 2007). Nonetheless, it should be argued that using these fertilizers to treat this issue is both economical and environmentally beneficial.Ogbo and Okhuoya (2008) reported the treatment of oil-

contaminated soils using direct application of inorganic fertilizers to cause soil hardening, disallowing the free movement of nutrients, oxygen and water within the soiland reduction in soil fertility.

Application plans for inorganic fertilizers should be carefully considered because of their propensity to be released quickly into the environment (likely as a result of their availability in free states). Research work has demonstrated that these fertilizers are very effective at promoting biodegradation and raising soil fertility (Akiakwo et al., 2005). In order to maximize cassava output, it is now necessary to assess the soil fertility status in oil-producing villages and to start a fertilization plan for these cassava farms. This work is acomparative study of the soil nutrient and fertilization plan of cassava farm of Agip oil company in Omoku, River State,Nigeria.

Materials and Methods

The study was conducted in three different farms in Omoku,Onelga LGA,River State. A major oil producing State in Nigeria with estimated population of 5,198,716 as of the 2006 census and 7,492,366 in 2023, Rivers State is the 7th most populous state in Nigeria(Alagoa, 2002). It lies within latitude 4° 51 and 29.0772 North and longitude 6° 55' and 15.29045°00 East Rivers. State is a diverse state that is home to many ethnic groups: Igbo, Ijaw, Ogoni, Ikwerre, Ogba, Ekpeye, and Kalabari Richard (Richard Fardon, 2002). Rivers State is the 26th largest state by area, and its geography is dominated by the numerous rivers (Alagoa, 2002). The inland part of the state consists of tropical rainforest with many mangrove swamps. Rivers State has a total area of 11,077 km2 (4,277 square miles), making it the 26th largest state in Nigeria. Surrounding states are Anambra for four km, Imo for about 122 km), and Abia for 87 km (54 miles, partly across the Imo River) to the north, AkwaIbom to the east across the Imo River and Bayelsa and Delta to the west across the Niger River for about 50 km. Total annual rainfall decreases from about 4,700 mm (185 in) on the coast, to about 1,700 mm (67 in) in the extreme north. It is 4,698 mm (185 in) at Bonny along the coast and 1,862 mm (73 in) at Degema (Jones, 2000). For Port Harcourt, temperatures throughout the year are relatively constant with little variation throughout the seasons. Average temperatures are typically between 25 and 28 °C (77 and 82 °F). Some parts of the state still receive up to 150 mm (6 in) of rainfall during the dry period. Relative humidity rarely dips below 60% and fluctuates between 90% and 100% for most of the year (Alagoa, 2002; Jones, 2000; Mitee, 2010).

Soil sample collection

Soil samples were taken from 0-30 cm depth at 12 meters intervals along transverses cut at 120 m apart. The samples were air-dried at room temperature, crushed and made to pass 2 mm sieve. The Soil sample was taken to Green River Project soil/water Testing laboratory, NAOC LTD, Endowed by PEDON NIGERIA, NAOC LTD for soil nutrient and fertilizer plan evaluation.

Soil Particulate Size Sampling

Three farms from the location were selected and cassava farm that was largely cultivated was assessed. Soil consists of an assembly of ultimate soil particles (discrete particles) of various shapes and sizes. The soil samples from these farms were collected at 12 meters intervals along transverses cut at 120 m apart. The object of a particle size analysis grouped the soil particles into separate ranges of sizes and so determine the relative proportion by weight of each size range. The method employs sieving and sedimentation of a soil/water/dispersant suspension to separate the particles.

Measurement of Soil Parameters

The soil nutrient was carried out at 5 meters intervals along transverses cut at 50 m apart. Mini soil profile at depth of 30 cm was dug randomly for soil samples collection. Soil pH, organic matter (OM), total nitrogen (TN), available phosphorus (P), Exchange potassium (ppm) and Acidity (H + AI) (meq/100g)

Laboratory Procedures

Soil pH was on a ratio of 1:2 soil/water suspensions. Soil organic matter was analyzed by Walkley and Black method (Nelson and Sommers, 1982). Total nitrogen was determined by micro - kjeldahl digestion method (Jackson, 1962). Available phosphorus was measured with Bray (II) (Olsen and Sommers, 1982). Exchangeable bases were extracted with 1N NH4OAC, Ca and Mg were read with ethylene diamine tetra-acetic acid titration method whileacidity was tested using titration method.

Soil Testing for Fertilization Plan

This soil-test report gives recommendations for a rate and grade of fertilizer to be apply per 1,000 square feet. One grade of fertilizer can be substituted for another, but it required a few calculations. Example, to apply 1 pound of nitrogen per 1,000 squares for a 15-15-15 fertilizer. Using the following formula: One (1) pounds of nitrogen desired per 1,000 square feet ÷ Percentage of nitrogen in fertilizer a farmer plan to use divided by 100 = 1 ÷ (15 ÷ 100) = 1 ÷ 0.15 = 6. In other vane, the farm measurement is known, the square feet can be determined before calculating the amount of fertilizer to be applied. Example:If the area is 500 feet by 20 feet, and the suggested fertilizer treatment is 30M (pounds per 1,000 square feet):
500 feet × 20 feet = 10,000 square feet
Divide 10,000 square feet by 1,000 = 10 units
Multiply 30 pounds by 10 units = 300 pounds of material (fertilizer)

Statistical Analysis

Data generated were subjected to descriptive statistics and results presented independently.

Result and Discussion

The result for the soil particulate size and type is presented in Table 1. The result obtained from soil in the first farm, shown that the soil type (loamy 49%) is a loamy soil, while that of the second and third farms were silt (silt 58%) and sandy (sandy 53%) soil respectively.

Table 1: Evaluation of the particulate sizes of the tested soil sample from different cassava farm from sample area.

Cassava farm	Soil particulates	Soil particulate sizes (%)	Evaluation
Farm 1	Grave	-	
	loamy	49	Loamy soil
	Silt	48	
	Clay	13	
Farm 2	Grave	-	
	Sand	32	
	Silt	58	Silt soil
	Clay	10	
Farm 3	Grave	-	
	Sand	53	Sandy soil
	Silt	41	
	Clay	6	

The result for thephysiochemical status as presented in Table 2, shown that soil from farm 1, has high organic matter (3.020) and total nitrogen (0.151%), low available phosphate (11.00ppm) and exchange potassium (70.00ppm), normal in electrical conductivity (0.011Ms/cm/), with a pH (6.4) partly salty and acidic. Soil from farm 2 recorded low organic matter (1.590), total nitrogen (0.080%), available phosphate (12.00ppm) and exchange potassium (90.00ppm) and normal electrical conductivity (0.086Ms/cm/), with a pH (6.2) partly salty and acidic. Soil from farm 3, was almost similar with farm 1, except having pH (6.600) neutral. It recorded high organic matter (3.090), high total nitrogen (0.155%), low available phosphate (10.00ppm), low exchange potassium (66.00ppm) and normal in electrical conductivity (0.065Ms/cm/).

Table 2: Physiochemical status of the tested soil sample from different cassava farm from sample area.

Cassava farm	Physiochemical parameter	Amount	Evaluation
Farm 1	pH	6.400	Slt. acid
	Electrical conductivity Ms/cm/25^{o} C	0.011	Normal
	Organic matter	3.020	High
	Total nitrogen (%)	0.151	High
	Available phosphate (ppm)	11.00	Low
	Exchange potassium (ppm)	70.00	Low
	Acidity (H + AI) (meq/100g	-	ND
Farm 2	pH	6.200	Slt. acid
	Electrical conductivity Ms/cm/25^{o} C	0.086	Normal
	Organic matter	1.590	Low
	Total nitrogen (%)	0.080	Low
	Available phosphate (ppm)	12.00	Low
	Exchange potassium (ppm)	90.00	Low
	Acidity (H + AI) (meq/100g	-	ND
Farm 3	pH	6.600	Neutral
	Electrical conductivity Ms/cm/25^{o} C	0.065	Normal
	Organic matter	3.090	High
	Total nitrogen (%)	0.155	High
	Available phosphate (ppm)	10.00	Low
	Exchange potassium (ppm)	66.00	Low
	Acidity (H + AI) (meq/100g	-	ND

The result for the fertilization status and plan for the tested soil sample from the different cassava farm is represented in Table 3. Result shown that a standard applicationof NPK at 15:15:15 would be applied at the rate of 333kg/ha at about 8 WAP, in a ring of about 10cm away from the plant 6 cm deep. For farm 1, following the standard of application, a fertilizer plan of 111kg of SSP and 83kg MOP to meet up with P and K requirements would be used, while that of farm 2 and 3 would used a fertilizer plan of 65kg of SSP and 50kg MOP and 111kg of SSP and 50kg MOP to meet up with the N and K requirements respectively.

Table 3. fertilization status and plan for tested soil sample from different cassava farm from sample area.

Cassava Farms	Element substance (kg/ha)	Amount (kg/ha)	Evaluation
Farm 1	N	30	1) Apply NPK 15:15:15 at the rate of 333kg/ha. Use 111kg of SSP and 83kg MOP to meet up with P and K requirements. 2) Apply fertilizer at about 8 WAP, in a ring of about 10cm away from the plant 6 cm deep.
	P_2O_5	50	
	K_2O	80	
Farm 2	N	80	1) Apply NPK 15:15:15 at the rate of 333kg/ha. Use 65kg of SSP and 50kg MOP to meet up with N and K requirements. 2) Apply fertilizer at about 8 WAP, in a ring of about 10cm away from the plant 6 cm deep.
	P_2O_5	50	
	K_2O	80	
Farm 3	N	30	1) Apply NPK 15:15:15 at the rate of 333kg/ha. Use 111kg of SSP and 50kg MOP to meet up with N and K requirements. 2) Apply fertilizer at about 8 WAP, in a ring of about 10cm away from the plant 6 cm deep.
	P_2O_5	50	
	K_2O	80	

Discussion

Soil pH in farms 1 and 2 is classified as strongly to mildly acidic when compared to farm 3. The range of the soil from farms 1 and 2 is 6.2 to 6.4. Higher acidity soil has been shown to lose basic cations (Abii and Nwosu, 2009). This pH may have an impact on nutritional availability, which could explain the reduced level of nutrients found in the sample. This provides strong support for the finding of Osuji and Nwoye (2007) that acidic soil conditions impeded the breakdown of organic matter and the fixing of nitrogen in soils. According to research by Oyem and Oyem (2013), low soil pH may have an impact on microbial activity and reduce the organic matter's decomposition, which releases plant nutrients and lowers the nitrogen contents in oil-producing communities. The nutrient contents that were lower in these farms may be linked to the oil exploration activities that reduced the activities of soil microorganisms in these farms.

Organic matter levels in farm 2 were lower than in farms 1 and 3. Chemicals spilled into the ground during oil drilling may disrupt the organic matter-adding metabolic processes. This

matches the outcome that Osuji and Nwoye (2007) reported. This could cause an imbalance in the carbon-nitrogen ratio in the soil, as Nkwopara et al. (2012) also reported. Depletion of nitrogen may result from this. The larger impact of oil activities can be the reason for the reduced organic matter when compared to other farms with comparable temperatures.

Low levels of detected exchange potassium and available phosphorus may be related to the soils' acidic composition, which can impede phosphorus fixation, according to a paper by Nkwopara et al. (2012). Since higher pH values have been shown to maximize phosphorus solubility, lower pH levels in the soil may also decrease the amount of phosphorus that is accessible and the rate at which potassium is exchanged. When breaking down hydrocarbons in the soil, microorganisms that use total petroleum hydrocarbon as a carbon source can also make use of potassium and phosphorus (Wang et al., 2010).

The soil sample from each cassava farm was examined to determine the fertilization status and plan. The results indicated that a conventional 15:15:15 NPK treatment will be administered at 333 kg/ha at approximately 8 WAP, in a ring that is about 10 cm distant from the cassava plant and 6 cm deep. The recommended plan for farmers in the research region for farms 1, 2, and 3 was to apply a conventional fertilizer plan consisting of 111 kg of SSP and 83 kg MOP, 65 kg of SSP and 50 kg MOP, and 111 kg of SSP and 50 kg MOP to meet the N and K requirements.

Conclusion

To sum up, soil testing is crucial for farmers in the oil region to assess the fertility and health of their land. The purpose of this study was to examine the soil texture, structure, and potential fertilizer plan of farms located in Agip, Omoku River State. Using the results of this soil test, plans for fertilization and soil modification were created in order to maximize cassava yields and long-term sustainability. This strategy is a wise investment in the well-being of your farm and the profitability of your agricultural business. To stop the soil from degrading further, the oil-producing communities require nutrient amendments, particularly those containing potassium, phosphorus, and nitrogen.

Reference

Abii, T.A. and Nwosu, P.C. (2009). The effect of oil spillage on the soil of Eleme in Rivers State of the Niger-Delta area of Nigeria. *Research Journal of Environmental Sciences*. 3(3): 316-320.

Achi, C. (2003). Hydrocarbon Exploration, Environmental Degradation and Poverty: Niger Delta Experience in Proceedings of the Diffuse Pollution Conference, Dublin pp76.

Agarry SE, Aremu MO, Aworanti OA (2013). Kinetic Modelling and Half-Life Study on Enhanced Soil Bioremediation of Bonny Light Crude Oil Amended with Crop and Animal-Derived Organic. *Journal of Petroleum & Environmental Biotechnology* 4(2):137.

Agbaje, G. O. andAkinlosotu, T. A (2004). Influence of NPK fertilizer on tuber yield of early and late planted cassava in a forest affisol of south-western Nigeria. *Afr. J. Biotechnol*. 3: 547 – 551.

Akiakwo MOG, Akinde SB, Dollah SA (2005). Synopsis of available technologies for the cleanup of oil spill in a terrestrial environment. *Journal of Environmental Management* 2:56-61.

Alagoa, Ebiegberi Joe (2002). The land and people of Rivers State :Eastern Niger Delta. Nembe: Onyoma Research Publ. ISBN 9783507559.

Evans, F. F, Rosando AS, Sebastian GV, Casella R, Machado Pl, Holmstrom C, Kjelleberg S, van Elsas, J. D, Seldin L (2004). Impact of oil contamination and biostimulation on the diversity of indigenous bacterial communities in soil microcosms. *FEMS Microbiology Ecology* 49(2):295-305.

Ewetola, E.A. (2013). Effect of crude oil pollution on some soil physical properties. Journal of Agriculture and Veterinary Science. 6(3): 14-17

Ezekiel, P. O.; Ojeniyi, S. O.; Asawalam, D. O. and Awo, A. O. (2009a) Effects of oilpalm bunch ash on soil NPK and root yield of sweet and bitter cassava. *Nigerian Journal of Soil Science*: 19 (1), 1 – 5.

Ezekiel, P. O.; Ojeniyi, S. O.; Asawalam, D. O. and Awo, A. O. (2009b) Root growth, dry root yield and NPK content of cassava as influenced by oilpalm bunch ash on ultisols of southeast Nigeria. *Nigerian Journal of Soil Science*: 19, 6 – 10.

Giwa, S.O., Adama, O.O. and Akinyemi, O.O. (2014). Baseline black carbon emissions for gas flaring in the Niger Delta Region of Nigeria. Journal of Natural Gas Science and Engineering. 20: 373-379.

Godson-ibeji, C.C. and Chikaire, J.U. (2016). Consequences of Environmental Pollution on Agricultural Productivity in Developing Countries: A Case of Nigeria. *International Journal of Agricultural and Food Research*. 5(3): 1-12.

Howeler, R. H (1991). Long term effect of cassava cultivation on soil productivity, *Field Crop Res*. 26: 1 – 8.

Irhivben, B.O. and Omonona, B.T. (2013). Implications of oil exploration on Agricultural Development in Delta State, Nigeria. *International Journal of Humanities and Social Science Invention*. 2(4): 59-63.

Jackson, M.L. (1962). Soil chemical analysis. New Delhi, Prentice Hall of India Pvt. Ltd. Pp 261.

Jones, G.I. (2000). The trading states of the oil rivers: a study of political development in eastern Nigeria. Oxford: James Currey. ISBN 0852559186.

Kingston P (2002). Long-term environmental impact of oil spills. *Spill Science & Technology Bulletin* 7(1-2):53-61.

Macaulay BM, Rees D (2014). Bioremediation of Oil Spills: A Review of Challenges for Research Advancement. *Annals of environmental Science* 8:9-37.

Mitee, Leesi Ebenezer (2010). Laws of Rivers State of Nigeria: an encyclopaedic guide. Luton: Worldwide Business Resources. ISBN 978-0956198815.

Nelson, D.W. and Sommers, L.E. (1982). Total carbon, organic carbon and organic matter. In [A.L. Page, R.H. Miller and D.R. Keeney. (Eds.)], Methods of soil analysis, Part 2. American Society of Agronomy Madison, W.I. Pp 539 – 579.

Nkwopara, U.N., Omeke, J.O., Eshetta, E.T., Ihem, E., Ndukwu, B.N. and Obasi, S.N. (2012). Some physico-chemical characteristics of arable soils around selected oil exploration sites in the Niger-Delta region of Nigeria. *International Journal of Agriculture and Rural Development*. 15(3): 1298-1309.

O Rourke, D. and Connolly, S. (2003). Just oil? The distribution of environmental and social impacts of oil production and consumption. Reviews in Advance. 28: 05.1-05.31.

Ogbo EM, Okhuoya JA (2008). Biodegradation of aliphatic, aromatic, resinic and asphaltic fractions of crude oil contaminated soils by *PleurotustuberregiumFr.Singer* - a white rot fungus. *African Journal of Biotechnology* 7(23):4291-4297.

Ojeniyi, S.O; Ezekiel, P.O., Asawalam,D.O., Awo A.O., Odedina, S.A and Odedina, J.N. (2009). Root growth and NPK status of cassava as influences by oil palm bunch ash. *African journal of biotechnology*: Vol8 (18), pp 4407 – 4412.

Olsen, S.R. and Sommers, L.E. (1982). Phosphorus. In A.L. Page, R.H. Miller and D.R Keeney (Eds.). Methods of soil analysis, part 2. Madison, W.I. American Society Agronomy. Pp 1572.

Osuji, L.C. and Nwoye, I. (2007). An appraisal of the impact of petroleum hydrocarbons on soil fertility: the Owaza experience. *African Journal of Agricultural Research* 2(7): 318-324.

Oyem, I.L.R. and Oyem, I.L. (2013). Effects of Crude Oil Spillage on Soil Physico-Chemical Properties in Ugborodo Community. *International Journal of Modern Engineering Research*. 3(6): 3336-3342.

Richard Fardon; Graham Furniss (2002). African Languages, Development and the State. Routledge. p. 66. ISBN 1134868049. Retrieved 6 August 2017.

Sarkar D, Ferguson M, Datta R, Birnbaum S (2005). Bioremediation of petroleumhydrocarbons in contaminated soils: comparison of biosolids addition, carbon supplementation, and monitored natural attenuation. *Environ Pollut*. 136:187-195.

Ukagbu, D. and Okeker, A.O. (2007).Flaring of Associated Gas Oil and Gas Industry: Impact on Growth, Productivity and yield of selected farm crops in Petroleum Industry and the Nigeria Environment, Proceedings of 1987 Seminar, NNPC Lagos.

Xia, W. X, Li JC, Song ZW, Sun YJ (2007). Effects of nitrate concentration in interstitial water on the bioremediation of simulated oil-polluted shorelines. *Journal of Environmental Sciences* 19(12):1491-1495.

CERAMICS AS A CONTEMPORARY ART IN BAYELSA STATE: THE BENEFITS, CHALLENGES AND PROSPECTS

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Abstract

In Nigeria, receiving a formal education in ceramics is increasingly necessary to pursue a career in the medium. Despite the consequences caused by internationalization and cross-cultural infiltration, there is a bright future for the art given the abundance of resources accessible for ceramic techniques in the nation with a seething population of over 140 million. Porcelain resources still need to be used despite their promise as raw materials, and the ceramic art program still needs to turn forth graduates who can work effectively in the fiercely competitive ceramics market economy. The advantages, difficulties, and future potential of the ceramics sector in Bayelsa State were the main subjects of this investigation. It discussed the study's conclusions using the analytical approach and secondary data gathering procedures. It turned out that Bayelsa State's ceramics sector may offer a lot of chances for youth to become involved and seek careers in this profitable industry. Furthermore, the availability of mineral resources provides excellent opportunities for the state's industry to grow and flourish.

Introduction

Between 1970 and 1980, Nigeria's ceramic industry flourished due to the country's abundance of raw materials, large human capital, and modern technology. All of the early ceramic enterprises have vanished, and the nation is constantly importing vast amounts of inferior pottery output(Moisembe, 2023). The ceramic industry was regarded as one of the small- and medium-sized sectors that made a substantial contribution to Nigeria's building industry, export revenue, and economic empowerment prior to 1980.

There are now just 10 active ceramic companies in Nigeria due to a number of issues, including trade impediments, a shortage of workers with the necessary general and technological skills, and haphazard raw material mining practice (Moisembe, 2023), About thirteen ceramic industries namely Okigwe pottery, Richware Ceramic, Modern Ceramics, Quality Ceramics, Nigerian/Italian Ceramics, Arewa Ceramics, Jacaranda Pottery, Ceramics manufacturer, Eleganza Ceramics, Maraba Pottery, Plateau Pottery, Ladi Kwali Pottery and Jos Museum Pottery have all gone moribund (Moisembe, 2023). As a result, the once-vibrant and crucial sectors that produced ceramics are no longer able to contribute legitimately to Nigeria's

economic growth and development. The general public, business owners, experts, and the private sector as a whole have all expressed serious concerns about this scenario. Comparing this position against what other industrialized and developing countries have accomplished with their ceramics industry makes it even more unsettling and concerning. while having abundant solid material resources, Nigeria is the only nation in the world without a sizable ceramics export industry, while holding eight of the top 18 developing economies rankings in this regard.

The current status of ceramic manufacturing companies in Nigeria is limited to wall and floor tiles, with almost no significant attempts being made to produce a wide range of products such as insulators, refractory, structural clay bricks, porcelain, electrical porcelain, table wares, and china goods. The development of intelligent ceramics, which uses ceramic applications in a variety of industries, including housing, healthcare, autos, etc., may be essential to boosting the nation's economy at this time. Thus, it could hold the key to unlocking the potential of next-generation energy storage and permitting the utilization of green energy sources by subsequent generations.

Nigeria and Bayelsa state is losing out on the vast global ceramic market estimated to be about $240bn (Oparaocha and Peters, N.D). It is obvious then that Nigeria and its constituent units, Bayelsa state inclusive, is still decades behind in achieving the level of ceramic product-range development and production offer significant impact on the National Gross Domestic Product (GDP). However, with the current level of ceramic tile production of over 100 million sq meters in Nigeria there are prospects for the country to be at par with China and India if efforts towards revitalization of the moribund industries are diligently implemented. This research studies is thus set out to assess potential benefits, challenges and prospects of this important sector in Bayelsa state. It is important to note that the study adopts descriptive and analytical methods and thus made use of secondary data sources to analyze the issues raised in the study.

Literature Review

Meaning and History of Ceramic Art

The term ceramics is ancient and has been described variously. The term "ceramics" originates from the Greek word keramikos (κεραμεικός), which means "pottery". Keramos (κέραμος) means "potter's clay" [3] Tableware and ornamental ceramics are often still created in the same way as the majority of historic ceramic goods were: from clay (or clay combined with other materials), they were molded, and then heated (Enhuber, (2015).

Basically, ceramics refers to the creation of objects of clay and other earthen materials that are fired to a temperature of glassy state, which is about 600 degrees centigrade and above. Rhodes (1975) asserts that “ceramics is the art of making permanent objects of usefulness and/or beauty by heat treatment of earthly raw materials”. Objects created with clay and other ceramic materials and hardened by high-temperature fire in a kiln are referred to as ceramic art.

According to Onuzuike (2015) ceramic art is a visual art form that belongs to the plastic arts. The majority of ceramics are regarded as ornamental, industrial, or applied art pieces, while some, like sculpture and pottery, are classified as fine art. One individual or a group can make ceramic art, and it may be produced at a pottery or ceramic factory by a collective that designs and manufactures the art ware.

Ceramics is the art and science of creating items by applying heat from inorganic, non-metallic elements in modern ceramic architecture. Glass and mosaics created with glass tesserae are not included (Peters, 2019). Clay and other ceramic materials are used to create ceramic art. It can appear in a variety of ways, such as beautiful ceramics for use as dinnerware, tiles, sculptures, and other objects.

On a general note, three key terms are emphasized in the definition of ceramics, which are: clay, firing and glassification (Esege and Unimke, 2015). Clay is the constituent raw material and firing and glassification delineate the chemical processes that convert pliable earth en material into robust and rigid objects of aesthec quality and usefulness. This perhaps, presents ‘ceramics’ as a unique discipline that comprises material, method and process.

For thousands of years, ceramics have been produced for both useful and ornamental uses in almost every culture on the planet. The origins of ceramic art may be traced to the antiquated societies of Egypt, Greece, Rome, Mesopotamia, China, and Persia (Jurgens, 2007; Buszek, 2011; Brock, 1991; and Esege & Unimke, 2015). Earthenware pottery was the first kind of ceramics, and it was used for cooking and storing. As ceramics progressed over time, civilizations produced exquisite porcelain goods, tiles, figures, and other ornamental items. The earliest ceramic objects were straightforward ceramics made from earth but as technology advanced, potters were able to produce complex shapes, sophisticated glazes, and sophisticated clay bodies. These days, ceramic art includes a wide variety of designs and methods for both functional and ornamental objects.

The Arts and Crafts movement served as a major source of influence for contemporary ceramics art in both Britain and the United States in the early 20th century, resulting in the resurgence of pottery as a distinct modern craft (Whiteford, 2022). These crafts placed a strong emphasis on time-honored, non-industrial manufacturing methods, material fidelity, the maker's unique abilities, practicality, and a Victorian-era-specific lack of over-the-top adornment.

Almost all established societies have a long tradition of ceramic art, and in many instances, the only creative remnants of extinct cultures—like the Nok in Africa, which dates back more than 2,000 years—are ceramic artifacts (Onuzuike, 2015). Along with the contemporary Western cultures, some particularly well-known cultures for pottery are the Chinese, Cretan, Greek, Persian, Mayan, Japanese, and Korean cultures. The contours of the piece, its ornamentation through painting, carving, and other techniques, and the glazing that is present on the majority of ceramics are elements of ceramic art that have received a variety of attention over time.

Role of Ceramic Art in Society

Ceramic art has played significant role from ancient time to this contemporary period. Using the clay media, artists may express their creativity in a multitude of techniques while creating ceramic art. Potters are appreciated for their haptic quality and immediateness; they can swiftly use their hands in order to shape, mold, and alter the clay (Ceramic Art: A Timeless Expression of Creativity, 2022). The form and framework of ceramic artwork may be created with a great deal of creative flexibility due to the clay's pliability. According to Whiteford (2022), to convey a variety of emotions, artists may use multidimensional, angular shapes or rounded smooth ones. Persuasive use can also be made of the artwork's dimensions, weight, and composition. Glazing in ceramics allows for creative expression through color, pattern, and texture, resulting in a wide range of colors, surfaces, and effects. High-fire glazes offer unpredictable discoveries, while texture and patterns enhance visual appeal (Esege and Unimke, 2015).

For thousands of years, ceramic items like bowls, plates, cups, vases, and various other receptacles have fulfilled crucial practical purposes. Ceramic utensils have been used for food storage, serving, and transportation for a very long time in various civilizations. Firing clay's strength and adaptability make it perfect for crafting items for daily use.

The creation of ceramics is essential to the preservation of historical cultures' cultural practices, rituals, and narratives (Renee & Nicky, 2022). Clay is a timeless media that crafts people use to retain cultural tales, values, and beliefs in concrete form, providing a physical link to the past. Specifically, pottery, with its methods, themes, and motifs handed down through the centuries as cultural history, effectively captures the creative soul of a society.

Because ceramic work is so pliable, it has spiritual and religious meaning. God is frequently portrayed in Christianity and Judaism as a potter who shapes people out of clay, signifying the link between the heavenly Potter and his creatures on earth (Kvarnstrom, 2015; Esege and Unimke, 2015; Renee & Nicky, 2022). Clay's spiritual metaphor has been influenced by its malleability and capacity to be shaped into artifacts and vessels of worship across cultural boundaries. Religious ceremonies and rites have historically included the use of ceramic arts, from Christian chalices to Native American ceramics to Hindu diyas.

Form, texture, color, and surface design are all used in ceramic art to express meaning and information. Incorporating cultural identity and meaning into their works, contemporary artists frequently use ceramic vessels as a vehicle for sharing narratives, morals, and viewpoints through a variety of tangible and visual components.

Ceramic art, a significant economic value, has been a significant industry for centuries due to low barriers to entry and affordable tools. Today, handmade ceramic art varies in value based on factors like artist reputation, size, complexity, and rarity. The global market for art pottery, valued in billions, supports ceramic artists and contributes to local economies (Esege & Unimke, 2015)

Ceramic art imparts knowledge about the ideas, values, and history of past civilizations. Ceramics along with other pottery frequently represent narratives, symbols, and occasions that were significant to the culture that produced them. Modern cultures can learn about the beliefs,

accomplishments, and daily lives of ancient peoples by examining these artworks. In addition to imparting cultural information, ceramic art training benefits the craftsman. Learning from mistakes, putting in a lot of practice, and studying under knowledgeable instructors are all necessary to become proficient in the intricate processes of working with clay. The act of creating itself teaches important life lessons like persistence, patience, and problem-solving.

The Development of Ceramic Art Culture in Nigeria

Nigerian culture has a long and rich history of using pottery and sculpture. They've been employed for a number of things, including as social and political power expression, historical remembrance, and religious rites. The Nok civilization, which thrived between 500 BC and 200 AD, is the source of the oldest sculptures known to exist in Nigeria (Esege and Unimke, 2015; Oparaocha & Peters, N.D; Hamer & Hamer, 2005). Terracotta sculptures like this were employed in religious and ceremonial contexts. Intricate sculptures and pottery reflecting distinct cultural identities were also made by later cultures, such as the kingdoms of Ife and Benin. Ceramics and sculpture continue to be significant in fostering social cohesiveness and defining national identity in modern-day Nigerian society. Ceramics and sculptures are used to celebrate cultural festivals, honor national heroes, and remember historical occurrences. Additionally, they serve as a vehicle for social and political themes including advancement, peace, and national cohesion.

Ceramic Art Education in Nigeria: The Role of Universities

The promotion of ceramics and sculpture as significant elements of Nigerian art and culture has been greatly aided by universities in the country (Esege and Unimke, 2015). Many institutions have set up art departments with courses in ceramics and sculpture, giving aspiring artists a place to show off their creations and hone their craft. Universities have also arranged art classes and exhibitions, which have assisted in broadening awareness of ceramics and sculpture.

Ceramic Art and Socio-Economic Development in Nigeria

Ceramic materials and artwork have the power to greatly advance Nigeria's economic and social development. Nigeria's economy is witnessing growth in the art business, which has great promise for generating income and jobs. Higher education institutions may assist the expansion of the art sector and advance the economic and social growth of Nigeria by highlighting sculpture and ceramics as significant elements of the nation's art and culture (Esege and Unimke, 2015).

Even though Nigeria may not yet have the chance to combine skill sets with educational backgrounds and credentials for employment, the ceramics sector is flourishing since ceramic products are a necessary component of every contemporary structure. As a result, this is the largest job field. In the fine and applied arts, engineering ceramics is a key phrase. This provides more work prospects and entails melting metals to fabricate airplanes. It goes without saying that students who majored in engineering ceramics would become successful business owners or lucrative employees in the government sector. This is due to the special chance Nigerian airspace has to provide value. Ceramics operations have increased recently around the world, including in Europe, Italy, China, and other nations (Esege and Unimke, 2015).

Certainty-Related Issues in Ceramic Arts

Ceramic wares are enhanced by adding color to their interior and exterior surfaces, enhancing their functional and aesthetic value. Ornamental techniques like stenciling, dipping in glaze, spraying, and incising enhance the appearance of ceramic items. Ceramic goods serve a functional purpose and are enhanced by painting and decorating techniques. Art and design principles are applied, with form, line, and color evoking emotions. Ceramics can tell stories and preserve cultural legacy for future generations.

Peterson (2019), emphasizes the use of narrative and symbolism in artists, who frequently project ideas for the audience. Handmade clay items blend practical use with visual appeal to maintain interest and high value among consumers. Because surface ornamentation frequently improves eye perception, these goods are valuable and should be preserved.

Gap in the Literature

This investigation would undoubtedly add to previous research on ceramic arts in Nigeria generally, but particularly ceramic literature in Bayelsa state, because there is a dearth of ceramics literature relevant to the study region.

Ceramic as a Contemporary Art in Bayelsa State

In the present tense, contemporary art is art that embodies the spirit and vocabulary of the modern era. We realize that contemporary art represents not only "modernity," but also "contemporaneity," which is derived from the social experiences of today and may mirror the temporal features of the present (Buszek, 2011). But before we discuss "contemporary art," it's important to understand the background: "classical art," "modern art," and "contemporary art" all developed in the West. Modern art sought to produce "meaningful" shape and was characterized by "Artistic beauty"; "Classical Art" was intended to be realistic and had a "natural beauty" aesthetic (Buszek, 2011);

But unlike the first two, modern art cannot be summed up in a single term; instead, we can only refer to it as "the third field beauty." But what exactly is "the third field beauty"? It is a beautiful thing that is beneficial to our bodies and minds and has a strong connection to human life and pleasure. The distinctive oriental traditional character of Chinese ceramics is created by the combination of ceramic art based on deft technological integration, solid idea support, exceptional temperament penetration, rich cultural legacy, and profound human philosophizing. People sought to "match" East pottery with modern art because of this amazing chance.

In general, ceramic arts wares refer to the creation of functional and aesthetically pleasing domestic items for human use, such as glassware, teacups, jugs, tiles, breakable plates, etc. Certain regions of Nigeria have the capacity to make ceramic art pieces, particularly those with a substantial clay deposit in the soil formation. Based on past experiences, Bayelsa State in Nigeria is home to the greatest clay. The item found in Bayelsa State historically suggested that our state was not well-known for producing pottery. We are renowned for our sculpting, carving, and weaving, with the exception of pottery utensils, which are imported. The lack of knowledge about ceramic works in Bayelsa State has been filled up thanks to ICT and teacher

education. Essentially in the culture of the Ijaw people, which includes the Brass people of South-South Nigeria, Ogbia, Nembe, Yenagoa, Kolokuma/Opokuma, Sagbama, Ekeremor, and South Ijaw. Experience has proven that the finest clay, or plastic clay, is found in the state's riverine zones, which is why Bayelsa State is a metropolis surrounded by water.

Ceramic products are the life jackets we wear every day; as tiles are made, pottery is being used to adorn our homes. As a result, we have a responsibility to guarantee that these natural resources are used in Nigeria, the Niger Delta, and the global community. Because of the high quality plastic clay found there, Bayelsa State is a location where the ceramic industry is expected to flourish. One of the most significant discoveries made in Bayelsa is the abundance of high-quality clay found across the state, particularly in regions such as Yenagoa, Ogbia local government area, southern Ijaw, Ekeremo local government, Nembe, and Sagbama Area.

Potential Benefits of Ceramic as Contemporary Arts in Bayelsa State

1. Based on research findings, sensors build into ceramic flooring can detect human presence and activate traffic signals, while the advanced products hold enormous developmental potentials for global resource efficient solution.
2. It is a key sector that can unlock the next generation energy storages to help future generations to harness renewable technology in the state and Nigeria at large.
3. The industry if adequately established and funded, could be a critical focus for the state government to employ large number of its youths directly or indirectly.
4. Ceramic skilled acquisition centers can provide the needed skills in the industry here in Bayelsa State and outside the state to solve the problem of lack of skill manpower.
5. It is a potential sector for wealth creation. Wealth can be generated from the exploitation of ceramic solid materials such as kaolin, ball clays, feldspar, quartz or silica sand, calcium carbonate, taic, bentonite, and so on. These materials, if processed are capable of contributing to the internally generated revenue of the state.
6. The ceramic arts bridge communication gaps that students with special needs or English Language Learners (ELL) experience outside of art class. Students are able to express themselves freely through the medium due to its easily malleable characteristics and need for little vocational instruction, due to its learning through watching and doing versus listening and executing. Students of any background can feel successful when working with clay because of its forgivable, plastic-like features (Kvarnstrom, 2015).
7. The medical community, in recent decades, has recognized the transformative potential of art (Kvarnstrom, 2015). Because clay is such a flexible substance, a wide range of people may learn and work with it with confidence. Students participate in creative and emotional engagement when teachers design a ceramic arts lesson plan that centers around the fundamental sense of touch.
8. Music can also be easily implemented into a ceramic arts lesson as music has been found to stimulate ideas in creative environments (Brock, 1991, p. 14). Music can reach a multitude of students, especially if they are auditory learners as it improves the learning process and environment.

The Difficulties of Ceramics in Bayelsa State as a Modern Art Form

1. Even though sculpture and ceramics are significant parts of Nigerian art and culture, they nonetheless confront a number of difficulties. The absence of official funding for the arts is one of the primary obstacles in the state. Due to this, artists and art organizations are underfunded, and there are little prospects for sales and exhibitions.
2. The absence of studios and workshops for artists is a barrier as well, since it might impede their ability to practice their craft and produce their work.
3. Lack of Appropriate Policy Framework in Bayelsa state: The Bayelsa state government has not yet put in place policies in the ceramic industry sector to provide guidelines for formation of ceramic industrial clusters, provide financial instruments for solid mineral characterization and ceramic capacity building and skills development, technology development for sustainable inclusive ceramic growth in the state.
4. International trade barriers such as lack of access to international market remain a serious challenge to the ceramic industry in Nigeria and Bayelsa state in particular.

The Prospects of Ceramic Art in Nigeria

Nigerian sculpture and ceramics have a bright future since more new artists are receiving training and assistance from academic institutions. The expanding Nigerian art market, propelled by the growing local and global market demand for Nigerian artwork, offers sculptors and ceramicists a platform to exhibit their creations and make a livelihood from their craft. To fully realize the potential of sculpture and ceramics in Nigeria's socio-economic development, nevertheless, the government and other stakeholders must overcome the issues facing the industry.

In general, the contribution of pottery and sculpture to nation-building is a rich and complicated subject that may be approached from a variety of perspectives, with a particular emphasis on Nigerian institutions of higher learning. This study offers insights on the role of the arts in nation-building by analyzing the historical and present relevance of sculpture and ceramics in Nigerian culture, as well as their potential to support the nation’s socioeconomic growth

Recommendations

1. The Federal Ministry of Education and the National Institutions Commission should mandate all Nigerian institutions to offer stand-alone degree programs in ceramic science, engineering, ceramic technology, and mineral engineering.
2. The Bayelsa state government should establish policies for intelligent, sustainable, and inclusive ceramic growth, including financial instruments for solid mineral characterization, capacity building, and skill development.
3. In order to maintain ceramic manufacturing's competitiveness and assist Bayelsa state’s inclusive and sustainable development, policymakers should provide a favorable regulatory environment.
4. The nation and Bayelsa state should establish ceramic skills acquisition centers or academies to foster the local ceramic industry, bridge the education gap, and provide a skilled labour pool for the future.

Conclusion

Through investments in ceramics firing, Nigeria's natural gas reserves and plenty of ceramic minerals can stimulate the country's economy and implication Bayelsa state's economy. Employment in production, distribution, manufacturing, and exploration will all be generated by this industry. By addressing gas flaring, oil waste may be turned into money by raising GDP and lowering health hazards in Bayelsa state. Nigeria's economy may be diversified away from petroleum by utilizing the mining, processing, and manufacturing opportunities offered by the ceramic minerals industry. Thorough investigation and evaluations are required to draw in international capital and advance ceramic technology employing natural gas as a sustainable energy source.

References

Brock, M. (1991). The therapeutic use of clay. British Journal of Occupational Therapy, 54(1), 13–15. https://doi.org/10.1177/030802269105400108

Buszek, M. (2011). *Extra/Ordinary: Craft and Contemporary Art.* New York, USA: Duke University Press. https://doi-org.eur.idm.oclc.org/10.1515/9780822392873

Enhuber, M. (2015). Art, space and technology: how the digitization and digitalization of art space affect the consumption of art—a critical approach, *Digital Creativity*, 26(2), 121-137. https://doi.org/10.1080/14626268.2015.1035448

Esege, E. E. and Unimke, J. A. (2015). Ceramic industry: its opportunities in the socioeconomic development of Nigeria. Journal of Science, Engineering and Technology. 4(1) pp 41-48

Hamer, F. and Hamer ,J .(2005). The Potters Dictionary of Materials andTechniques. London A&C Black Publishers Ltd

Jurgens, K. K., (2007). *Dunmore Pottery: The Art of the Art Pottery Business.* (Publication No. 10392404). [Doctoral dissertation, University of Glasgow]. ProQuest Dissertations and Theses Global.

Kashim, I. B. (2002). "Ceramic as a Factor of Environ mental Aesthe cs in Nigeria". In J. T. Agberia (Ed.) Design History in Nigeria (pp.481-486). Port Har court: University of Port-Harcourt Press.

Kvarnstrom, E. (2015, December 7). The shape of healing: The power of pottery in mental health treatment. Bridges to Recovery. Retrieved July 21, 2022, from https://www.bridgestorecovery.com/blog/the-shape-of-healing-the-power-of-pottery-in- mental-h ealth-treatment/

Noel Arnold Associates. (2003). Ceramics hazards and their control [Online]. Available: http://www.cheminfonet.org/art/ceramics1.pdf

Onuzulike, O. (2015). The emergence of modern ceramics in Nigeria. The Kenneth Murray decade, 1929-1939. The Journal of Modern Craft. 6(3). Pp 293-313.

Oparaocha, C., and Peters, E. (N.D). the role of sculpture and ceramics in nation building: A case study of sculpture and ceramic practice in Nigeria.

Peters, E. E. (2019). Interrelationship between ceramics and painting technology. Modern International journal of Applied Science and Research. 2(1). Pp 25-32.

Renee, K and Nicky E. (2022). How is ceramics craft transforming itself to a form of contemporary art.

Whiteford, T. (2022). The benefits of ceramic art with secondary learners. Master's thesis submitted to Bethel University, Spark. Available: https://spaark.bethel.edu/etd/850 .

HEAVY METAL CONCENTRATION IN TILAPIA (TILAPIA ZILLI) FROM MINI-NDAI CREEK, RUMUOLUMENI, PORT HARCOURT.

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Abstract

Heavy metals are naturally occurring elements but industrial activities and other anthropogenic activities can also release them into our environment to levels causing pollution. Heavy metals in high concentration in the aquatic organisms may pose a health risk when these organisms are consumed. The aim of the study was to evaluate the state of heavy metal contamination of the Mini-Ndai creek. Heavy metal concentrations in *Tilapia zilli* from Mini-Ndai Creek, Rumuolumeni, Port Harcourt were determined using Atomic Absorption Spectrophometer (AAS). Samples were collected in January, March and May. Data were analyzed using mean and standard deviation represented in bar graph. The heavy metals analyzed are Ni, Cd and Mercury. The resulted indicated high concentrations of Ni (3.94µg/g) and low concentrations of Hg (0.02µg/g). The trend of heavy metals concentration can be represented as Ni>Cd>Hg, with their concentrations as (3.94>0.17>0.02)µg/g. Hg was within the safe limits while Ni and Cd were seen to be above the safe limits for human consumption. It is recommended that further studies of heavy metals should be carried out to monitor the physicochemical parameters and the heavy metal content of the creek.

Keywords: Concentration, heavy metals, Mini-Ndai creek, Tilapia

Introduction

The continual developments of the petroleum industry as well as other industrial and urban activities are giving rise to a number of environmental problems. These environmental problems are due to a variety of waste products generated from these activities that are not being managed properly. As a result of the poor management of these waste materials discharged into aquatic habitats, many contaminants such as heavy metals have become major concerns due to their toxicity; bioaccumulation and that they are not readily biodegraded (Al-Busaidi*et al*., 2011).

Any metallic chemical element having a relatively high density above 5g/cm^3 and toxic nature even at low concentrations are often referred to as heavy metals. Examples; Mercury, Cadmium, Nickel, Arsenic, Chromium, Cobalt and Lead. Trace elements likeCopper, iron, Zinc, Manganese and Selenium, are important as they help maintain the metabolism of the human body (Igwemmar*et al*., 2013). However, at high concentrations can lead to poisoning.

Skeat (2005) revealed that "heavy metals are members of a loosely defined subset of elements that exhibit metallic properties which include solubility in water; and strong attachment of polypeptides and protein".

Heavy metals are 'naturally occurring in the ecosystem with varying concentrations. Some of the metals present in the water environment like the streams and rivers come from industrial wastes, municipal and urban run-offs which can be a threat to life' (Tolcin, 2011).

In recent times, there has been an increase in the world consumption of fish simultaneously due to the growing concern of their benefits therapeutically and nutritionally. In addition to it being an important source of protein, fish typically have rich contents of important minerals, vitamins and unsaturated fatty acids (Medeiros *et al*., 2012). Fishes are somewhat situated at the top of the aquatic food chain; as a result of this, they can accumulate heavy metals from food, water and sediments. (Yilmaz *et al*., 2007).

Toxic heavy metal content in fishes can hinder their beneficial nature; the severe unfavourable effects of heavy metals to the health of human have been identified for long time (Castro-Gonzalez *et al*., 2008). This may include severe health issues like kidney failure, liver damage, cardiovascular diseases and may even lead to death (Al-Busaidi*et al*., 2011). Therefore, many international monitoring programs have been established in order to assess the quality of fish for human consumption and to monitor the health of the aquatic ecosystem (Meche *et al*., 2010).

There are varying levels of heavy metal toxicity as the surrounding environment also affects it through certain factors. Even in fishes, the toxicity levels of these heavy metals like Pb, Hg, Cu and Znplays certain roles that could cause some harm. When water and fishes contaminated with heavy metals are consumed, diseases could occur due to these heavy metals being bioaccumulated in the body system of human beings, thus leading to serious health problems and eventually death. Also, many of these metals are carcinogenic in nature and cannot be easily destroyed by heat (Adeosun *et al*., 2015).

Due to the bioaccumulation of heavy metals, they are somewhat dangerous.

Bioaccumulation means 'an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment' (Lenntech, 2005).

The aquatic environment being contaminated with heavy metals has led to a lot of researches on the effect of heavy metal pollution. The source of pollutants in the aquatic environment can be from industrial wastes, agricultural and geochemical structures, and these wastes can affect the water quality as well as the aquatic species.

Fishes that inhabit aquatic bodies where heavy metal pollution is prevalent take up these pollutants which bioaccumulate in their body tissues. Majority of the population in Nigeria consume fishes on a daily basis because they are seen to be good sources of protein and are cheap and easily affordable. Fishes that contain heavy metals that are been consumed by either humans or animals poses a serious health risk.

Studies carried out by Anaero-Nweke*et al*. (2018) on various concentration of heavy metal in fish from the Upper Bonny Estuary showed "Cr and Ni to be above the FAO/WHO (2012) permissible limits of 0.5mg/kg and 0.6mg/kg respectively".

Alinnor& Obiji (2010), carried out an investigation to survey heavy metal content of fish samples from Nworie River. Results showed that "Fe, Cd, Mn were present in the fish species, *Tilapia guineensis* with mean values of 3.275, 0.048 and 0.103ppm respectively".
Umunnakwe and Aharanwa (2014) carried out an investigation in different fish species which included Tilapia fish and found out that "Ni and Cd exceeded the permissible limits and Fe had the highest concentration, and the trend of accumulation was Fe>Cd>Ni>Hg>Cr".
This study is of great importance because it tends to evaluate out the concentration of heavy metals in *Tilapiazilli* found in the Mini-Ndai creek located at Rumuolumeni, Port Harcourt.
This fish is been consumed on a daily basis, hence the need for the evaluation for heavy metal contents in it to monitor potential hazards and provide possible early warnings.

Aim and Objectives of the study

The aim of the study was to evaluate the state of heavy metal contamination of the Mini-Ndai creek. The objectives of this study was to determine the relative concentrations of Nickel (Ni), Cadmium (Cd), Mercury (Hg)in the Tilapia fish.

Materials and Methods

Study Area

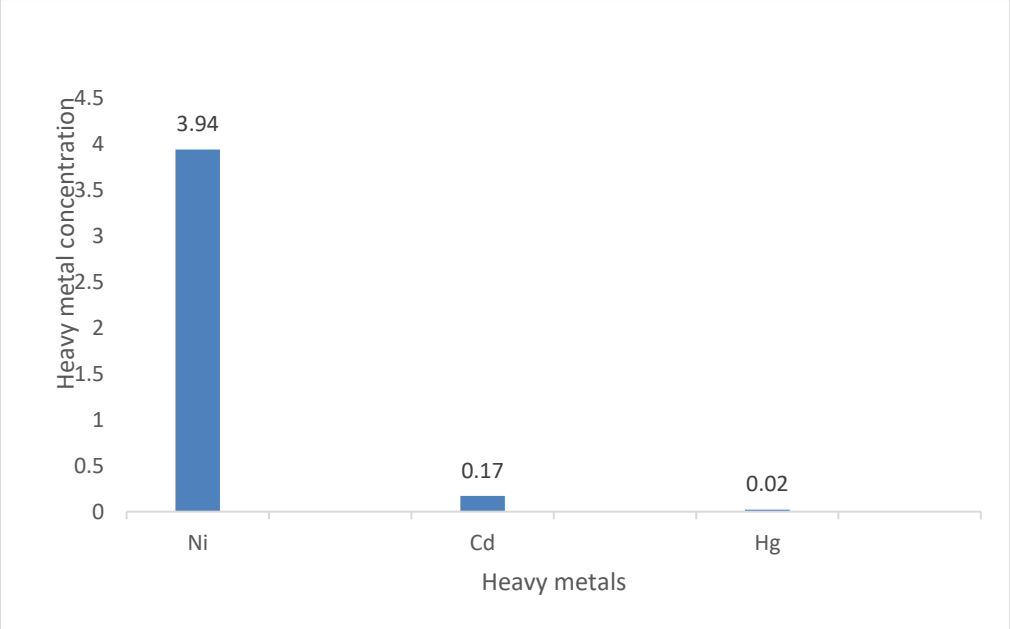
The study was carried out at the Mini-Ndai creek situated at Rumuolumeni, Port Harcourt, Rivers State. Water enters the creek at high tide from the New Calabar River and drains from the surrounding mangrove swamp into the river as the tide ebbs.

Fish Sample: Fish samples were purchased from the local fishermen and fish sellers of the creek. They were immediately transferred into plastic containers containing ice and stored in a freezer prior to analysis.

Sample Preparation: On the day of analysis, the fish samples were taken out of the freezer and thawed at room temperature. They were oven dried and pulverized to produce its powdered form.Powdered samples were digested with nitric acidand then analyzed for Nickel (Ni), Cadmium (Cd) and Mercury (Hg) using the Atomic Absorption Spectrophometry (AAS).

Statistical Analysis: Statistical analysis was carried out and the results obtained using arithmetic mean and standard deviation.

Results: The mean concentration of heavy metals in Tilapia fish are presented in Fig. 1. The mean concentrations of Ni, Cd and Hg in the *Tilapia zilli*were 3.94±0.17µg/g, 0.17±0.04µg/g, 0.02±0.01µg/g respectively. Ni had the highest concentration in the *Tilapia zilli*among other heavy metals studied. The order of heavy metal concentration in the *Tilapia zilli*was Ni>Cd>Hg.



Discussion of Findings

The study revealed that Mercury analyzed in the Tilapia fish sample was within the safe limits while Nickel and Cadmium were seen to be above the safe limits.

Although, the order of heavy metal concentrations in the *Tilapia zilli is* Ni>Cd>Hg; which contrasts slightly with the trend Fe>Cd>Ni>Hg>Cr as reported by Umunnakwe and Aharanwa (2014). This indicates that Nickel had the highest concentration in the fish sample, while Hg had the least concentration in *Tilapia zilli.*

Conclusion

Heavy metals are known to affect aquatic lives. When these heavy metals accumulate over a long period, it exerts direct consequences to aquatic biota and in turn man within the ecosystem. The heavy metals except Ni and Cd were within the safe limits for consumption.

With these findings, one may admit that the continuous eating of these fishes could have adverse effects (such as carcinogenic effects, kidney damage and cardiovascular effects) on human health as regards the adverse nature of these heavy metals (Ni and Cd)(Chervona*et al*., 2012 and Duruibe*et al*., 2007).

Based on theresults obtained fromthe study area, the following measures need to be noted.

1. The abbatoir effluents discharge into the creek should be discouraged.
2. Further researches should be carried out on the creek to check the physicochemical parameters and the heavy metal content of the creek.

References

Adeosun, F. I, Akinyemi, A. A, Idowu, I. O, Omoike, A. &Ayorinde, B. J. O (2015). The effects of heavy metals concentration on some commercial fish in Ogun River, Opeji, Ogun State, Nigeria. *African Journal of Environmental Science and Technology*, *9*(4), 365-370.

Al-Busaidi, M., Al-Harthy, K.S., Al-Mamun, A. & Al-Rahbi, W. A.(2011). Heavy metals in fish from coastal waters of Oman. *Journal of Environmental Science and Health, 4* (6), 561 – 568.

Alinnor, I.J &Obiji, I.A (2010). Assessment of Trace Metal Composition in Fish Samples from Nworie River. *Pakistan Journal of Nutrition,9*(1), 81-85.

Anaero-Nweke, G. N., Ugbomeh, A. P., Ekweozor, I. K. E., Moslen, M. & Ebere, N. (2018). Heavy Metal Levels in Water, Sediment and Tissues of *Sarotherodonmelanotheron*from the Upper Bonny Estuary, Nigeria and their Human Health Implications. *International Journal of Marine Science, 8* (23), 186 – 194

Castro-Gonzalez, M. I. & Mendez-Armenta, M. (2008). Heavy metals: Implications associated to fish consumption. *Environmental Toxicology Pharmacology,26* (3), 263-271.

Chervona, Y, Arita, A&Costa,M.(2012). Carcinogenic metals and the epigenome understanding the effect of nickel, arsenic and chromium. Metallomics. 2012 Jul; 4(7):619-27.

Duruibe, J. O, Ogwuegbu, M.O.C &Egwurugwu, J. N (2007). Heavy metal pollution and human biotoxic effects. *International Journal of Physical Sciences*, 2(5): 112-118.

Igwemmar, N. C, Kolawole, S. A, Odunoku, S. O (2013). Heavy metal concentration in Fish species sold in Gwagwalada Market, Abuja. *International Journal of Science and Research (IJSR), 2*(11), 2319-7064.

Lenntech (2005). Heavy metals. http://www.lenntech.com/processes/heavy/heavy-metals/heavy-metals.htm.

Meche, A, Martins, M. C., Lofrano, B. E. S. N., Hardaway, C. J., Merchant, M. &Verdade, L. (2010). Determination of heavy metals by inductively coupled plasma-optical emission spectrometry in fish from the Piracicaba River in Southern Brazil. *MicrochemJournal*, 94, 171-174. http://dx.doi.org/10.1016/j.microc.2009.10.018.

Medeiros, R. J, Santos,L. M., Freire, A. S., Santelli, R. E., Braga, A. M. C. B & Krauss, T. M. (2012). Determination of inorganic trace elements in edible marine fish from Rio de Janeiro State, Brazil Food Control, 23,535-541. http://dx.doi.org.1016/j.foodcont.2011.08.027.

Skeat (2005). *Concise Etymological Dictionary of the English Language*. Cosimo, Inc...p. 622.

Tolcin AC (2011). *Mineral Commodity Summaries 2009: Zinc*: United States Geological Survey. WHO Contributors (2007). The impact of zinc supplementation on childhood mortality and severe morbidity.

Umunnakwe, J. E.&Aharanwa B. C (2014). Assessment of Water Quality and Heavy Metal levels of Fish Species in Oguta Lake, Imo State Nigeria. *Journal of Natural Sciences Research, 4* (8), 103-112

WHO (2012).*Guidelines for drinking water quality* (4thed.). World Health Organisation library cataloguing in publication data.

Yilmaz F, Ozdemir N, Demirak A. & Tuna, A. L. (2007). Heavy metal levels in two fish species, *Leuciscuscephalus*and *Lepomisgilbosus. Food Chemistry,100* (2). 830-835.

ASSESSMENT OF TEACHERS COMPETENCY IN ELECTRICAL INSTALLATION AND MAINTENANCE WORK FOR STUDENTS SELF-RELIANCE IN TECHNICAL COLLEGES IN BAYELSA STATE.

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Abstract

The study assessed teachers competency in Electrical Installation and Maintenance Work for students' self-reliance in technical colleges in Bayelsa state. Three research questions guided the study. The study adopted descriptive survey research design. The population of the study was 37 comprising of 31 Electrical Installation and Maintenance Work tech-3 students and 6 Electrical Installation and Maintenance Work teachers from two technical colleges in Bayelsa state. There was no sampling size due to the small population. The instrument for the data collection was a self-structured questionnaire designed after the pattern of 4point rating scale. The instrument was validated by three experts: one expert from the Department of vocational and technology education, Rivers State University and two of the teachers in two different technical colleges in Bayelsa State. The reliability coefficient of 0.86 was obtained using Cronbach Alpha. Research questions were answered with mean and standard deviation. The study find out that teachers are very competent in domestic installation and students as well and this will result to self-reliance of the students. The study also find out that teachers are competent in rewinding of electric machines. The finding revealed that teachers are incompetent in electric motors.it was recommended among others that Electrical Installation and Maintenance Work teachers should be encouraged to go for training especially in their areas of incompetency through, in-service and sandwich programmes.. Competent teachers of Electrical Installation and Maintenance Work should employed by the government to teach in technical colleges of States.

Keywords: Electrical Installation and Maintenance Work, Teachers Competency, Students Self-Reliance.

INTRODUCTION

The Federal Republic of Nigeria however, stated in her National Policy on Education (2013) that, "Technical and Vocational Education is used as comprehensive term referring to those aspect of the educational process involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in the sectors of economic and social life". This has drawn attention to the significance of Technical and Vocational Education (TVE) in manpower development, from various countries around the world. TVE has been seen as the only

attracting programme that tackles the peril of poverty and creates employability skills.In Nigeria, the teaching of skills in the formal sector exists in two types of institutions (Oziegbe, 2009).These institutions are Technical Colleges and Trade Centres.

Technical Colleges are post primary institutions where students are giving full vocational training that will enable them acquire relevant knowledge, skills and attitude for paid or self-employment in various occupations in the world of work (Odika& Tom, 2020).It is the grassroots of Technical and vocational Education Training program (TVET).

According to NBTE,(2011) the quality of academic programmes in technical colleges is regulated by National Board for Technical Education body of curriculum development, supervision and periodic accreditation visits while the National Business and Technical Examinations Board (NABTEB) is responsible for the examination and certification of the occupational trades leading to the award of National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC). According to Mohammed, Usman and Raymond, (2019***)*** Technical colleges were recognised to train individuals to obtain, basic scientific knowledge, practical skills and attitudes essential as craftsmen and technicians at sub professional level, to meet the manpower needs for national development. Technical college's graduates need to acquire the essential new inclination of knowledge of subject matter, practical skills and instructive knowledge for effective outcome of the goals and objective of Technical Colleges. This calls for the technical competency of the teacher in order to attain success.

Competency is the ability of someone to perform a task in which he/she had been trained. According to Danielson (2016), Competency in teaching refers to the ability of a teacher to exhibit on the job skills and knowledge gained as a result of training. James (2013), states that competency is a bunch of connected knowledge, skills, abilities that affects a major part of one's job that can be measured against well-accepted standards, and that can be improved through training and development.

Teachers' competency therefore is the ability of a teacher to effectively and efficiently transfer all the knowledge and skills he had acquire during his/her training to his students. Teachers' competency augments a teacher's ability to create an atmosphere that is reasonable, understanding, and tolerant to different students with different ideas, experiences, and backgrounds.Anobi (2016) recognizes that as true educators, teachers are always learning; and teachers need to continue to prove their qualification at all times for students' performance. If a student is asked about a teacher who is highly qualified and competent, they will most likely say that it is the teachers who spend extra time with them and who makes the class content clear and achievable (Lewis, 2015).

The teaching skills of a teacher can be measured based on the teacher's abilities around how he is well able to comprehend his subject matter and transform the knowledge of the subject matter to be communicated effectively to his learners (Ganyaupfu, 2013). Teaching requires one to first understand the specific outcomes of the topic as well as the subject matter structures of the respective discipline. Competent teachers have high expectations of students in terms of both their standard of learning and their behaviour, they also help their students meet those

expectations. They have high expectations of themselves and their own learning which lead them to professional development in their subject area.

Teachers' competency is the ability of the teacher to communicate the relevant skills, knowledge and methods steadily over time to meet the predictable performance of students (Mark, 2011). He further said there are two aspects of teacher's competence: competency in the subject area and the pedagogical competency; the application of methods relevant to effectively participate in the classroom is the pedagogical competency, while the essential skills and knowledge found in the subject area is the technical competency.

Knowledge of subject area is the total know how of the teacher in is subject area for effective teaching and learning of the skills acquired (Amenger in Mohammed, Usman& Raymond, 2019***)***.

The effectiveness of teaching is measured by a teachers effectiveness and competency, that means a teacher that teach effectively is a competent teacher.According to Fldrez and Sammons, (2013), an effective teacher struggle to stimulate and involve all their students in learning, they don't believe that some students cannot perform well. Kington*et al,* (2011), an effective teacher believes every student is capable of attaining success at school and they put in their best in making each student successful. Teacher competence is highly linked to the effectiveness or ineffectiveness of teaching. Subtly, the effectiveness of all educational programmes is dependent largely on the devotion and competency of teachers who constitute in the educational system (Adamu in Babayo, 2021)).

Therefore, comprehension of the instructional purpose or subject matter is a very important element ofteacher's competence. According to Shulman, (2012) the educational purposes for engaging in teaching are to assist learners gain knowledge, develop skills and standards to function well in the society. It arms them with prospect to acquire and learn new ideas, identify new concepts and allow students to enjoy their learning experiences. This will enhance learners' responsibility to become productive in the economy, contribute to the well-being of the social, economic and business community.

Conversely, the unqualified teachers are the ones who are boring and do not connect with their students.. Students do not care about educational certificates or years of experience but what the teacher has to impact them, (Ugochukwu, Paul & Elisha, 2019). Technical competency possessed by teachers enables them to prepare individuals for self-reliant and useful living in the society (Babayo, 2021).

Electrical installation and maintenance works as offered in technical colleges to prepare an individual with job-satisfying requirements towards employment and self-reliance (Mohammed, Usman, & Raymond, 2019). Electrical installation and maintenance works curriculum is designed to prepare the students to acquire entry level knowledge and manipulative skills for employment in the electrical industry (Odika& Tom, 2020). According to Alegbemi, (2010), electrical installation and maintenance is that part of technical education which deals mainly with electricity, principles of magnetism and forces of nature and materials for the benefits of mankind. Students who undergo training in electrical installation and maintenance trades as expected to get hold of skills for fineness in installation of electrical

machines and equipment, maintain of machines and equipment, winding of electrical machines, testing and inspection of electrical installations, repair of electrical machine and others
The aim of Electrical Installation and Maintenance Work is to give training and impart the essential skills important to the making of craftsmen, technicians and other skilled personnel who will be resourceful and self-reliant (NBTE 2004). This is supported by the Federal Republic of Nigeria (2009) which stated that the objective of technical education is to provide technical training and impart the necessary skills leading to the production of skilled personnel who will be enterprising and self-reliant.Competencies of individual's practical skill in TVE are designed to lead the beneficiaries' to self-employment, economic self-sufficiency, and employment generation through short or long-term training (Odika& Tom, 2020).

However, according to Mohammed, Usman, and Raymond, (2019) acquisition of technical skills in electrical installation and maintenance work can only be effective if teachers in the trade are competent and knowledgeable in both theory and practical. Students' quickly loose respect and confidence in the teacher who is ineptitude at the trade or occupation he professes to teach. Thus, electrical installation and maintenance work trade teachers have to show mastery in both theory and practice of the trade.

Hence, come the reason for assessing teachers' competency in EIMW for students self-reliance in technical colleges in Bayelsa state. This will play crucial role in achieving academic objectives. This is supported by the National policy on Education which states that no education system can rise above the quality of its teachers (FRN, 2009).

Statement of Problems

Electrical installation and maintenance works skills learned in technical colleges are rested with abilities of equipping the students with required skills to drive them toss meaningfully to national economic development, be self-reliant, creates job for sustainability and reduce unemployment. This is in line with the federal government goal. This can be realised if the amount of knowledge and skill imparted to Electrical installation and maintenance work students meets the demand of industries for them to be employable or self-reliant. Nevertheless, most graduates of electrical installation and maintenance works are unemployed and could not establish their own workshop due to the fact that they lack marketable skills which may be as a result of ill training or inadequate skill acquisition of electrical installation and maintenance work.The impartation of these knowledge and skills will be done by the teacher, this means the success of the students' knowledge and skill in electrical installation and maintenance work to a large extent is tied to the teachers competency in electrical installation and maintenance work. Hence, the need for assessment of teacher's competency in electrical installation and maintenance work for students' self-reliance in technical colleges in Bayelsa state.

Purpose of the Study

The main purpose of this study is to assess teachers' competency in electrical installation and maintenance work for students' self-reliance in technical colleges in Bayelsa state.
The study specifically sorts to find out;

1. Teachers' competency in domestic installation for student self-reliance in technical college, Bayelsa state.
2. Teachers' competency in rewinding of electric machines for student self-reliance in technical college, Bayelsa state.
3. Teachers' competency in Electric motor for students' self-reliance in Technical colleges, Bayelsa state.

Research Questions

The following research questions are raised for the purpose of this study;

1. To what extent are teachers competent in domestic installation for student self-reliance in technical college, Bayelsa state?
2. To what extent are teachers competent in rewinding of electric machines for student self-reliance in technical college, Bayelsa state?
3. To what extent are teachers competent in Electric motor for student's self-reliance in Technical colleges, Bayelsa state?

II. METHODOLOGY

Descriptive survey research design was adopted for this study, because it was considered suitable for this study. A well-structured questionnaire consisting of twenty-one items was used to obtain responses from tech-3 students of electrical installation and maintenance work and teachers in government technical colleges in Bayelsa state. According to Alio, cited byOdika and Tom,(2020) structured questionnaire and sampling methods are used to assess public opinion in order to obtain information from them.

The population of the study was 37 respondents which comprises of thirty-one (31) tech-3EIMW students and six (6) EIMW Teachers of electrical installation and maintenance work of two technical colleges in Bayelsa State. They were purposively sampled because it is assumed that tech-3 student would have been taught all the various aspect of EIMW. The study was a census as the entire population was studied; this is relatively due to the small size of the population.

A structured questionnaire titled "questionnaire on assessment of teacher competency in electrical installation and maintenance work (QATCEIMW)" with 21-item was designed in a 4-point rating scale developed by the researcher. The responses were Strongly Agreed (AS), Agreed (A), Disagreed (D) and Strongly Disagreed (SD) having numerical values of 4, 3, 2 and 1respectively.The instrument was subjected to face and content validation by one experts from the Department of vocational and technology education, Rivers State University and two of the teachers in the two different technical colleges in Bayelsa State. The internal consistency of the instrument was established using Cronbach Alpha reliability method and 0.86 was obtained as reliability coefficient of the instrument.

37 copies of questionnaires were administered and 37 were retrieved by the researcher for analysis.Data collected from respondents were analysed using mean and standard deviation to answer the research questions. The computation of the mean and standard deviation were carried out with Statistical Package for Social Sciences (SPSS). It was decided that an item

with a calculated mean value equal or greater than 2.50 (2.50 – 4.00) was rated agreed while item with the calculated mean less than 2.50 (0 – 2.49) was rated disagreed as required.

RESULTS

Research Question 1: To what extent is teacher's competency in domestic installation results to student self-reliance in technical college, Bayelsa State?

Table 1: Mean and Standard Deviation of Teachers' Competency in Domestic Installation Result to Student Self-Reliance in Technical College, Bayelsa State.

S/N	Items	Students			Teachers		
		Mean	S.D	Rmk	Mean	S.D	Rmk
1	I Understand electrical working diagrams very well	3.13	0.62	Agreed	4.00	0.00	Agreed
2	I you Know the different types of domestic surface wiring.	3.03	0.55	Agreed	3.50	0.55	Agreed
3	I Know different types of domestic conduit wiring.	3.00	0.52	Agreed	3.67	0.52	Agreed
	I Understand the principles of protecting electrical devices and installing them.	3.32	0.75	Agreed	3.33	0.52	Agreed
4	I Understand sequence for inspecting and testing domestic installations.	3.13	0.67	Agreed	3.67	0.52	Agreed
5	I Understand the terms used in illumination.	2.13	0.56	Disagr eed	3.50	0.55	Agreed
6	I Know various types of lamps for illumination.	2.58	0.85	Agreed	3.33	0.52	Agreed
	Ground Mean/SD	**2.90**	**0.64**		**3.57**	**0.45**	

Source: Researchers Field Work

Data in Table 1 shows the responses of teachers of EIMW with mean range of 3.33-4.00 and standard deviation range of 0.52-0.00. The students had a mean range of 2.13-3.32 and standard deviation range of 0.56-0.75. The standard deviation showed the homogeneity of the respondents, while the mean indicated that the respondents agreed on all the items of domestic installation resulting to students' self-reliance in technical colleges in Bayelsa State.

Research Question 2: To what extent is teacher's competency in rewinding of electric machines results to student self-reliance in technical college, Bayelsa state?

Table 2: Mean and Standard Deviation of Teachers Competency in Rewinding of Electric Machines Results to Student Self-Reliance in Technical College, Bayelsa State.

S/N	Items	Students			Teachers		
		Mean	**S.D**	**Rmk**	**Mean**	**S.D**	**Rmk**
1	I Understand the principles of operation of AC and DC machines and their applications.	2.94	0.85	Agreed	3.17	0.41	Agreed
2	I Know the installation of all types of electrical machines and equipment.	2.84	0.64	Agreed	2.67	0.52	Agreed
3	I Understand various methods of controlling electrical machines.	2.84	0.73	Agreed	2.83	0.98	Agreed
4	I Know methods of maintaining electrical machines and equipment.	3.23	0.62	Agreed	2.50	0.55	Agreed
5	I Diagnose faults in machines, equipment and installations.	2.55	0.62	Agreed	2.67	0.82	Agreed
6	I Know the installation of MICC cable.	2.35	0.84	Disagreed	2.33	0.52	Disagreed
	Ground Mean/SD	**2.79**	**0.72**		**2.69**	**0.63**	

Source: Researchers Field Work

Data in Table 2 shows the responses of teachers of EIMW with mean range of 2.50-3.17 and standard deviation range of 0.55-0.41. The students had a mean range of 2.13-3.32 and standard deviation range of 0.56-0.75. The standard deviation showed the homogeneity of the respondents, while the mean indicated that the respondents agreed on all the items except item 6 of rewinding of electrical machines resulting to students' self-reliance in technical colleges in Bayelsa State.

Research Question 3: To what extent is teachers' competency in Electric motor results to student's self-reliance in Technical Colleges, Bayelsa State?

Table 3: Mean and Standard Deviation of Teachers' Competency in Electric Motor Results to Student's Self-Reliance in Technical Colleges, Bayelsa State.

S/N	Items	Students			Teachers		
		Mean	**S.D**	**Rmk**	**Mean**	**S.D**	**Rmk**
1	I understand and can apply all statutory regulations during electrical winding work.	2.42	0.81	Disagree	1.83	1.17	Disagree
2	I can Identify and select appropriate tools and equipment used for winding jobs.	2.90	0.87	Agree	2.17	0.98	Disagree

3	I have acquired skills for preparation and interpretation of winding drawing.	2.48	0.77	Disagree	2.50	1.05	Agree
4	I have acquired skills for preparation and interpretation of winding drawing.	2.29	0.74	Disagreed	1.83	0.98	Disagreed
5	I have acquired skills for dismantling machines for rewinding them	2.45	0.77	Disagreed	2.00	1.10	Disagreed
6	I understand the rewinding of burnt static/rotating machines.	2.26	0.82	Disagreed	2.00	0.89	Disagreed
7	I know the skimming/undercutting of armature, commutators and slip rings.	2.32	0.79	disagreed	2.50	1.05	Agreed
8	I can Inspect rewound electrical machines and equipment and test for continuity, insulation, correct rotating voltage.	2.48	0.96	Disagreed	2.17	0.98	Disagreed
	Ground Mean/SD	**2.45**	**0.82**		**2.13**	**1.03**	

Source: Researchers Field Work

Data in Table 3 shows the responses of teachers of EIMW with mean range of 1.83-2.50 and standard deviation range of 1.17-1.05. The students had a mean range of 2.26 - 2.90 and standard deviation range of 0.82-0.87. The standard deviation showed the homogeneity of the respondents, while the mean indicated that the respondents disagreed on all the items except item items 3 and 7 for teachers and item 2 for students of electrical motors resulting to students' self-reliance in technical colleges in Bayelsa State.

Discussion of Findings

The study as presented in research question 1 (Table 1) above, revealed that teachers are competent in domestic installation as also seen in students responses. That means based on teachers competency in mastery and using the appropriate instructional method in teaching domestic installation, Students are able to understand electrical working diagrams. Know the different types of domestic installations, understand the principles of protecting electrical devices and how to install them. They also understand sequence for inspecting and testing domestic installations, the terms used in illumination and know the various types of lamps for illumination. These knowledge and practice will help students to be self-reliance. This opposes and contradicts the findings of other researchers such as: Bayo, (2021) that electrical installation and maintenance work trade teachers teaching in the skills acquisition centres in Yobe state needed technical competency improvement in all the items listed in domestic electrical installation. Also Mbaga, (2011) conducted a study on the retraining needs electrical installation and maintenance work teachers and indicated that there is low level of possession of technical skills by teachers in domestic electrical installation module.

Findings in research question 2 as in table 2 revealed teachers competency in rewinding machines as also affirmed from the students responses. The strategies and mastery teachers

imply in rewinding have made students to understand the operational principles of AC and DC machines and their applications, Know the installation of all types of electrical machines and equipment, understand the maintenance and control of various electrical machines and be able to diagnose fault. This is contrary to the findings of Bayo, (2021) that the teachers needed the technical competency in all the 16 items of rewinding of electrical machines. This also disagrees with Terrel, (2004) that many electrical teachers need more improvement in winding of electrical machine.

Findings to research question 3 as in table 3 revealed that, Teachers are not competent in electric motors as also indicated by the students' responses. It is what the teachers know they can teach the students. The incompetency of teachers has affected students negatively since the students relay on the teachers for knowledge. Students don't understand and cannot apply all statutory regulations during electrical winding work, they have not acquired skills for preparation and interpretation of winding drawing and dismantling machines for rewinding. They don't have the understanding for rewinding of burnt static/rotating machines and the skimming/undercutting of armature, commutators and slip rings. This is one of the major area where EIMW teachers need to improve on, knowing through well that the role of teachers competency in students self-reliance in any subject matter cannot be overemphasize. Technical competency possessed by teachers enables them to prepare individuals for self-reliant and useful living in the society (Babayo, 2021).

Conclusion

The findings of this study had shown that teachers are competent in some areas of EIMW and deficient in other aspect. The arrears of teachers competency is also shown in students' responses. This confirms the fact that there is need for the assessment of teachers' competency in EIMW from time to time. This will call for developmental training in areas of deficiencies, so that students of EIMW can be self-reliance after graduation. . It is believed that when competent teachers teach these skills, it would facilitate job creation, self-reliance and sustainability in Bayelsa State.

Recommendations

The following recommendations were made in view of the findings of the study:

1. EIMW teachers should be encouraged to go for training especially in their areas of incompetency through, in-service and sandwich programmes.
2. Government should also organize workshops/seminars for teachers of EIMW on the use of modern tools and equipment in the different areas of EIMW.
3. Competent teachers of EIMW should employed by the government to teach in technical colleges of States.

REFERENCES

Anobi, E. (2016). *The effect of socio-economic background, gender and school type on the achieving of female students in introductory technology*. Kenya: Academy science publishers.

Danielson, U. (2016). Successful schools: From research to action plans; *A Journal presented at June 2005 model schools conference*, 6 (2), 34-37.

Federal Government of Nigeria (2013).*National policy on education, 6*. Lagos: Nigerian research and development council press.

Oziegbe, U.V. (2009).Industrializing the Nigerian Society through creative skill Acquisition Vocational and Technical Education Programme. International NGO Journal.4, 4.142-145.

Odike, E.M & Tom, C.C (2020).Electrical Installation and Maintenance Works Skills for Sustainability amongst Graduates of Technical Colleges in Rivers State. International Journal of Innovative Education Research 8(1):1-10, Jan.-Mar., 2020.© SEAHI PUBLICATIONS, 2020 **www.seahipaj.**org ISSN: 2354-2942

National Board for Technical Education - NBTE (2011).*Report of the national steering committee on the development of National Vocational Qualifications Framework (NVQF) for Nigeria*http://www.nbte.gov.ng/downloads/FINALpercent 20REPORT percent 20NVQF.pdf Accessed 8/8/2014

Mohammed, G. M., Usman, G. A., & Raymond, E. (2019).*Electrical Installation and Maintenance Works Teachers' Professional Development Needs for Effective Teaching in Kwara State.*Kwara State College of Education (Technical) Lafiagi.Department of Industrial and Technology Education, Federal University of Technology, Minna.africascholarpublications@gmail.com

James, A. (2013). *The Essential guide to the mandatory knowledge, skills and competency required for personnel working in hazardous areas*. www.intertek.com or training.uk@intertek.com Retrieved 4/6/2013

Lewis, G. (2015). Teaching styles and learners' achievement in Kiswahili language in secondary schools, *International Journal of academic research in progressive education and development*, 1(3),62-87.

Ganyaupfu, E.M. (2013). Factors influencing academic achievement in quantitative courses among business students of private higher education institutions.*Journal of education and practice*, 4(15), 57-65.

Mark, A. J. (2011). *Proficiency in Teaching of Technical and Vocational Skills*. A Lead paper presented during the 2nd National Conference organised by School of Technical Education, Federal College of Education (Technical) Potiskum, Yobe State, Nigeria.

Fidrez, M. T. & Sammons, P. (2013).*Assessment for learning*: effects and impact reading C.B.T

Kington, A., Sammons, P., Day, C. & Regan, E. (2011). Stories and statistics; Describing a mixed methods study of effective classroom practice: *Journal of Mixed Methods Research*, 5(2) 103-125.

Babayo A. S (2021) Assessment of Technical Competency Needs Of Electrical Installation And Maintenance Work Teachers In Vocational Training Centres For Effective Skills Acquisition Delivery In The North-East Zone, Nigeria. International Journal of Innovative

Scientific & Engineering Technologies Research 9(3):52-62, July-Sept., 2021 SEAHI PUBLICATIONS, 2021 www.seahipaj.org ISSN: 2360-896X.

Shulman, L. (2012). Ways of seeing, ways of knowing, ways of teaching, ways of learning about teaching. *Journal of curriculum studies*; 28, 393-396.

Ugochukwu, C. O., Paul A. I., & Elisha, N. E. (2019).*Improving graduate outcomes for technical colleges in Nigeria.* Ebonyi State University, Nigeria University of Lincoln, UK, *Australian Journal of Career Development*, 28(1) 21–30.

Alegbemi, F. A. (2010). Vocational technology education and work skill requirements in contemporary Nigeria; *the way forward in electrical technology*.

Federal Republic of Nigeria (2009).*National policy on Education*. Abuja NERDC Press.

National Board for Technical Education (NBTE).(2004). *Curriculum for technical colleges*. Kaduna: NBTE Press National Business and Technical Examination Board (2004). National Technical Certificate Examination Syllabuses for Engineering Trades. Benin: Yuma Printing Press.

National Policy on Education (2013).*National Policy on Education and 4 Year Strategic Plan for the Development of the Education Sector*, 2011 – 2015. Lagos: NERDC Press

Mbaga, V. E. (2011). Retraining Needs of Electrical Installation and Maintenance Works Trade Teachers in Technical Colleges in North-Eastern Nigeria. Unpublished *Doctoral thesis*, Modibbo Adama University of Technology Yola.

Terrel, C. (2004). *Winding of Electrical Machines*.McGraw Hill, NewYork.

EFFECT OF AGE ON THE LEVEL OF STRESS EXPERIENCED AND ACADEMIC PERFORMANCE OF AUTOMOBILE TECHNOLOGY STUDENTS EXPOSED TO MULTIPLE STRESS MANAGEMENT INTERVENTIONS IN UNIVERSITIES IN SOUTHERN NIGERIA

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Abstract

The study sought to determine the effect of age on the level of stress experienced and academic performance of automobile technology students exposed to multiple stress management interventions in universities in Southern Nigeria. 1 purposes with corresponding research questions and 1 hypothesis were generated, answered and tested respectively. The study employed quasi-experimental design. The population for the study was 97 first year Automobile students. The instruments used for data collection were validated by 3 experts and has overall reliability coefficients of 0.77. Data analysis was carried out using mean and standard deviation. MANCOVA was used to test the hypothesis. The findings revealed significant effect of the intervention on student's health status and improved academic performance. It was therefore recommended among others that multiple stress management intervention should be integrated in Automobile technology education and other engineering/technology based programmes to foster effective stress management practices among students. Also, there is the need for stress management training for all levels of Automobile students with involvement of capability within the university.
Keywords: Automobile Technology Education, Academic Performance, Age and Multiple Stress Management Intervention.

Introduction

Helping students to manage stressful academic lives has been a goal of counseling practitioners, the concerns of Psychologists and Automobile Lecturers. Automobile is a self-propelled vehicle used for transportation of goods and passengers on the ground. The goal of Automobile Technology Education in Nigerian universities including South-South Universities is to produce Automobile Technology teachers and technologists with sound theoretical and practical knowledge who can test, diagnose, service and repair faults relating to Automobile assembly main units and systems to the manufacturers specification Poripo, (2023; 2021), (Federal Republic of Nigeria (FRN, 2014). The achievement of this goal requires adequate provision of learning facilities, stress free and conducive learning environment, qualified and skilled Automobile lecturers who will facilitate students learning for academic performance.

Academic performance is the measure of students' success. Students' success implies meeting up with the set academic standard and cut-off demands prescribed by the school. Academic performance points to the extent to which Automobile students have gained from a particular curriculum, subject or task based on relatively standardized experiences, such as a

class test (Akinade, 2001), (Akerstedt, 2006). Effective learning and sound academic performance are said to constitute an integral part of the goal of schooling for students optimal performance (Hassan 2006). Student's academic performance however, have high tendency to be drastically affected or influenced by academic stressors manifestation which include lack of concentration in the classroom, absence from lectures, examination tension, fear of failure and academic grading system, inability to complete multiple assignments, inadequate study equipment, work apparatus, and facilities for practicals, limited time for practical activities among others (Nkem 2015, Bataineh 2013, Awino and Agolla, 2008). This implies that, if the stresses experienced by Automobile Technology Education students are not properly managed, it could affect their academic performance. In this study, academic performance means the total or overall output of an Automobile Technology Education student after assessment for participating in required academic activities at the end of the session. However, if Automobile students are not exposed to stress management treatments especially at this early stage of their university life before adult life, stress may jeopardize their academic ambition, force them to adopt maladaptive behaviours. Thus, it becomes imperative to investigate the effect of multiple stress management intervention on level of stress, motivation, mental health and academic performance of first year Automobile Technology Education students in Universities in South-South Nigeria with active participation in related automobile activities for both students age.

Age seems to also impact on how individual student react or cope with stress. Literature revealed that older students may differ in terms of stress experience and approaches to coping with stress as compared with younger students; and that as individuals mature their coping capacities expand such that they are able to successfully utilize coping strategies that are effective for specific situation (Zimmer-Gembeck & Skinner, 2008; 2011). While examining age differences in perceived stress and coping resources, Hamarat, Thompson, Zabrucky, Steele, Matheny and Aysan, (2001) found that students perceived stress decreased with age, and that older students reported more effective coping resources than the younger or adolescent students. However, Heiman (2004) established that older students are not better than the younger ones in coping with stress while examining student's psychosocial resources, perceived stress and coping styles using the sense of coherence model. The age difference among first year Automobile Technology Education students which varies from late teenage years to early adulthood may have considerable contributions to students' level of stress and coping responses as well as mental health and academic performance. Hence, various stressors coupled with varying individual characteristics may facilitate different levels of stress experience among the students (Abdulghani, Alkanhal, Mahmoud, Ponnameruma, and Alfaris, 2011; Mikolajczky, Ansari & Maxwell, 2009; Waghachavare, Dhumale, Kadam, and Gore, 2013; Yusoff, Rahim, Baba, Ismail, and Esa, 2013).

Although, few studies in Nigeria explained that irrespective of university student's age group, stress appears to limit academic performance. In order to prevent severe psychological effects of stress and its implications among the Automobile Technology Education students, effective stress management intervention is needed which could help or assist the students in handling stressful academic events appropriately, thereby reducing its harmful effects which

could affect or jeopardize student's academic performance and future working ambitions (Lee, Ahmed, Pathirana & Papier, 2016) (Adewuya, Ola, Olutayo, Mapayi&Oginni, 2006).

Statement of the Problem

The Automobile graduates in South-South Nigeria have the prospect of either being employed in industries and government establishment or setting-up their own business and become self-employed. However, these graduates of Automobile Technology Education in universities in South-South Nigeria prove to be ill equipped and lack interest in Automobile activities, as most companies and industries spend money in training and retraining the graduates of Automobile Technology in South-South Nigeria, in other to meet the standard required by the companies and industries, instead of starting work immediately. South-South Nigeria is also characterized with high level unemployment, making majority of graduates including graduates of automobile technology to roam about and get involved in various restive activities.

However, these Automobile graduates in southern Nigeria prove to be ill equipped and lack interest in Automobile activities, as most companies and industries spend money in training and retraining the graduates of Automobile Technology in South-South Nigeria, in other to meet the standard required by the companies and industries, instead of starting work immediately after graduation from school.

Purpose of the Study

The general purpose of this study is to determine the effect of age on the level of stress experienced and academic performance of automobile technology students exposed to multiple stress management interventions in universities in Southern Nigeria.

Research Questions

The following research questions were answered in the study:

1. What is the influence of age on the level of stress experience, motivation and academic performance of Automobile Technology Education students exposed to multiple stress management interventions?

Hypothesis

1. There is no significant influence of age on the level of stress experience, level of motivation and academic performance of Automobile Technology Education students exposed to multiple stress management interventions.

Methodology

Quasi-experimental design was adopted for this study. The study was conducted in South-South, Nigeria. The population for this study consists of 97 students of Automobile Technology in South-South, Nigeria. A structured questionnaire was used as instrument for data collection. The instrument was validated by three experts from the University of Nigeria, Nsukka. Statistical Package for Social Sciences (SPSS) version 20.0 was used to analyzed the data collected from the respondents. Cronbach alpha reliability coefficient index was used to determine the internal consistency of the instruments. The overall reliability index for the

instruments was 0.77. The data collected from the administration of both pre-test and post-test, were analyzed and interpreted using mean (X) and standard deviation (SD).

Presentation of Results

Research Question 1

What is the influence of age on the level of stress experienced, motivation, mental health status and academic performance of automobile technology education students exposed to multiple stress management interventions?

Table 1: Mean difference between the pretest and posttest responses based on age of students on the level of stress experienced, motivation, mental health status and academic performance

Age Group	Level of Stress (Mean)			Motivation (Mean)			Mental health (Mean)			Academic Performance (Mean)		
	pre	post	MD	pre	post	MD	pre	post	MDpre	post	MD	
20 and Below	130.05	50.43	-79.61	99.55	118.27	19.71	97.01	39.10	-47.88	34.27	73.60	39.32
21-25	133.22	49.82	-83.40	99.80	116.72	17.82	94.66	40.01	-44.66	33.32	73.42	50.11
26 and Above	135.24	53.91	-81.33	98.74	116.96	19.21	97.07	37.66	-49.40	34.52	74.46	49.88

Note: Pre= Pretest, Post= Posttest MD= Mean Difference (Posttest-Pretest), 20 Below= Students Below 20 years, 21-25= Students Between 21-25 years, 26 and Above= Students Between 26 years and Above.

Table 1 presents the mean differences between the pretest and posttest responses of students of 20 years and below, between 21 to 25 years as well as those from 26 years and above on the level of stress experienced and academic performance. This revealed that a structured stress management practices could influence any age group with age disparity. However, the result presented shows that when students are exposed to effective stress management practices, its application may not be based on age factor. This revealed that those students from 26 years and above experience greater decrease in mental health problems and challenges, followed by those students that are under 20 years and below and students between the age 21 to 25 years. This implies that Automobile Technology Education students in Universities in South-South age may not necessarily influence the height or degree of performance with exposure to multiple stress management intervention. The result show that age positively influences student's motivation and academic performance, while it negatively influences level of stress experience and mental health status of Automobile Technology Education Students in Universities in South-South Nigeria.

Hypothesis 1

There is no significant influence of age on the level of stress experienced, level of motivation and academic performance of automobile technology education students exposed to multiple stress management intervention.

Table 13: Multivariate analysis of co-variance (MANCOVA) of the influence of age on the level of stress experienced, level of motivation and academic performance of automobile technology education students exposed to multiple stress management intervention.

Age		**Sum of squares**	**Df**	**Mean square**	**F**	**Sig.**	**Partial eta squared**	**Dec.**
Level of stress Exp.	Contrast	8.921	2	75.924	.806	.443	.02	NS
	error	5728.463	98	82.751				
Motivation	Contrast	.065	2	.147	.020	.875	.011	NS
	error	4014.278	98	49.162				
Academic performance	Contrast	13.233	2	12.231	.310	.751	.006	NS
	Error	4753.132	98	64.664				
GROUPING (Wilks' Lambda)	Hypothesized	900.621	6		.547[b]	.871	.042	NS
	error	-	62	-				

Note: NS = Not Significant, Df = Degree of Freedom, Dec = Decision

The result in Table 2 shows the MANCOVA result of the influence of age on the level of stress experienced, motivation and academic performance of Automobile Technology Education Students in Universities in South-South Nigeria. The result indicates that in level of stress experienced, an F-ratio of 0.806 with associated probability value of 0.443was obtained, while in motivation an F-ratio of 0.020 with associated probability value of 0.875 was obtained, in academic performance an F-ratio of 0.310 with associated probability value of 0.751 was obtained and Wilks' Lambda combined effect of multiple stress management interventions on the level of stress experience among students shows an F-ratio of 0.47 with associated probability value of 0.871. Since the associated probability values are greater than 0.05 set as criterion level of significance, the null hypothesis which states that there is no significant influence of age on the level of stress experienced, motivation and academic performance of Automobile Technology Education students is accepted. Thus, the inference drawn is that there is no significant influence in the mean performance scores of students on the influence of age on both the level of stress experienced, motivation and academic performance of Automobile Technology Education Students in Universities in South-South Nigeria.

Discussion of Findings

The study found that multiple stress management intervention is effective in influencing stress among automobile students. In essence, MSMI was found to improved academic performance of first year Automobile Technology Education students in South-South

Nigeria by reducing stress and promoting positive changes in their coping skills. The findings of this study is in line with study of Chinaveh, (2013), (Chinaveh, Ishak&Salleh, 2010), and (Sharoff, 2004; Vesser& Blakemore, 2006) who stated that the multiple stress management intervention has significant positive influence on students level of stress and motivation, as well as academic performance.

Based on the influence of age on the level of stress experienced, and academic performance, this study found that age do interplay in the effectiveness of the outcomes of the multiple stress management intervention. The findings of this study is in agreement with the findings of Hamarat, Thompson, Zabrucky, Steele, Matheny and Aysan (2001) who linked perceived stress decrease with age, and that older students would report more effective coping resources than younger or adolescent students. In the same vein, Zimmer-Gembeck& Skinner (2008; 2011) solely link stress management to individual age and maturity. The age difference among first year Automobile Technology Education students which varies from late teenage years to early adulthood may have considerable contributions to students' level of stress and motivation as well as mental health and academic performance. Hence, various stressors coupled with varying individual characteristics may facilitate different levels of stress experienced among the students.Heiman (2004) agrees that older students may not necessarily be better than the younger ones in motivation and coping with stress they both faced most especially when a model or intervention is applied.

Conclusion

Based on the findings, this study concludes that MSMI will be effective in training Automobile students in stress management thereby limiting and reducing the detrimental effects of stress among students most especially those in the first year visa-vi, level of stress, mental health and their academic performance. Also, based on the influence of age on the level of stress experienced, motivation, mental health status and academic performance, this study found that age do interplay in the effectiveness of the outcomes of the multiple stress management intervention. This means that older students would report more effective coping resources than younger or adolescent students.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Multiple stress management intervention should be integrated in Automobile Technology Education and other engineering/technology based programmes to foster effective stress management practices among students.

2. There should be stress management training for all levels of Automobile Technology Education students with involvement of professional therapists and educational stakeholders to improve students stress management capability within the university education.

References

Abdulghani, H. M., Alkanhal, A. A., Mahmoud, E. S., Ponnamperuma, G. G., &Alfaris, E. A. (2011). Stress and its effects on medical students: a cross-sectional study at a college of medicine in Saudi Arabia. *Journal of Health Population Nutrition, 29 (5), 516-522*.

Adewuya, A., Ola, B., Olutayo, O., Mapayi, B., &Oginni, O. (2006). Depression amongst Nigerian University students: Prevalence and socio-demographic correlates. *Psychiatry Epidemiology, 41, 674-678.*

Agolla, J. E. (2009). Occupational stress among Police Officers: The case of Botswana police service. *Resources Journal of business Management, 2 (1), 25-35.*

Aheme, D. (2001). Understanding students stress: A qualitative approach. *Irish Journal of Psychology, 22, 176-187.*

Akerstedt, T. (2006).Psychosocial stress and impaired sleep. *Scandinavian Journal of Work, Environment & Health, 32 (6), 493-501.*

Akinade, E. A. (2001). *Modern concise dictionary of psychology*. Lagos: Pumack Nigerian Limited.

Al-Qaisy, L. M. (2011). The relation of depression and anxiety in academic performance among group of university students. *International Journal of Psychology and Counselling, 3 (5), 96-100*.

Awino, J. O., &Agolla, J. E. (2008). A quest for sustainable quality assurance measurement for universities: case of study of the University of Botswana. *Education Research Revolution, 3 (6), 213-218.*

Baldwin, D. R., Harris, S. M., & Chambliss, L. N. (1997). Stress and illness in adolescence: Issues of race and gender. *Adolescence, 32 (128), 839-853.*

Bataineh, M. Z. (2013). Academic stress among undergraduate students: The case of education faculty at King Saud University. *International Interdisciplinary Journal of Education.2 (1), 82-88.*

Boujut, E., Bruchon-Schweitzer, M., &Dombrowski, S. (2012). Coping among students; development and validation of an exploratory measure. *Psychology, 3 (8), 562-568.*

Boujut, E., Bruchon-Schweitzer, M., &Reascle, N. (2004). Stress and health in a student population: a transactional model perspective. *Psychology and Health, 19, 25-26.*

Boujut, E., Koleck, M., Bruchon-Schweitzer, M., & Bourgeois, M. (2009). La santé mentales chez les etudiants: enqueteaupres d' une cohort de 556 etudiants de lereannee. *Annals Medico-Psy-chologiquees, 167, 668.*

Chan, D. (2008). Emotional intelligence, self-efficacy, and coping among Chinese prospective and in-service teachers in Hongkong. *Educational Psychology, 28, 397-408.*

Chang K., L. U. (2007). Characteristics of organizational culture, stressors and wellbeing: the case of Taiwanese organizations. *Journal of management psychology, 22 (6), 549-568.*

Chang K., L. U. (2007). Characteristics of organizational culture, stressors and wellbeing: the case of Taiwanese organizations. *Journal of management psychology, 22 (6), 549-568.*

Chen, H., Wong, Y., Ran, M., & Gilson, C. (2009). Stress among Shanghai university students: The need for social work support. *Journal of Social Work, 9 (3), 323-344*.

Chen, H., Wong, Y., Ran, M., & Gilson, C. (2012). Stress among shanghai university students. *Journal of Social Work, 9 (3), 323-344.*

Chen, k. L. (2009). A Study of stress sources among college students in Taiwan. *Journal of Academic and Business Ethics, 2 (14), 1-8.*

Cheng, C. S. (1999). *Life stress of and guidance for adolescents. Taipei:* Psychological Publishing Co., Ltd.

Chinaveh, M. (2013). The effectiveness of multiple stress management intervention on the level of stress, and coping responses among Iranian students. *Procedia Social and Behavioural Sciences, 84, 593-600.*

Chinaveh, M., Ishak, N. M., &Salleh, A. M. (2010). Improving mental health and academic performance through multiple stress management intervention; Implication for diverse learners. *Procedia Social and Behavioural Sciences,7 (C), 311-316.*

Cohen, J. (1984). *Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ; Lawrence Erlbaum Associates.*

Compass, B. E., Connor-Smith, J. K., Saltzman, H., Thomsen, A. H., & Wadsworth, M. E. (2001). Coping with stress during childhood and adolescence: Problems, progress, and potential in theory and research. *Psychological bulletin, 127 (1), 87-127.*

Elgard, J. F., &Arlett, C. (2002). Perceived social inadequacy and depressed mood in adolescents. *Journal of Adolescence, 25, 301-305.*

Federal Republic of Nigeria (FRN), (2014). National policy on education. NERDC.

Folkman, S. & Lazarus, R. S. (1984). If it changes it must be a process: Study of emotion and copign during three stages of a college examination. *Journal of Personal Social Psychology, 48 (1), 150-70.*

Folkman, S., Lazarus, R. S., Dunkel-Schetter, C., DeLongis, A., &Gruen, R. J. (1986). Dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes, *Journal of Personal Social Psychology, 50 (5), 992-1003*.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Education research: An introduction.* New York: person International Inc.

Garret, J. B. (2001). Gender differences in college related stress. *Undergraduate Journal of Psychology, 14, 25-34.*

Grant, K. E., Compas, B. E., Thurm, A., McMahon, S. D., &Ey, S. (2000). *Stress and developmental psychopathology: Moving form markers to mechanisms of risk* (Unpublished manuscript). De Paul University, Chicago.

Grebot, E., &Barumandzadeh, T. (2005). L'acce' a l'universite: Une situation stressante a I'origine de certaines strategies d' ajustementdysfornctionnelles. (French). *Annales Medico Psychologiques, 163, 561-567.*

Hage, G. (2000). Response to the reviews. *Oceania, 70 (3), 276-279.*

Hamarat, E., Thompson, D., Zabrucky, K. M., Steele, D., Matheny, K. B., &Aysan, F. (2001). Perceived stress and coping resource availability as predicators of life satisfaction in young, middle-aged, and older adults. *Experimental Aging Research, 27, 181-196.*

Hassan, T. (2006). Educational assessment in Nigeria; a paradox of a victim of its own failure. *Retrieved from www.google.comon13/04/2007.*

Heber, E., Lehr, D., Ebert, D. D., Berking, M., Cuijpers, P., & Riper, H. (2016). Internet-and mobile-based stress management for employees with adherence-focused guidance: efficacy and mechanism of change. *Scandinavian Journal of work, Environment and Health, 42 (5), 382-394.*

Heiman T. (2004). Examination of the salutogenic model, support resources, coping style, and stressors among Israeli university students. *The Journal of Psychology, 138, 505-520.*

Hicks, T., & Miller, E. (2006). College life style, life stressors and health status: differences along gender lines. *Journal of College admission, 192, 22-29.*

Hiebert, B. (1983). A framework for planning stress control interventions. *Canadian Counsellor, 17, 51-61.*

Hiebert, B. (1988). Controlling stress: A conceptual update. *Canadian Journal of Counselling, 22, 226-241.*

Hiebert, B. (2002). Relaxation in the classroom: A win-win life skill. *Guidance & Counselling, 17 (3), 73-81.*

Lazarus R. S., &Folkman S. (1987). Transactional theory and research on emotions and coping. *European Journal of Personality. 1, 141-169.*

Lazarus, R. S, &Folkman, S. (1977). Stress-related transactions between person and environment. In L. A. Pervin& M. Lewis (eds.), *Perspectives in Interactional Psychology* (pg. 8-327). New York; Plenum.

Lazarus, R. S. (1993). Coping theory and research: Past, present, and future. *Psychosomatic Medicine, 55, 2324-2347.*

Lazarus, R. S., &Folkman, S. (1984). *Stress, appraisal, and coping.* New York; Springer Publishing Company.

Lee, P. C., Ahmed, F., Pathirana, T., T., &Papier, K. (2016). Factors associated with stress among first-year undergraduate students attending an Australian university. *Food Nutrition Report, 1(3). 17-24.*

Mills, R. C. (1995). *Realizing Mental Health: Toward a new Psychology of Resiliency.* Sulzberger & Graham Publishing, Ltd.

Mikolajczky, R. T., Ansari, W. E., & Maxwell, A. E. & Maxwell, A. E. (2009). Food consumption frequency and perceived stress and depressive symptoms among students in three European countries. *Nutrition Journal, 8 (31), 1-8.*

Nkem, E. D. (2015). Academic stress among home economics students in higher education: A case of college of education in Nigeria. *IOSR Journal of Research & Method in Education. 5 (6), 49-58.*

Oku, A., Oku, O., Owoaje, E., &Monjok, E. (2015). An assessment of mental health status of undergraduate medical trainees in the university of Calabar, Nigeria; A cross-sectional study. *Open access Macedonian journal of Medical Sciences, 3 (2), 356-362.*

Ongori, H. (2007). A review of the literature an employee turnover. *African Journal of Business Management, 193), 49-54.*

Ongori, H., Agolla J. E. (2008). Occupational stress in organizations and its effects on organizational performance. *Journal of Management Resources, 8 (3), 123-135.*

Poripo, J. &Youdiowei, B. T**. (**2014**).** Assessment of Utilization of Instructional Facilities in the Teaching and learning of Automobile Technology in Tertiary Institutions in South-South Nigeria. *Journal of Vocational Education and Technology. 11(1&2),77-90.*

Poripo, J. (2021).Effect of multiple stress management intervention on stress, motivation, mental health status and academic performance of automobile technology education students in universities in South-South, Nigeria. Ph.D Thesis, UNN.

Poripo, J. (2023).Impact of Multiple Stress Management Intervention on Motivation and Academic Performance of Automobile Technology Education Students in Universities in South-South, Nigeria. *Sagbama Journal of Science and Technical Education, 1 (2), 46-54.*

Poripo, J., Ede, E. O., Nwaodo, S. I. &Youdiowei, B. T. (2020).Effect of Multiple Stress Management Intervention on Stress and Academic Performance of Automobile Technology Education Students in Universities in South-South, Nigeria. *Eng. Applied Sci., 15 (9): 2121-2127***.**

Sharoff, K. (2004). *Coping skills therapy for managing chronic and terminal illness*. New York: Springer Publishing.

Stanley, N., &Manthorpe, J. (2001). Responding to students' mental health needs: Impermeable systems and diverse users. *Journal of Mental Health, 10, 41-52.*

Stevenson, A., &Harpern, S. (2006). Workplace stress and the student learning experience. *Quality assurance Education, 14(2), 167-178.*

Tosevski, D. L., Milovancevic, M. P., & Gajic, S. D. (2010). Personality and psychopathology of university students. *Current Opinion Psychiatry, 23 (1), 48-52.*

Towbes, L. C., & Cohen, L. H. (1996). Chronic stress in the lives of college students: scale Development and prospective prediction of distress. *Journal of Youth and Adolescence, 25, 199-217.*

Uehara, T.,Takeuchi, K., Kubota, F., Oshima, K., & Ishikawa, O. (2010). Annual transition of major depressive episode in university students using a structured self-rating questionnaire. *Asia-Pacific Psychiatry, 2, 99-104.*

Unger, J. B., Li, Y., Johnson, C. A., Gong, J., Chen, X., Li, C. V., Trinidad, D. R., Tran, N. T., & Lo, A. T. (2001). Stressful life events among adolescents in Wuhan, China: Association with smoking, alcohol use and depressive symptoms. *International Journal of Behavioral Medicine, 8, 1-18.*

Veeser, P. I. & Blakemore, C. (2006). Student assistance program: A new approach for student success in addressing behavioral health and life events. *Journal of American College Health, 54 (6), 377 – 381*.

Waghachavare, V. B., Dhumale, G. B., Kadma, Y. R., & Gore, A. D. (2013). A study if stress among students of professional colleges from an urbane area in India. *Sultan Qaboos UniversityMedical Journal, 13 (3), 429-436.*

Wordsworth, M. E., & Berger, L. (2006). Adolescents coping with poverty-related family stress: prospective predictors of coping and psychological symptoms. *Journal of Youth andAdolescence, 35, 57-70.*

Yusoff, M. S. B., Rahim, A. F. A., Baba, A. A., Ismail, S. B., Pa, M. N. M., &Esa, A. R. (2013). Prevalence and associated factors of stress, anxiety and depression among prospective medical students. *Asian Journal of Psychiatry,6 (2), 128-133.*

Zimmer-Gembeck, M. J., & Skinner E. A. (2011). The development of coping across childhood and adolescence: An integrative review and critique of research. *International Journal ofBehavioral Development, 35(1), 1-17*.

ASSESSMENT OF NON-TECHNICAL SKILLS REQUIRED BY TECHNOLOGY EDUCATION GRADUATES FOR EMPLOYMENT IN BAYELSA STATE.

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Abstract

The study centered on assessment of non-technical skills required by technology education graduates for employment in Bayelsa State. The study made use of descriptive survey research design. Three research questions were formulated to guide the study. The population for the study comprised 31 respondents consisting of directors, managers, principal of various organisations. A twenty-one (21) items questionnaire was used as instrument for data collection. The instrument was validated by an expert from the Department of vocational and technology education, Rivers State University and a Director from Isaac Jasper Boro College of Education Bayelsa State. The reliability of the instrument was determined using Cronbach Alpha and the reliability index stood at 0.98, 0.95 and 0.96. The data collected were analysed using mean statistic and standard deviation. The study revealed that employers placed great importance on non-technical skill such as communication skill, problem solving skill and team work skills. Base on the findings, the study recommends that Non-technical skill should be integrated into the curriculum of technology education programmes. Lecturer of technology education should be exposed to training and workshop on the relevance arrears of non-technical skills. Graduates of technology education should also help by attending seminars and workshops that will expose them to non-technical skills.

Key Words: Non-Technical Skills, Employment, Technology Education Graduates.

INTRODUCTION

Higher institutions have been concerned with producing graduates with developmental knowledge, attributes, and skills which any educated person is expected to have. They also spore individuals to develop their abilities to highest potentials in their life span so, they can contribute effectively to societal growth and development, achieve personal fulfilment and be well fortified for job (Maripaz&Ombra, 2016). Higher Institutions should make parallel adjustment that will respond to the labour market, they should be committed to develop graduates that are experts in their field and be able to transfer their expertise to any work environment they found themselves (Abas-Mastura, Imam & Osman, 2013). In essence, graduates of these institutions are expected to have developed not only in their subject specification but also in generalize skills. It was based on this thatVocational and Technology Education courses obtained in the higher institutions in Nigeria are structured in a manner that there is a separation between Vocational and Technology courses and Education courses. These courses are expected to exposed graduates to perform effectively and efficiently in the workplace (Mohammed & Esther, 2020). The students of Vocational and Technology

Education programme are expected to choose options they want to specialize in the course of their four years of study.

The fast changing global business environment due to technological advancement, has resulted to greater demand and challenges so, the twenty-first 21st century technology education graduates should be capable enough to handle situations which require a complex set of technical as well as non-technical skills (Suhail, *et al*., 2018). In the past, focus of Technology education had been to provide excellent technological education with technological knowledge and skills, but lately the importance of non-technical skills cannot be overemphasized as it has been widely acknowledged as part of the vital areas required for employment in industrial organisations (Bakare, *et al*, 2019). Hence graduates of technology education must possess both technical and nontechnical skills in order to catch up with the current demands of industrial organisations (Jackson & Chapman, 2012). According to Dupre& Williams cited by Ehimen and Sele (2021**),** the most effective way for graduates to stand out among the crowd is for them to possess Non-technical skills. Studies have also shown that non-technical skills of graduate are either from an employer's perspective or students' perspective in an organisation (Leslie, 2021).

An organisation is a group of people who have united together to pursue and accomplish a common purpose as one team (Komora, 2017). Industrial organisations are businesses that produce (manufactures) goods as opposed to services (Komora, 2017). These industries being a production organisation require the services of well skilled workers in both technical and non-technical skills in order to efficiently actualize their outlined organisational goals (Omar, *et al*, 2012). To be successful in any industrial organisation, Technology education graduates must distinguish themselves from other candidates with similar qualifications. This differentiation is showcased by the role of non-technical skills possessed by technology education graduate.

The main barriers to higher institution graduates in entering the world of work is the gap between the graduate job skills and the skills needed in the workplace which are non-technical skills. The workforce in the 21st century dose not only requires graduates with high academic qualifications as represented by the subject and degree classes but they should also be equipped with a number of non-technical skills and attributes. Employer surveys indicate that occupation-specific skills are no longer sufficient for graduates to meet the needs of national labour markets (OECD, 2013).

In addition to basic and specific knowledge and skills, workers are nowadays expected to have an additional set of skills because the current working environment differs from the previous age. A number of skills and attributes called non-technical skills are required by students to prepare them to meet the needs of various occupations after graduation. Non-technical skills are considered one missing link between education and training and the world of work. The global job market is characterized by change and increased competition for jobs. Research conducted by Think Global and British Council found that for job seekers, knowledge and awareness of the wider world are more important than degree classification (Think global and

British council, 2011). In Today's global competition the process of new management require the employee to have non-technical skills such as critical thinking, ability to solve problems besides excellent in communication skills. In order to respond to technology advances and the competitive world of work, it is necessary to prepare graduates to have the skills and ability to adapt to working environment (Sauder &Zuzei, 2021).

According to Cassidy and Yorkein Made *et al*., (2017). The importance of non-technical skills is increasingly emphasized in recent times. Non-technical skills are those skills which are generic in nature and are relevant across various jobs or professions (Awang, *et al.*, 2018). They are those skills that do not require technical knowledge or technical background. They are also referred to as essential skills, basic skills, generic skills, soft skills, employability skills, key skills and core skills (Nasir, *et al.*, 2011). According to Leach in Ehimen&Sele (2021). Non-technical skills are cognitive personal and social, skills necessary for safe and effective performance of technical skills, tasks and procedures in an organisation. Non-technical skills are a group of essential abilities that involve the development of a knowledge base, expertise level and mind-set that is increasingly necessary for success in the modern workplace.
Non-technical skills are typically considered essential qualifications for many job positions and hence have become necessary for the success of an individual's employment at any level within a business environment (business dictionary.com, 2017). According to the American Management Association, non-technical skills such as critical thinking and problem-solving, creativity and innovation, collaboration, and communication skills are becoming increasingly important in today's global economy (AMA, 2010). Other research also shows that non-technical skills are essential for success of graduate's career in the workplace. Klibi and Oassu (2013), Abayadeera and Watty (2016).

Conrad and Leigh (2015) classified non- technical skills into four types: problem solving & other cognitive skills; oral communication skills; personal qualities & work ethics; and interpersonal & teamwork skills. Gowsalya and Kumar (2015), listed some of these employability skills which include: team working, problem solving, self-management, knowledge of the business, literacy and numeracy relevant to the post, ICT knowledge, effective interpersonal and communication skills, ability to use own initiative but also to follow instructions and leadership skills where necessary.

In addition, for technical students to understand and apply the effective communication and other employability skill they have to be taught by technical educators (Gowsalya*et al.*, 2015). Wilson *et al*., (2012) highlighted various non-technical skills to be; communication, critical thinking, problem-solving, team work; lifelong learning, information management, entrepreneurial skills, moral and professional ethics and leadership skills. Non-technical Skills required by graduates in entering the workforce includes communication, problem-solving, decision-making, analytical and critical thinking, synthesizing information, teamwork, interpersonal, and continuous learning (LOW *et al*, 2016), which is also a prerequisite for professional recognition.

Hence it becomes important for higher institutions to design and implement programs that are appropriate for the missions and goals of stakeholders or employers in the 21st century workplace. Higher institutions has the responsibility to provide graduates with knowledge in the professional field with intellectual skills and ability to apply theory to practical situations.

In recent years, many countries have started to focus on the employability of their graduates (Al-Azri, 2016; Al Hinai, 2018). However, the concept of employability seems to be a difficult one to define for employers, academics and students. Generally, non-technical skills includes "skills that enable fresh graduates to secure jobs and those who are already used to maintain or advance in their career" (Marzuki& Jerome, 2017). Amongst these skills that are required by the job market is the ability to communicate in English (Al-Azri, 2016; Thomas, Piquette, & McMaster, 2016; Mourshed, Farrell, &Barton, 2013). . In the same vein, Abdulla, Naser and Saeid (2014) stated that employers in Kuwait need graduates to be competent in expressing themselves verbally, having good presentation skills, listening and participating successfully in a meeting and responding to a conversation.

Shonubi and Akintaro (2016) stress that nothing can be achieve in any organization without communication. Communication represents the blood stream in human body without it human body cannot function effectively. Communication is the process that occurs between two or more people in which a message is delivered and received by the other party. Communication happens every day in the workplace, such as managers give direction to workers, co-workers communicate to plan a project and employees communicate information to customers. The ability to communicate is one of the non-technical skills necessary for the success of a graduate's in entering the workforce. A job candidate with good communication skills could be selected over the other candidate (Crawford *et al*, 2011). Communication skills that contribute to harmonious and productive relations between employees and customers are critical to career success and also contribute significantly to organizational success (Du-Babcock in Made *et al*, 2017). Communication skills relate to one's ability in the context of speaking, listening, writing and reading. Communication is effective only when the message sent by sender is received by the receiver in the way it was expected by the sender. In order to be able to communicate effectively, a graduate or job seeker must have mastery in all domains of communication skills : (a) listen effectively, (b) communicate accurately and concisely, (c) effective oral communication, (d) communicate pleasantly and professionally, (e) effective written communication, (f) ask good question, and (g) communicate appropriately and professionally using social media (Crawford *et al*, 2011).

Another skill is problem solving skills which are highly sought after by employers as many companies rely on their employees to identify and solve problems. It is among the most important skill students must have when they start life after graduation. In this 21st century, one of the objectives of education is raising individuals, who can apply the information they learn to solve problems, develop strategies, and transfer their knowledge. Problem solving abilities are important skills for graduates because a healthy society or a healthy nation can only maintain its existence through adopting themselves into new conditions by problem solving abilities (Incebacat&Ersoy, 2016).

Abazou (2016) in the same vein noted that problem solving skills involve identification of the problem, defining the main element of the problem, examining the possible solutions, acting on the resolving problem and looking for lessons to learn. These skills can effectively lead to efficiency in job performance in an organization. Gomez (2017) also explained that problem solving skills involves the ability to identify problems, look at them objectively, decide based on facts, develop practical and creative solutions, and follow a process to solve them without being overwhelmed by them or being dependent on others to solve them. Even the hardest problems can be solved with the right mind-set and working systematically towards a solution. Therefore, problem solving skills involves identification of problems and being able to proffer solutions to the problems. Saygili (2017) noted that the stages of effective problem solving include the following:

i. **Problem Identification:** This stage involves detecting and recognizing that there is a problem, identifying the nature of the problem and defining the Problem.
ii. **Structuring the Problem:** This involves careful observation, inspection, fact finding and developing a clear picture of the problem and to increase understanding.
iii. **Looking for Possible Solutions:** At this stage possible courses of action is being generated by letting each person in the group express their views on possible solution.
iv. **Making a Decision:** This stage involves careful analysis of the different possible courses of action and then selecting the best solution for implementation.
v. Implementation: This involves accepting and carrying out the chosen course of action.
vi. **Monitoring/Seeking Feedback:** This stage involves reviewing the outcomes of problem solving over a period of time and seeking feedback as to the success of the outcomes of the chosen solution.

Team working skill, is composed of individuals who have several different characteristics. Teamwork is a cooperative process that allows ordinary people to achieve extraordinary results (Scarnai cited by Made *et al*, 2017). Teamwork is synonymous to working collaboratively in groups. When individuals working collaboratively in groups, they:(1) have a shared collective identity,

(2) have common goals,
(3) are interdependent in terms of their assigned tasks or outcomes,
(4) have distinctive roles within the team, and
(5) are part of a larger organizational context that influences their work.

And that they, in turn, can influence (Kozlourski&Llgen in Made *et al*, 2017). Teamwork replies upon individuals working together in a cooperative environment to achieve common team goals through sharing knowledge and skills. Successful teamwork relies upon synergism existing between all team members creating an environment where they are all willing to contribute and participate in order to promote and nurture a positive, effective team environment. Team members must be flexible enough to adapt to cooperative working environments where goals are achieved through collaboration and respect with another team member.

Teamwork involves building relationships and working with other people using a number of important skills and habits, such as: working cooperatively; contributing to groups with ideas,

suggestions, and effort; a sense of responsibility; a healthy respect for different opinions; and ability to participate in group decision-making. Teamwork is a key requirement in most occupations and an essential part of workplace success. Employers are seeking to recruit individuals who pay due attention to relations with peers and superiors. Students and employers noted the ability to work with others effectively is an important work-readiness skill (Crawford et al, 2011). Business executives want to recruit employees who will add value to the workplace with a composite of soft skills and who will embrace teamwork (Griffin and Annulis, 2013).

Teamwork skills can contribute to productive working relationships and outcomes. Teamwork skills are a set of skills that individuals use to foster the success of groups or teams from diverse backgrounds. Teamwork skills groups consist of a number of facets: (a) productive as a team member, (b) positive and encouraging attitude, (c) punctual and meets deadline, (d) maintains accountability to the team, (e) work with multiple approaches, (f) aware and sensitive to diversity, and (g) share ideas to multiple audiences (Crawford *et al*, 201).

According to Kathleen (2005), the employers in America are not pleased with many job applicants, particularly those who graduated from technical institutions. This problem occurs mostly because the applicants do not possess enough nontechnical skills (Suhail, et al., 2018). In Malaysia, these resulted in a low performance in the place of work. Rasul and Mansor (2016), also revealed that there is a mismatch between the skills that graduates acquired and the prerequisite demanded by employers that can make them perform effectively at work. Technical skills development alone without non-technical skills cannot provide assurance for employment in modern industrial and business organisations. In order to overcome this deficiencies, it becomes imperative for this study assessment of non-technical skills needed for employment of technology education graduates in Bayelsa state.

Statement of Problem

In spite of governments several efforts through different policies to make the Nigerian educational system more functional, there are still growing concerns as many graduates from technology education are found rooming the streets and become agents of crime. Unfortunately some of them have very good certificate, then what could have caused these problem? Could it be that such Graduates from educational institutions lacks adequate relevant job related skills that would help them become employed. Oviawe, Uwameiye and Uddin, (2017) noted that Employers of labour have continued to express their worry over the quality of the current graduate of technical institutions in Nigeria partly due to their lack of relevant job skills for performance in industries. Hence the study of this paper assessment of non-technical skills needed for employment of technology education graduates in Bayelsa state.

Purpose of the Study

The main purpose of the study is to assessment of non-technical skills needed for employment of technology education graduates in Bayelsa state. The study specifically sort to find out:

1. The extent to which communication skill is required for employment of technology education graduates in Bayelsa state.

2. The extent to which problem solving skill is required for employment of technology education graduates in Bayelsa state.
3. The extent to which team- working skill is required for employment of technology education graduates in Bayelsa state.

Research Questions

1. To what extent is communication skill required for employment of technology education graduates in Bayelsa state.
2. To what extent is problem solving skill required for employment of technology education graduates in Bayelsa state.
3. To what extent is team- working skill required for employment of technology education graduates in Bayelsa state.

METHODOLOGY

The study adopted a Descriptive survey research design because it was considered suitable for this study. Shona (2021), a descriptive survey design deploys the use of questionnaires, interviews and direct observation to ascertain the opinions, attitudes, perception and preference of individuals under study. The population of the study was 31 respondents. They were purposively sampled because they decide who is to be employed in an organisation.

A well-structured questionnaire titled "questionnaire on assessment of non-technical required by technology education graduates for employment in Bayelsa State (QANSTEGE)" was used to obtain responses from directors, personnel managers and principals of various Organisations. The questionnaire contained 21-items, designed in a 4-point rating scale developed by the researcher. The responses were Strongly Agreed (AS), Agreed (A), Disagreed (D) and Strongly Disagreed (SD) having numerical values of 4, 3, 2 and 1 respectively.

The instrument was subjected to face and content validation by an expert from the Department of vocational and technology education, Rivers State University and a Director from Isaac Jasper Boro College of Education Bayelsa State. The internal consistency of the instrument was established using Cronbach Alpha reliability method and the reliability index stood at 0.98, 0.95 and 0.96. A total of 31 copies of questionnaires was administered and they were all retrieved by the researcher for analysis.

Data collected from respondents were analysed using mean and standard deviation to answer the research questions. The computation of the mean and standard deviation were carried out with Statistical Package for Social Sciences (SPSS). It was decided that an item with a calculated mean value equal or greater than 2.50 (2.50 – 4.00) was rated agreed while item with the calculated mean less than 2.50 (0 – 2.49) was rated disagreed as required.

ANALYSIS OF DATA

Research Question 1. To what extent is communication skill required by technology education graduates for employment in Bayelsa State.

Table 1: Mean and Standard Deviation of Communication Skill required by Technology Education Graduates for Employment in Bayelsa State.

S/N	Items	Mean	SD	Remark
1	Graduates of technology education need to have the ability to listen attentively to be employable.	3.48	0.62	Agreed
2	Graduates of technology education need to have the ability to communicate effectively and concisely to be employable.	3.42	0.72	Agreed
3	Graduates of technology education need to have the ability of effective oral communication to be employable	3.35	0.66	Agreed
4	Graduates of technology education need to have the ability to communicate pleasantly and professionally to be employable.	3.39	0.72	Agreed
5	Graduates of technology education need to have the ability to effectively communicate in writing to be employable.	3.32	0.70	Agreed
6	Graduates of technology education need to have the ability to ask good question to be employable.	3.16	0.73	Agreed
7	Graduates of technology education need to have the ability to communicate appropriately to be employable.	3.45	0.62	Agreed
8	Graduates of technology education need to have the ability to professionally and effectively use social media to be employable.	3.16	0.82	Agreed

Source; Researchers Field Work

The result of the data presented in Table 1 above revealed the response of employers with a mean range of 3.16 - 3.48 and standard deviation range of 0.62 - 0.82. The Standard deviation indicates that the opinions of the employers were not far from one another in their responses while the mean response of the employers indicates that all the items on communication skills are required by Technology Education Graduates for employment in Bayelsa State.

Research Question 2. To what extent is problem solving skills required by technology education graduates for employment in Bayelsa State.

Table 2: Mean and Standard Deviation of Problem Solving Skills required by Technology Education Graduates for Employment in Bayelsa State.

S/N	Items	Mean	SD	Remark
1	Graduates of technology education need to have the ability to identify problems and the causes to be employable.	3.42	0.67	Agreed
2	Graduates of technology education need to have the ability of Structuring the problems to be employable.	2.97	0.80	Agreed
3	Graduates of technology education need to have the ability of Looking for possible solutions to be employable.	3.03	0.80	Agreed
4	Graduates of technology education need to have the ability of sound Decision Making to be employable.	3.13	0.85	Agreed
5	Graduates of technology education need to have the ability of effective Implementation of decision to be employable.	3.10	0.75	Agreed
6	Graduates of technology education need to have the ability of Monitoring and seeking for feedback to be employable	3.16	0.69	Agreed

Source: Researchers Field Work

Data in Table 2 above showed the response of employers with a mean range of 2.97-3.42 and standard deviation range of 0.67-0.85. The Standard deviation indicates that the opinions of the employers were not far from one another in their responses while the mean response of the employers indicates that all the items on problem solving skills are required by Technology Education Graduates for employment in Bayelsa State.

Research Question 3: To what extent is team work skill required by technology education graduates for employment in Bayelsa State.

Table 3: Mean and Standard Deviation of Team Work Skills required by Technology Education Graduates for Employment in Bayelsa State.

S/N	Items	Mean	SD	Remark
1	Graduates of technology education need to have the ability to be productive as a team member to be employable.	3.61	0.62	Agreed
2	Graduates of technology education need to have a positive and encouraging attitude to be employable.	3.45	0.62	Agreed
3	Graduates of technology education needs to be punctual and meets deadline to be employable.	3.52	0.51	Agreed

4	Graduates of technology education need to have the ability to maintain accountability to the team to be employable.	3.61	0.50	Agreed
5	Graduates of technology education need to have the ability of working with multiple approaches to be employable.	3.19	0.65	Agreed
6	Graduates of technology education need to be aware and sensitive to diversity for employment.	3.48	0.61	Agreed
7	Graduates of technology education need to have the ability of sharing ideas to multiple audiences for employment.	3.48	0.77	Agreed

Source; Researchers Field work

Data in Table 3 above exposed the responses of employers with a mean range of 3.19 - 3.61 and standard deviation range of 0.50-0.77. The Standard deviation indicates that the opinions of the employers were not far from one another in their responses while the mean response of the employers indicates that all the items on team work skills are required by Technology Education Graduates for employment in Bayelsa state.

DISCUSSION OF FINDINGS

The study as presented in research question 1in table 1 above revealed that communication skills is one of the most important non-technical skills required by technology education graduates for employment in Bayelsa State.

This study is in confirmity with Maripaz*et al.,* (2013) who in their study revealed that employers gives special consideration to non-technical skills over specific job skills. Caleb and Udofia, (2014) in their study also revealed that recruitment conditions of employers in the contexts of TVE fall into three major categories: professional skills, non-technical skills and entrepreneurial skills. Osami (2013), also showed that graduates in technical education with both professional skills and non-technical skills have more advantage to secure suitable employment.

Findings in Research question 2 as in table 2, showed that problem solving skills is one of the non-technical skills required by technology education graduates for employment in Bayelsa State. This finding was supported by Bakare*et al.,* (2019) who in their study indicated that the following non-technical skills: communication, teamwork, learning, creative thinking, decision-making, self-management and problem-solving skills are essential to metalwork technology graduates from technical colleges in Nigeria to be employable. Hence, non-technical skills are required for the recruitment of technology education graduates in organisations in Bayelsa state.

Findings in Research question 3 as in table 3, indicated that team work skills is one of the non-technical skills required by technology education graduates for employment in Bayelsa state. This aligned with a study by Rasul and Mansor (2016) who found that employers are very

particular about needing graduates who are Self-confident with positive image and can work on pressure without supervision. These findings conform to the findings of Caleb and Udofia (2014), who found that the students of Electrical installation in technical colleges of AkwaIbom State needed interpersonal skills which is one of the generic skills for employability.

CONCLUSION

Most employers want employees who will be effective in today's changing economy demand indicates that occupation-specific skills are no longer sufficient for graduates to meet the needs of today's labour markets. They prefer to hire graduates who can manage change and thrive on it, flexible and adaptable workers who are quick to learn. Increasingly, graduates' attributes are more important than the graduates 'degree subjects

The findings of this study had proved that this study therefore concludes that non-technical skills such as communication skill, problem solving and team work skills are required by technology education graduates for employment in Bayelsa State.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made;

1. Non-technical skill should be integrated into the curriculum of technology education programmes.
2. Lecturer of technology education should be exposed to training and workshop on the relevance of non-technical skills.
3. Graduates of technology education should also help themselves by attending seminars and workshops that will expose them to non-technical skills.

REFERENCES

Abas-Mastura, M., Imam, N., & Osman, P. (2013). Employability Skills and Task Performance of Employees in Government Sector. *International Journal of Humanities and Social Science, 3*(4), 150-162.

Abayadeera, N., &Watty, K. (2016). Generic skills in accounting education in a developing country: Exploratory evidence from Sri Lanka. *Asian Review of Accounting,* 24(2): 149 – 170.

Abazou, R. (2016). How to improve your problem solving skills. Retrieved from httop://www.top.univerities.com.

Awang, Z., Abidin, H., Hafilah, A., Razib, H. &Yahya, A. (2018). Non- technical skills for engineers in the 21st century: a basis for developing a guideline. Retrieved on 3rd September, 2021 from http://eprints.utm.my/2755/1/74232.pdf.

Bakare S., Azlan A. L., Rosmah S., Yusri K., Muhammad S., & Nor F. A. (2019). The nontechnical skills needed by graduates of technical colleges in metalwork technology. *International Journal of Evaluation and Research in Education (IJERE),* 8(4), 654-658.

Conrad, C. A. & Leigh, W. A. (2015). Soft Skills: Bridge or Barrier to Employment, The monthly magazine of the Joint Centre for Political and Economic Studies, *Journal of Career and Technical Education.* 26(1), 8-19.

Ehimen, T. E. &Sele, A. (2021). Assessment of Workplace Performance of Graduates of Vocational and Technology Education in Bayelsa State.

Gomez, S. J. (2017). Self-management skills of management graduates. *International Journal of Research in Management & Business Studies*,4(3), 40-44.

Gowsalya, G. & Kumar, A. M. (2015). Employability skill: A literature review. *International Journal of Advance Research in Computer Science and Management Studies*, 3(3), 2321-7782.

Griffin, M., &Annulis, H. (2013). Employability skills in practice: The case of manufacturing education in Mississippi. *International Journal of Training and Development*, 17(3): 221-232.

Incebacat, B. B. &Ersoy, E. (2016). Problem solving skills of secondary school. *China-USA Business Review*, 15(6), 275-285. *International Journal of Innovative Social & Science Education Research9(3):46-53, July-Sept., 2021* © SEAHI PUBLICATIONS, 2021 www.seahipaj.org ISSN: 2360-8978**.**

Jackson, D. & Chapman, E. (2012). Non-technical skill gaps in Australian business graduates, *Australian journal of Education and Training*, 54(2), 95 - 113.

Klibi, M. F., &Oussii, A. A. (2013). Skills and Attributes Needed for Success in Accounting Career: Do Employers' Expectations Fit with Students' Perceptions? Evidence from Tunisia. *International Journal of Business and Management*, 8(8): 118 – 132.

Komora, Y. (2017). Organisation and the Working of an Administrative System. New York: Oxford University Press.

Leslie, C. (2020). Balancing Technical and Non-Technical Skill Development. Retrieved on 6th September, 2021 from https://balancing.technical.and.nontechnicalskills/pdf.

Low, M., Botes, V., Dela Rue, D., & Allen, J. (2016). Accounting Employers' Expectations - The Ideal Accounting Graduates. *e-Journal of Business Education & Scholarship of Teaching, 10(1): 36-57.*

Made, S, Ketut, S, I.G.P, Fajar, P.S, Ni Kadek, D.H (2017). Employability skills required by the 21st-century workplace: a literature review of labour market demand. PoliteknikNegeri Bali Badung, Indonesia. Advances in Social Science, Education and Humanities Research, volume 102. 1st International Conference on Technology and Vocational Teachers .madesuarta@pnb.ac.id.

Maripaz, A., Ombra, A. I., &Shuki, O. (2013). Employability skills and task performance of employees in government sector, *International Journal of Humanities and Social Science.*

Mohammed, A. A., & Esther, O. E. (2020). Work place performance of university Technology and Vocational Education (TVET) student-teachers: a tracer study. *Journal of Education, 25*(1), 230-231.

Nasir, A., Dayana, A. & Muhammad, N. (2011). Technical skills and non-technical skills: predefinition concept, IETEC 2011, Malaysia.

OECD. (2013). OECD Skills Outlook 2013: First Results from the Survey of Adult Skills. Retrieved February 25, 2016, from http://skills.oecd.org/skillsoutlook.html

Omar, M. K., Bakar, A. R., & Rashid, A. M., (2012). Employability skill acquisition among Malaysia community college student. *Journal of Social Sciences. Science Publication.* 8(3), 472 - 478.

Oviawe, J. I., Umwameiye. R., & Uddin, P. S. O. (2017). Bridging skill gap to meet technical vocational education and training school work place collaboration in the 21st century. *International Journal of Vocational Education and Training Research, 3*(3), 7-14.

Rasul, M. S., &Mansor, A. N. (2016). Employability skills indicator as perceived by manufacturing employers. *Asian Social Science*. 9(8), 42-50

Saygili, S. (2017). Examining the problem solving skills and the strategies used by High School students in solving non-routine problems. *E-International Journal of Educational Research,* 8(2), 91-114.

Shonubi, A. O., &Akintaro, A. A. (2016). The impact of effective communication on organizational performance. *The International Journal of Social Sciences and Humanities Invention, 3*(3), 1904-1914.

Suhail M. G., Monica C., &Sumit G. (2018). A conference paper on the Importance of Non-Technical Skills for Employment Opportunities: A Gap Analysis of Students and Employers Perception. Retrieved on 6th September 2021 from https://www.researchgate.net/publication/326826438.

Think Global and British Council. (2011). The Global Skills Gap: Preparing Young People for the New Global Economy. Retrieved October 12, 2013, from http://clients.squareeye.net/uploads/dea/documents/BusinessPoll.online

Wilson, A.J., Ariffian, B.A. & Abu Z. H. (2012). The embedment of soft skills in real estate program via coursework, *Journal of Teaching in Travel & Tourism.* 9(4), 266-287.

HEAVY METAL CONCENTRATION IN MULLET (*MUGIL CEPHALUS*) FROM MINI-NDAI CREEK, RUMUOLUMENI, PORT HARCOURT.

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Abstract

Heavy metals are elements that occur naturally but are also released into the environment from industries, and other anthropogenic activities to levels that can cause pollution. High concentrations of heavy metals in the aquatic organisms may pose a health risk to consumers of these organisms. The aim of this study was to ascertain the levels of heavy metals in Mullet fish (*Mugilcephalus*)in Mini-Ndai creek, Rumuolumeni. Heavy metals were determined using Atomic Absorption Spectrophometer (AAS). Samples were collected in January, March and May. Data were analysed using mean and standard deviation represented in bar graph. The heavy metals analysed are Ni, Fe and Cr. The results indicated high concentrations of Fe and Ni(8.18µg/g and 1.36µg/g) respectively with low concentrations of Cr (0.03µg/g). The trend of heavy metals concentration can be represented as Fe>Ni>Cr. Fe and Cr was within the safe limits while Ni was seen to be above the safe limits for human consumption. It is recommended that further studies of heavy metals should be carried out to determine the physicochemical parameters and the heavy metal content of the creek.

Keywords: Concentration, heavy metals, Mini-Ndai creek, Mullet

Introduction

Heavy metals pollution in the aquatic environment as a result of anthropogenic activities is increasing at an alarming rate and has since become a worldwide issue (Abdel-Baki *et al.*, 2011). Heavy metals level in the aquatic ecosystem has been on the increase in recent times due to the release of domestic, industrial and also agricultural wastes (Kaoud, 2015). Due to the toxicity of the heavy metals, when released to the water bodies causes a geological change. They are long-lasting and have the ability to accumulate in the organisms that inhabit the marine environment. (Ogbuagu et al., 2011).

Heavy metals pollution of water and aquatic organisms as a result of urbanization and industrialization provides potential risks to their drinking and consumption and thus has a global issue (Hammed et al., 2023).

Fishes are aquatic organisms and are one of the main sources of protein to humans. They are great indicators of heavy metal contamination in the aquatic environment as they occupy levels in the food chain (Karadede-Akin &Unlu, 2007). The channels through which heavy metals get accumulated in the fish are the food chain and water. These heavy metals get through the bodies of fishes through their digestive tract, gills or body surface (Wang, 2015). After these

metals have been effectively absorbed in the fish, they are transported through the bloodstream to the organs where they get accumulated (Fazio et al., 2014).
This fish is been consumed on a daily basis, hence the need for the evaluation for heavy metal contents in it to monitor potential hazards and provide possible early warnings.
Heavy metals are non-biodegradable and persists in the environment for a very long time (Javed & Usmani, 2017). Toxic heavy metals are greatly dangerous as elements or when in the combined state, such as Arsenic (As), Chromium (Cr), Cadmium (Cd), lead (Pb). Mercury (Hg), Nickel (Ni), Zinc (Zn) have varying levels of toxicity and health effects (Kinuthia et al., 2020).

Heavy metals are "often referred to as any metallic element that has relatively high density and are toxic at low concentrations. E.g Hg, Pb, As, Cr and Cd. Trace elements like Copper (Cu), Iron (Fe), Zinc (Zn) are important for maintaining the body metabolism of humans but can lead to poisoning when they are at high concentrations (Igwemmar et al., 2013).
Heavy metals concentrations at different levels present in the tissues of fishes show the level of exposure in time past, either through water or food and can indicate to a great extent the existing state of the animals before toxicity as it affects the interrelationship of the populations within the aquatic environment (Birungi et al., 2007).
The concentration of metals varies with different species as it relates to their feeding habits and ability to bioaccumulate (Akoto et al., 2014). There is a direct impact on the concentration of heavy metals in the various tissues and organs of fishes as a result of the aquatic environment's contamination, uptake, regulation and elimination inside the fish (Effiong et al., 2019)
High level concentration of metals are said to have lethal and chronic effects evident on the fishes (Jaishankar et al., 2014). Hence, fishes are used for evaluating the environmental state in the aquatic environment in recent times (Akan et al., 2012). The consumption of fishes has recently been on the increase because of their nutritional and therapeutic effects. Fishes contain some vital vitamins, unsaturated fatty acids and minerals (Medeiros et al., 2012). Fishes are one of the most abundant in the aquatic environments. About 1 billion people globally depend solely on fishes as their primary source of animal protein (FAO). The metal concentration varies with species that relates to the feeding habits and bioaccumulation capacity (Akoto et al., 2014).

This study is of great importance because it tends to ascertain the concentration of heavy metals in Mullet fish (*Mugilcephalus*) found in the Mini-Ndai creek located at Rumuolumeni, Port Harcourt.

Aim and Objectives of the study
The aim of the study was to evaluate the state of heavy metal contamination of the Mini-Ndai creek. The objectives of this study was to determine the relative concentrations of Nickel (Ni), Iron (Fe) and Chromium (Cr) in Mullet fish (*Mugilcephalus).*

Materials and Methods

Study Area

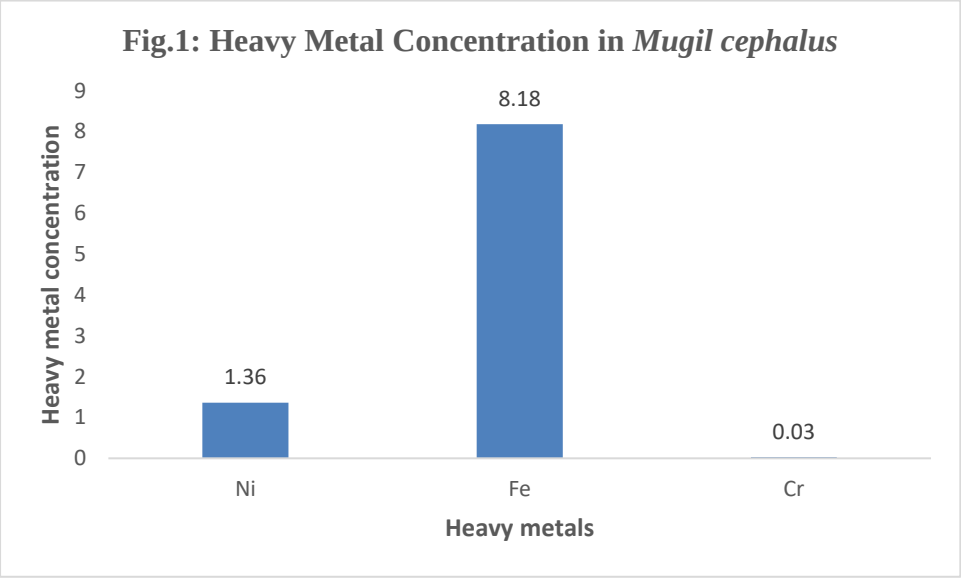
The study was carried out at the Mini-Ndai creek situated at Rumuolumeni, Port Harcourt, Rivers State. Water enters the creek at high tide from the New Calabar River and drains from the surrounding mangrove swamp into the river as the tide ebbs.

Fish Sample: Fish samples were purchased from the local fishermen and fish sellers of the creek. They were immediately transferred into plastic containers containing ice and stored in a freezer prior to analysis.

Sample Preparation: On the day of analysis, the fish samples were taken out of the freezer and thawed at room temperature. They were oven dried and pulverized into powdered form. They were digested with nitric acid and then analysed for Nickel (Ni), Iron (Fe) and Chromium (Cr) using an Atomic Absorption Spectrophometer (AAS).

Statistical Analysis: Statistical analysis was carried out and the results gotten using arithmetic mean and standard deviation.

Results: The mean concentration of heavy metals in *Mugilcephalus* are presented in Fig. 1. The mean concentrations of Ni, Fe and Cr in the *Mugilcephalus* were 1.36±0.45µg/g, 8.18±0.98µg/g and 0.03±0.01µg/g respectively. Fe had the highest concentration in the *Mugilcephalus*among other heavy metals studied. The order of heavy metal concentration in the *Mugilcephalus*was Fe>Ni>Cr.



Discussion

The study showed that the heavy metals analyzed in the fish sample *(Mugilcephalus)* were within the safe limits except for Nickel that was seen to be above the safe limits.

The order of heavy metal concentrations in the *Mugilcephalus are* Fe>Ni>Cr which contrasts slightly with the trend Fe>Cd>Ni>Hg>Cr as reported by Umunnakwe and Aharanwa (2014).This indicates that Fe had the highest concentration in the fish species with Cr having the least concentration in *Mugilcephalus.*

Conclusion

Heavy metals are known to affect aquatic lives. When these heavy metals accumulate over a long period, it exerts direct consequences to aquatic biota and in turn man and otherorganisms within the biosphere. The heavy metals except Ni and Cr were within the safe limits for consumption.

Continuous consumption of these fishes could have adverse effects on human health as regards the adverse nature of these heavy metals (Ni and Fe)**.**

Based on the research carried out in the study area, the following measures need to be noted.

3. The abattoir effluents discharge into the creek should be discouraged.
4. Further studies should be carried out on the creek to determine the physicochemical parameters and the heavy metal content of the creek.

References

Abdel-Baki, A. S., Dkhil, M. A. & Al-Quraishy, S. (2011). Bioaccumulation of some heavy metals in tilapia fish relevant to their concentration in water and sediment of Wadi Hanifah, Saudi Arabia. *African Journal of Biotechnology,10* (3), 2541 – 2547

Akan, J. C., Mohmoud, S., Yikala, B. S. &Ogugbuaja, V. o. (2012). Bioaccumulation of some heavy metals in fish samples from River Benue in Vinkilang, Adamawa State, Nigeria. *American Journal of Analytical chemist, 3* (11), 727 – 736

Akoto, O., Bismark, E. F., Darko, G. & Adei, E. (2014). Concentrations and Health Risk Assessments of Heavy Metals in Fish from the Fosu Lagoon. *International Journal of Environmental Research, 8* (2), 403 – 410

Birungi, Z., Masola, B., Zaranyika, M. F., Naigaga, I. & Marshall, B. (2007). Active biomonitoring of trace heavy metals using fish (*Oreochromisniloticus*) as bioindicator species. The case of Nakivubo wetland along Lake Victoria. *Physics and Chemistry of the Earth, 32*, 1350 – 1358

Effiong, E. J., Okoye, E. I., Anyaegbunam, L. C., Nwosu, M. C., Ezike, F. A. &Ibemenuga, K. N. (2019). Bioaccumulation of Some Heavy Metals in Some Organs of Three Selected Fish of Commercial Importance from Niger River, Onitsha shelf, Anambra State, Nigeria. *Journal of Fisheries Sciences.com, 13* (3), 001 - 012

Fazio, F., Piccione, G., Tribulato, K., Ferrantelli, V., Giangrosso, G., Artuso, F. &Faggio, C. (2014). Bioaccumulation of heavy metals in blood and tissue of stripped mullet in two Italian lakes. *Journal of Aquatic Animal Health, 26* (4), 278 – 284

Hammed, A. M., Akinterinwa, A., Yussuf, H. M. & Sanusi, K. A. (2023). Levels of Heavy Metals in Water and Nile Tilapia fish (*Oreochromisniloticus*) of Eleyele Lake in Ibadan, Nigeria.*Dutse Journal of Pure and Applied Sciences (DUJOPAS), 9* (3a), 2635 – 3490

Igwemmar, N. C, Kolawole, S. A, Odunoku, S. O (2013). Heavy metal concentration in Fish species sold in Gwagwalada Market, Abuja. *International Journal of Science and Research (IJSR), 2*(11), 2319-7064.

Jaishankar, M., Tseten, T., Anbalagan, N., Matthew, B. B. &Beeregowda, K.N. (2014). Toxicity mechanism and health effects of some heavy metals, *interdisciplinary Toxicology, 7* (2), 60 – 72

Javed, M. & Usmani, N. (2017). An Overview of Adverse Effects of Heavy metal contamination on fish health. *Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci, 17, 875 – 882*

Kaoud, H. A. (2015). Article review: heavy metals and pesticides in aquaculture: health problems. *European Journal of Academic Essays, 2* (9), 15 – 22

Karadede-Akin, H and E. Unlu (2007). Heavy metal concentrations in water, sediment, fish and some benthic organisms from Tigris River, Turkey. Environ. Monit. Assess., 131:323-337.

Kinuthia, G. K., Ngure, V., Beti, D., Lugalis, R., Wanglia, A. & Kamau, L. (2020). Levels of Heavy metals in wastewater and soil samples from open drainage channels in Nairobi, Kenya: community health implication. *Scientific Reports, 10*, 8434

Medeiros, R. J, Santos,L.M., Freire, A. S., Santelli, R. E., Braga, A. M. C. B & Krauss, T. M. (2012). Determination of inorganic trace elements in edible marine fish from Rio de Janeiro State, Brazil Food Control, 23,535-541. http://dx.doi.org.1016/j.foodcont.2011.08.027.

Ogbuagu, D. H., Okoli, C. G., Emereibeole, E. I., Anyanwu, I. C., Onuoha, O. & Ubah, N. O. (2011). Trace metals accumulation in biofilms of the upper and middle reaches of Otamiri River in Owerri, Nigeria. *Journal of Biodiversity and Environmental Sciences, 1,* 19 – 26

Umunnakwe, J. E.&Aharanwa B. C (2014). Assessment of Water Quality and Heavy Metal levels of Fish Species in Oguta Lake, Imo State Nigeria. *Journal of Natural Sciences Research, 4* (8), 103-112

Wang, Y. E. (2015). Determination of Heavy Metals in Water, Sediment and Fishes of Bakun Hydroelectric reservoir.