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PUBLIC AWARENESS, KNOWLEDGE, ATTITUDE AND PERCEPTION ON MICROPLASTICS POLLUTION AROUND LAGOS LAGOON

Microplastic pollution is now globally flagged as a foremost menace to livelihoods, biodiversity, and public health due the pervasive nature of plastic wastes, poor knowledge of its ecological impact and poor attitude towards sustainable waste management practices. Hence, this paper explores public awareness, knowledge, attitude and perception on Microplastic pollution and its ecological health implication through a survey data collected from residents, students, fishermen and local tourist around Lagos Lagoon, a significant area in Lagos. This study relied on psychometric model of inquiry (through indirect questions) were employed to extrapolate the study's unbridle goal. Data were collected, coded and analyzed using descriptive statistics and inferential statistics on the IBM SPSS 28 version. Findings revealed that though awareness on microplastics was apparently high (over 50%), however, public knowledge was fairly acceptable and poor perception of Microplastic pollution was observed. Respondents (with a mean attitude score of 3.40 ± 1.485) generally shows a good attitude towards learning more on this subject and a shared commitment to support government through cleanup volunteering and advocacy. This study succinctly observed that a good number of respondents that were aware about microplastics and its associated risks had the knowledge through social media campaigns, followed by internet sources. In light of this findings, this study recommends that government, academia and relevant stakeholders should intensify efforts to educate the public more on sources, contamination, fate and effects of microplastics and other issues of public health importance through massive campaigns, learned community activities and strategies that may reinforce positive environmental attitude.

Keywords: Microplastic pollution, Public perception, Environmental Education, Lagos Lagoon

Introduction. Annually, humans produce about 400 million tons of plastic globally and a remarkable portion of this plastic is depleted in the milieu as litter [1]. In 2010, about 4.8 - 12.7 million metric tons of plastic was reported to have entered into oceans from coastal countries in various ways as industrial discharge, trash, or litter from inland waterways, wastewater outflows, as well as transport from winds or tides [2, 3]. Nigeria like every other nation is not left out in the global issue of marine pollution perhaps due to abundance of plastic wastes and coastal water bodies. According to a report, Nigeria was ranked among the top 20 countries of the world facing plastic pollution about (0.13-0.34 in units of Millions of metric tons of mismanaged waste per year) due to the nation's poor waste management culture [2].

Indeed, the ubiquity and pervasiveness of plastics in our world today is not contentious. Plastic wraps our meals and makes food last longer; our food systems are responsible for a sizeable portion of this global plastic diet. Plastic streamlines our cars. It transports sewage and delivers human blood. In Nigeria, people often give away plastic artefacts as gifts during parties or festivals while some people even trade off their old local fabrics in exchange for plastic artefacts. This norms might have contributed to generally high consumption pattern coupled with the alarming rate at which plastics are discarded into the environment as litters. Unfortunately, when these discarded artefacts are swept off by rain, they gathered and clog the drain and even constitute another public health concern. Plastics or their fragments are found almost everywhere on the planet including air, soil, sediment, oceans, plants, animals and are usually formed from breakdown of plastic polymers such as polyethylene, polypropylene, polyvinyl chloride, polystyrene etc. [4, 5, 6]

It is important to also note that inspite of plastics' ubiquitous nature, their production activities consume substantial feedstock resources and the worst part is that they are principally disposed of after their service life. With increased reliance on plastic for packaging, and the increase in single use of plastics coupled with the quest for durability of plastics, global plastic production will not only continue to increase but will also create an unpleasant and unhealthy environment for all if appropriate mitigation

approaches are not painstakingly and inclusively [7, 8]. When plastics find their way into the ocean or water bodies, they gradually degrade into tiny pieces or fibers called Microplastics.

Microplastics could best be understood as micron-size pieces of plastic (less than 5 mm in diameter), formed by combining chains of simple molecular building blocks and can have very different chemical compositions (polymer types) and morphology (such as fibers, fragments, or films) [9, 10]. The public health and ecological impact of Microplastics have monumentally received great attention in the last decade because of their potential to pervade the food chain and elicit harmful effects. Their shape, size, and weight can further help us identify where the plastic particles may come from. In other words, the degradation rate as well as plastics persistence varies depending on the polymer, density, shape as well as the plastic purpose itself [11]. Microplastics have reached most places of the planet, including the remote areas of the Ocean and Rivers, even in areas with little human activity but major issue is limited knowledge of its distribution.

However, it is critical to note that Microplastics may originate from a variety of sources but when they are ingested by aquatic organism, their bio-accumulation or bio-magnification may distort the food chain and hence, affect the survival of the organism involved [12]. Due to their low size, they can easily be consumed by the diversity of biological species oscillating from protozoans toward other marine mammals. Plastic fibers join a disturbing list of pollutants “endocrine-disrupting chemicals” threatening the world’s water supplies and ecological balance in that many marine animals consume them. Coastal Microplastic fibers often contains fibers which might have originated from brittle plastic ropes, fishing nets or domestic effluents of textile washing [13]. The toxicity of microplastics are monumentally gaining global attention. Studies have pinpointed that the presence and or accumulation of Microplastics in humans and animals may elicit local inflammation or induce allergic reactions in tissue and could possibly cause severe physiological disorders such as chronic pulmonary disorder, neurologic disease and cancer [13, 14, 15]. There are evidences of Microplastic pollution in Nigeria. Microplastics were detected in the freshwater gastropods of River Osun, a major river that drains into the lagoon [14].

Human behaviors and anthropogenic activities such as microwaving food in plastic containers and the irresponsible disposal of plastic by-products (e.g., toys, cosmetics, grocery bags and candy wrappers), wear and tear of car tires, washing of microfiber clothing are some of the many ways Microplastics could be formed. As human behavior is well-thought to be a major marine litter source, meaning that changes in perceptions as well as behavior is vital toward addressing litter in the natural milieu [15]. Intensifying efforts to promote public health knowledge about Microplastic pollution may be crucial in promoting sustainable healthy lifestyles or choices that people often as an effort towards preventing pollution threats, overexploitation, habitat destruction [6, 16]. Hence, sustainable management as well as policy from decision makers toward curbing the inhumane marine pollution and adequate public sensitization about Microplastic pollution is a dire necessity.

Understanding public knowledge, attitude and perception about Microplastic pollution could help to mind the gap towards proper management of the marine environment especially in developing suitable priorities toward decreasing the influx of plastic waste into the ocean, along with motivation to engage in solutions. The foregoing statement is a critical step in attempts to engage society in this environmental concern and move towards more sustainable purchasing, use and disposal behaviours. For instance, a decrease in the usage of single use plastics along with design as well as manufacture through end of product life are environmentally sound interventions that has great and tremendous impact [17]. Previous perception study on marine litter observed that beach users are often displeased seeing marine litters themselves but paradoxically, they are the main source of marine litters [18]. Littering behaviours are often influence by social norms, self-awareness and conviction and incentives [18]. For instance, a well-established finding from empirical studies as expounded by Hartley et al. [18] is that “people are more likely to litter in a littered, compared to clean, environment, and are less likely to litter after observing someone pick up litter”. Whilst there is substantial scientific literature on Microplastic pollution and its ecological impacts, little research to date has examined the public's knowledge, attitude and perception on Microplastic pollution, a pressing global problem. We believed there is dearth of insights and data that connect perceptions of the problem with public attitude and knowledge even at the individual level to see if respondents themselves are concerned, keen to take action and willing to change their present situation of their immediate environment.

Against this backdrop, the overarching goal of this study is to assess the awareness, knowledge, attitude and perception about Microplastics among the people living around the Lagos lagoon. The novelty of this study is to provide knowledge and insights on how the public comprehends Microplastic

pollution and its associated health risks as well as what could be done toward reducing its destructive effects with the aim of advancing public health and formulating ecosystem protection policy.

Materials and Method. *Description of Study Location and Its Significance.* This study was conducted in a culturally diverse space around the University of Lagos, Akoka and the Lagos lagoon community, Lagos. Lagos is located in the South-Western part of Nigeria and it is perhaps the largest city in African continent with a population of about 9 million people based on the 2006 National Census [19]. It is a mega city with robust economic activities, often described as the commercial nerve of Nigeria blessed with human capital; diverse people of different culture but mostly dominated by the Yoruba tribe. Lagos lagoon in particular, is a water body in the heart of Lagos metropolis; with a surface area of approximately 6,354.7 sq.km, more than 50 km long and 3-13 km wide [20]. Lagos lagoon is an important water body of socio-economic importance as it provides inhabitants a means of livelihood and transport, places of abode and recreation, dumpsite for residential and industrial discharges, and a natural shock absorber to balance forces within the natural ecological system [21]. Hence, it is a very significant part of Lagos, with high socio-economic importance and at least three colleges/higher learning institution in this community. Prominent areas include Akoka, Ijaje/Bariga, Oworonshoki and Ogudu. All the areas are predominantly characterized by residential buildings lining the coastline, natural fish ponds, boat transport, fishing and sand mining activities. For the most part, our study location has very busy “open markets” and the total surroundings including water bodies and patches are often littered by plastics cans, water sachets and other debris. More so, adequate clean water for drinking is a major challenge and low income dwellers mainly rely on fishing as an occupation.

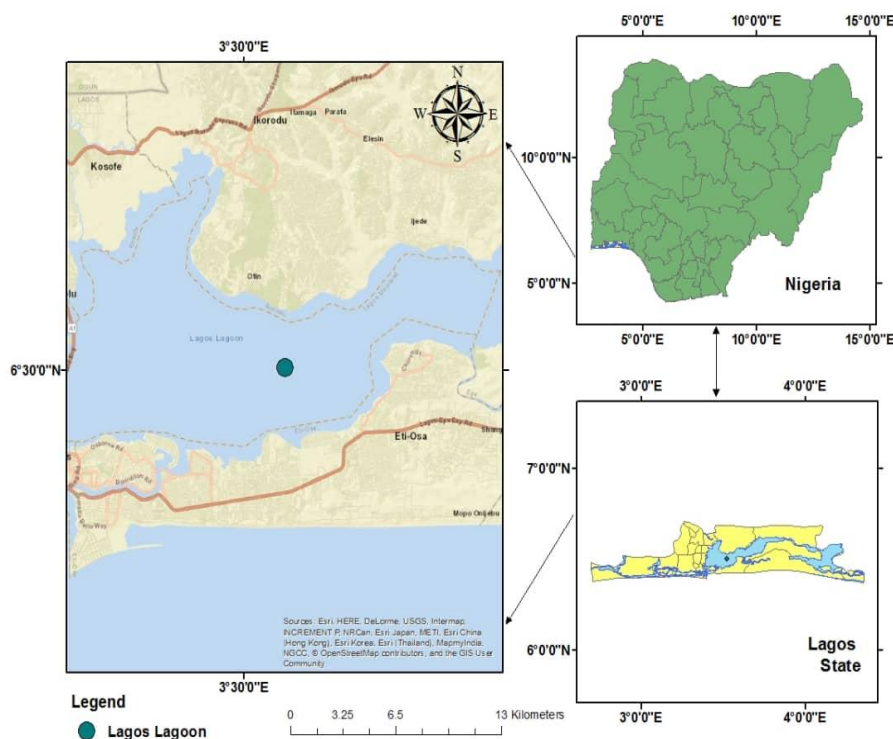


Fig. 1. Map showing the study location

Research Design, Data Collection and Analysis. This study basically assumed a descriptive survey design. A self-administered questionnaire was used in collecting relevant information based on study’s unbridled objective. This survey (well-structured) generally contains information on respondents’ socio-demographics, and questions measuring peoples’ knowledge and perception about Microplastic pollution. Basic information for this assessment was obtained from primary data collected with the aid of a pre-tested questionnaire and previous publications especially that of Akyildiz et al. (2015). Guided dialogue was basically used to capture information on trends, awareness, attitude and perception towards Microplastic pollution and plastic use. Likewise, translation of questionnaire to Yoruba language being the native language in study area was done for inclusivity. A total of 120 questionnaires were administered via “drop and collect” method and simple random sampling technique from students, residents and fishermen around Lagos lagoon front. Basically, residents and students going out of their way to utilize the aesthetic value and local fishermen in search of a living on the Lagos lagoon coast were

thoroughly sampled. At the beginning of the questionnaire, we briefly introduced what Microplastics are and their characteristics so that people who had not heard of them before could complete the questionnaire. Awareness, Knowledge, Attitude and Perception were measured constructively on Likert scale according to Harpe (2015), we based statements measuring each variable on a scale of 1 to 5, where 1 equals strongly disagree and 5 equals strongly agree, to create a simple way to compare data. We basically employed psychometric model of inquiry; we started with basic known facts to the more intriguing aspect of our survey; some of the statements in each variable were negatively framed while others were positively framed for quality-check, in order to circumvent the trend of choosing all the same answer. We also reworded some statements to validate the genuity of our inquiry. The population of this study comprised of one hundred and forty (140) consisting of government officials, academia, student, business personnel and Fishermen (see table 1 below). The sample size of 104 was estimated using Taro Yamane formula [22] as shown below:

$$n = \frac{N}{1 + N(e)^2}, \quad (1)$$

n = Sample size to be determined, e = Level of significance and N = Population size.

$$n = 140, e = 0.05$$

$$n = 140/1+140 (0.05)^2$$

$$n = 140/1+140 (0.0025) = 140/1+0.35$$

$$n = 140/1.35 = 103.7037037$$

$$n = 104.$$

However, out of the one hundred and four (104) questionnaires distributed to participants, only one hundred and two (102) was found useable. Statistical analysis (frequency, mean, standard deviation and correlation) was done using IBM SPSS Statistics 28.0.

Table 1

Population Distribution

S/N	Government	Academia,	Students	Business	Fishermen	Total
1.	29	16	61	21	13	140

Results. Table 2 reveals that 18.6% of the respondents were government workers while 8.8%, 52.0%, 12.7% and 7.8% of the respondents belong to the academia, students, business and others. It was obvious that more than half of the respondents were students (52.2%) and the rest of the distribution assumed this order: Government employed individuals (18.6%)> Business enterprise employed (12.7%)> Academia (8.8)> Fishermen (7.8%). The sample was biased towards younger people as the age distribution follows this pattern; 18-25 years (61.8%) > 26-35 (30.4%) > 36-45 (7.8%). The vast majority of the respondents were male (60.8%) and single (68.6%). In terms of education attainment, respondents were generally well educated. Respondents with Bachelor's degree and those with high school diploma were 33.3% each while the rest of the distribution assumed this order: Master's degree (15.7%) > PhD (11.8%)>National Diploma or College associate degree equivalent (3.9%).

Table 2

Respondents' Socio-demographics Information

Demographics variables	No. of Respondents	Percentage (%)
1	2	3
Categories of workers		
Government	19	18.6
Academia	9	8.8
Student	53	52.0
Business	13	12.7
Fishermen	8	7.8
Age (years)		
18-25 years	63	61.8
26-35 years	31	30.4
36-45 years	8	7.8
Gender		
Male	62	60.8
Female	40	39.2

Continuation of the table 2

1	2	3
Marital status		
Single	70	68.6
Married	26	25.5
Divorced	6	5.9
Education		
PhD	12	11.8
Masters or equivalent	16	15.7
Bachelors or equivalent	34	33.3
National Diploma/Associate Degree	4	3.9
High School Diploma	34	33.3
No formal education	2	2.0

Source: Field Survey, 2021

Deducible from fig. 2, It was evident that those that had awareness on Microplastic pollution (57.8%) outnumbered those that were unaware.

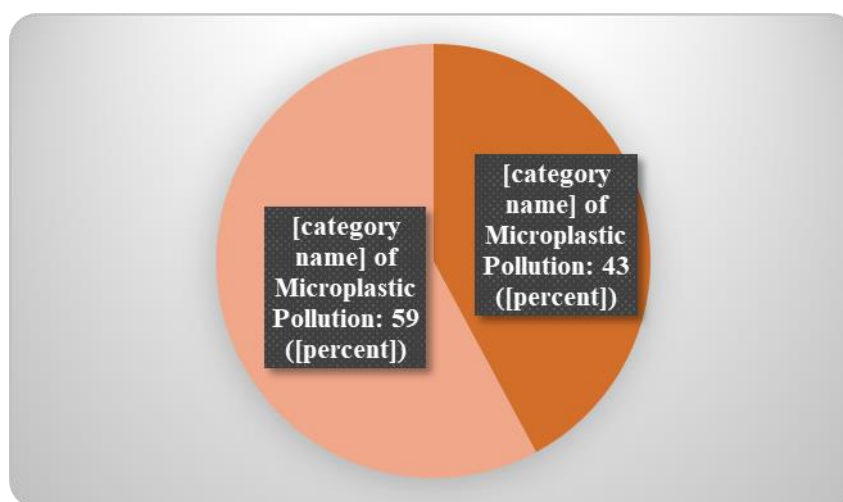


Fig. 2. Awareness of Microplastic pollution in the study area. (n=102)

The result of findings on the public health knowledge, attitude and perception was rationalized and presented in Table 3. With at least 5 questions measuring each variable of interest (Knowledge, attitude and perception), the overarching goal of this study was fulfilled. Majority of respondents claimed good responsibility in the disposal of plastic wastes. When asked to respond to a negatively framed statement “I often don’t dispose plastic waste into designated waste bins”, more than two-third of respondents (total 69.6%) were in disagreement with the statement while others expressed agreement (21%) and indecision (9.8%). Only 26.5% in total claimed reusing and/or recycling household plastic food containers, pet bottles etc. (10.8% affirmed, 15.7% strongly affirmed) while majority (53.9%) do not. Majority (total 58.8%) claimed knowing that “marine plastic waste would eventually produce Microplastics” (10.8% affirmed, 48% strongly affirmed) while a total of 18.6% expressed disagreement on this knowledge item and 22.5% were indecisive as well. About two-third (total 64.7%; 8.8% affirmed and 55.9% strongly affirmed) of respondents were in agreement that “Plastic pollution is a serious global problem” while few (13.7%) expressed disagreement on this knowledge item and 21.6% were indecisive. Interestingly, majority (total of 43.1%) claimed not having adequate knowledge of Microplastic pollution and its associated health risks but 36.2% claimed having adequate knowledge while 20.6% were indecisive. In overall, a mean and median knowledge score of 3.108±1.443 and 3.2 respectively literally implies that respondents generally have a fairly acceptable knowledge about Microplastic pollution.

With regards to attitude items, when respondents were asked to respond to a negatively framed attitude statement “I am less concern about where plastic waste generated ends”; majority expressed disagreement (52.9% total; 44.1% strongly affirmed, 8.8% affirmed) implying that a fair majority were actually concerned about where plastic waste generated ends. 24.5% were indecisive and a total of 22.5% agreed with this attitude item.

Table 3

Respondents' Knowledge, Attitude and Perception

Items	SD	D	U	A	SA	Mean	SDV	Median
A Knowledge Variables (n=102)								
i. I often don't dispose plastic waste into designated waste bins.	44(43.1)	27(26.5)	10 (9.8)	4(3.9)	17(16.7)	2.25	1.465	2.00
ii. I often reuse and/or recycle household plastic food containers, pet bottles etc.	39 (38.2)	16 (15.7)	20 (19.6)	11 (10.8)	16 (15.7)	2.50	1.481	2.00
iii. Plastic marine debris will eventually become Microplastics	9 (8.8)	10 (9.8)	23 (22.5)	11 (10.8)	49 (48.0)	3.79	1.367	4.00
iv. Plastic pollution is a serious global problem	10 (9.8)	4 (3.9)	22 (21.6)	9 (8.8)	57 (55.9)	3.97	1.353	5.00
v. I do not know much about Microplastics especially how it could get into the food chain or impact human health	29 (28.4)	8 (7.8)	21 (20.6)	19 (18.6)	25 (24.5)	3.03	1.551	3.00
Average						3.108	1.443	3.20
B Attitude Variables (n=102)								
i. I am less concern about where plastic waste generated ends	45 (44.1)	9 (8.8)	25 (24.5)	5(4.9)	18 (17.6)	2.43	1.519	2.00
ii. I am not willing to tell my family and friends about the issue of Microplastics in Nigeria	39(38.2)	6(5.9)	22 (21.6)	11(10.8)	24(23.5)	2.75	1.613	3.00
iii. I am willing to participate in the cleanup efforts of Microplastics in my community	12(11.8)	7(6.9)	13(12.7)	7(6.9)	63(61.8)	4.00	1.449	5.00
iv. I am willing to encourage the government to work on the issue of Microplastics in Lagos	5(4.9)	6(5.9)	6(5.9)	12(11.8)	73(71.6)	4.39	1.145	5.00
v. I want to learn more about Microplastics	15(14.7)	6(5.9)	15(14.7)	12(11.8)	54(52.9)	3.82	1.492	5.00
vi. I live a lifestyle that may contribute to Microplastic pollution	34(33.3)	9(8.8)	14(13.7)	12(11.8)	33(32.4)	3.01	1.692	3.00
Average						3.40	1.485	3.83
C Perception Variables (n=102)								
i. Microplastics are not toxic	57(55.9)	14(13.7)	17(16.7)	3(2.9)	11(10.8)	1.99	1.353	1.00
ii. Microplastics pollution is not a serious problem in Lagos lagoon	56(54.9)	11(10.8)	13(12.7)	9(8.8)	13(12.7)	2.14	1.476	1.00
iii. Microplastics do not affect human's health	59(57.8)	14(13.7)	20(19.6)	1(1.0)	8(7.8)	1.87	1.232	1.00
iv. Microplastics do not have a profound impact on sustainable development in Nigeria	46(45.1)	18(17.6)	20(19.6)	5(4.9)	13(12.7)	2.23	1.399	2.00
v. People in my neighborhood do not know about Microplastic pollution	9(8.8)	10(9.8)	17(16.7)	11(10.8)	55(53.9)	3.91	1.380	5.00
vi. I think it is the responsibility of my community authority to reduce plastic pollution	16(15.7)	11(10.8)	10(9.8)	15(14.7)	50(49.0)	3.71	1.539	4.00
vii. Marine animals will not consume Microplastics	38(37.3)	15(14.7)	20(19.6)	5(4.9)	24(23.5)	2.63	1.585	2.00
Average						2.64	1.423	2.29

SD=Strongly Disagree, D=Disagree, U=Undecided/Neutral, A=Agree, SA=Strongly Agree, SDV=Standard Deviation, n=number of respondents, (Coded as SD =1, D=2, U=3, A=4, SA=5) Mean scores>Median scores=positively skewed; Mean scores< Median scores=negatively skewed; Mean score=Median score=Symmetrical distribution. Unlike Mean scores, Median scores are not affected by outliers. Scale for Mean scores: 0.01-1.00=Strongly Disagree; 1.01-2.00=Disagree; 2.01-3.00=Undecided/Neutral; 3.01-4.00=Agree; 4.01-5.00=Strongly Agree. Scale for Median scores (1-5 approx.): Poor (<3), Fair (3), Good (>3)

Additionally, another negatively framed attitude statement “I am not willing to tell my family and friends about the issue of Microplastic pollution in Nigeria” was considered. Majority (total of 44.1%) showed disagreement, 21.6% indecisive and 34.3% were in agreement. Conversely, a good attitude was observed in the fair majority of 44.1% that showed disagreement on the attitude item among respondents. A good majority (total of 68.7%) of respondents expressed willingness to participate in the cleanup efforts of Microplastics in their community, few (total of 18.7%) showed “unwillingness” and others (12.7%) were indecisive on this subject. A good majority (total of 83.4%) expressed willingness to encourage the government to work on the issue of Microplastics in their community; few (total of 10.8%) showed “unwillingness” and others (5.9%) were indecisive on this subject. A good majority (total of 64.7%) expressed willingness to learn more about Microplastic pollution, (total of 20.6%) showed “unwillingness” and others (14.7%) were indecisive on this subject. When respondents were asked to respond to a negatively framed statement “I live a lifestyle that may contribute to Microplastic pollution”; a total of 44.2% agreed while 42.1% disagreed and 13.7% were indecisive on this subject. This statement yielded a close margin of responses in “favor and against”. In overall, with a mean and median knowledge score of 3.40 ± 1.485 and 3.83 on scale of 5 rating, it was obvious that respondents generally have a good attitude about Microplastic pollution and showed great willingness to curb associated menace of Microplastic pollution.

Perception constructs used in this study were basically negatively framed. Majority (69.6%) expressed disagreement with the statement “Microplastics are not toxic”; 16.7% were indecisive and 13.7% disagreed on this subject. In other words, a good majority perceived that Microplastics are toxic, which implies they have good perception based on this single perception construct. Similarly, majority (65.7%) expressed disagreement on the subject “Microplastics pollution is not a serious problem in Lagos lagoon”; 12.7% were indecisive and 21.5% agreed. This literally implies that a good majority perceived that Microplastic pollution is a serious problem in Lagos lagoon. Majority (71.5%) expressed disagreement on the subject “Microplastics do not affect human’s health”; for others, 19.6% were indecisive and a total of 17.6% agreed. Thus, a good majority perceived Microplastic to be detrimental to human health. However, when respondents were asked whether they think people in their neighborhood knew about Microplastic pollution; majority (total of 64.7%) perceived people in their neighborhood did not know about Microplastic pollution; 16.7% were indecisive and others (18.6%) have a contrary opinion. Similarly, majority (63.7%) believed it is the responsibility of government to enforce strict regulation against attitude that may engender Microplastic pollution; 9.8% were indecisive and others (total of 26.5%) have a contrary opinion. Relatively few respondents (28.4%) actually perceived that “Marine animals will not consume Microplastics”, others, 19.6% were indecisive and majority (52%) gave a contrary opinion, implying that Marine animals do consume Microplastics. Though respondents showed good perception about some of the variables than others but with an average mean and median perception score of 2.64 ± 1.423 and 2.29 respectively on a scale of 5.0 rating, it shows vividly that respondents generally have a poor perception about Microplastic pollution. Taken together from the findings in this study, respondents generally have a fairly acceptable knowledge about Microplastic pollution, a good attitude on how the menace of Microplastic pollution could be curbed in Lagos lagoon but a poor perception on what Microplastics entailed and its attendant ecological impacts.

The table 4 below shows that only Education has significant but weak relationship with knowledge and attitude. There was a significant positive but weak relationship ($P < 0.05$) between educational attainment and knowledge of micro (plastic) pollution which may weakly imply that the more educated the respondents are, the more knowledge they have about Microplastic pollution and vice versa. However, there was a negative and weak relationship between educational attainment and attitude ($P < 0.01$). Hence, this observation may weakly imply that the more educated respondents are, the less of the good attitude towards curbing Microplastics pollution that they show. It was clear that there was no significant relationship ($P > 0.05$) between perception and the other two variables (Knowledge and Attitude).

Table 5 shows the various source of information about Microplastic pollution among the proportion of respondents that had awareness on this subject. It was clear that majority (54.24%) acquire information on social platforms, 23.73% through internet sources, and 15.25% through workshop, trade fairs and conferences and 6.78% through word of mouth by family, friends and acquaintance.

Discussions and Policy Implications. Exploring respondents’ socio-demographics in this study may provide insight into whether social identity has influence on public knowledge, attitude and perception about Microplastic pollution and its ecological health implication and vice-versa [23]. Based on our observation (table 2), this study reflects knowledge, attitude and perception of the sampled

majority being young people within age bracket of 18-25 years (61.8%), students (52.2%), male (60.8%), single (68.6%) and mostly educated individuals. A possible explanation for this outcome is that the study was conducted in a culturally diverse community with a number of colleges or higher institution of learning around. Our bias is that the presence of institutions in a community is supposed to bring about transformation of lives through learning and culture and not degradation of environmental resources. Hence, we believed the well-educated and socially active class of the public would have knowledge on issues of public health importance especially on microplastics.

Table 4

Bivariate Relationship between Education, knowledge, attitude and perception of respondents on Microplastic pollution

	Education	Knowledge	Attitude	Perception
Education	1	.215*	-.336**	-.025
Knowledge		1	.031	.174
Attitude			1	.100
Perception				1

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

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

Table 5

Source of Information about the awareness of Microplastic pollution

	Information Sources (n=59)	Frequency	Percentages
i.	Internet	14	23.73
ii.	Social Media	32	54.24
iii.	Word of mouth by family, friends and colleagues	4	6.78
iv.	Workshop, Trade fairs and Conferences	9	15.25
	Total	59	100

Source: Field Survey, 2021

Global concerns about Microplastic pollution with its threat to food safety and public health has monumentally increased over time [24]. However, there is much more ample concern for communities of developing nations wallowing in poor attitude that may engender Microplastic pollution and its attendant health risk. Thus, intensifying efforts to strengthen policy advocacy on issues of public health importance especially emerging contaminants as such is critical in harnessing potential health benefits of nations [25]. Thus, a well-informed community on public health issues is literally a community with potential health benefits. From this study, it was clear that though majority of respondents had awareness on the subject “Microplastics” but interestingly these respondents showed a “fairly acceptable knowledge about Microplastic pollution” when asked to further respond to other knowledge items. Notably, many respondents (43.1%) claimed they do not have an adequate understanding about Microplastic pollution and its ecological impact. However, a previous study that assessed Microplastic concentration and that equally gauged public awareness of Microplastic pollution on beaches surrounding Hong Kong profoundly observed a very low level of awareness on the subject: 82% of respondents in their sample have never heard of Microplastics. Though other similar studies observed higher level of awareness on health risks associated with plastic’s use in the environment [26, 27, 28]. Based on insights drawn from other literature, Hartley et al. [29] suggests that that young people are for the most part aware of various environmental problems, such as pollution, litter, and hazardous waste, but may have greater difficulty understanding the causes of and solutions to environmental issues. The significant positive but weak relationship ($P < 0.05$) between educational attainment and knowledge of micro (plastic) pollution observed in this study weakly implies that the more educated the respondents are, the more knowledge they have about Microplastic pollution and vice versa. This findings supports the necessity for government and relevant stakeholders to reinforce awareness campaign throughout the nation from the academia to the outside community. For instance, awareness campaign “teach-to-reach accelerator program” could be developed to increase public understanding about how Microplastics could be formed from plastic polymers and to increase shared responsibility in protecting communities from the negative effects of the inappropriate disposal of plastic wastes in the environment. More so, more funding should be directed towards research and publicity of research outcomes on “Microplastics” especially scientific data on the debilitating effects of plastic pollution should be available on public domains. Academia and

research institutes should do more in terms of enriching students and the public with timely access to information on issues of emerging public health importance.

Changing public attitudes through education on their lifestyles and consumption patterns, waste management practices, and support or other engagement in the implementation of policies towards plastic use and integrated waste management principles are sustainable paths to reducing Microplastic pollution [30]. Indeed, plastics are the most ubiquitous, pervasive, versatile and user-friendly product. Society's ability to cope with the overwhelming amounts of plastic produced and those that are inappropriately discarded as well as its attendant ecological impact would require reinforcing positive environmental attitudes in the public. There are likelihoods that people may struggle to relate environmental problems to products, and may find great difficulty to cope with doing things in an eco-friendly way or admit to littering the environment [29, 31] However, in this present study, respondents showed a relatively good attitude (in terms of willingness and readiness) to curb the menace of Microplastic pollution in their immediate environment. The majority of respondents expressed concern for where plastic waste generated ends while the vast majority were willing to learn more about Microplastics and its ecological impact, and to co-operate with the government to mitigate Microplastic pollution in order to ensure a safe haven for all inhabitants. Previous study observed similar great attitude in public willingness to co-operate with the government on mitigation efforts towards reducing Microplastic pollution [4]. Nonetheless, these scientists also opines that clean-up efforts where communities gather together like in the case of Hong-Kong to get rid of plastic wastes, the result will not only reduce Microplastic pollution but will also help to educate the public about Microplastics and other emerging issues of public health importance [4]. Government and stakeholders have crucial and dynamic roles to play towards regulation and proper waste management. Positive reinforcement (e.g., rewards for not littering and monetary incentives) may be effective in reducing littering and increasing recycling since marine litters is a significant environmental problem inherently linked to individuals' purchasing, use and disposal behaviour [29]. However, when the incentive is removed, the behaviour may revert. However, other mitigation approach is that of the "zero waste policy" a policy that requires people going to the store to bring their own food container and reuse their household plastic bags and get discount prices may help to control excessive food waste and plastic litters [31]. This option may go a long way in changing public attitudes and increasing awareness on the threats of plastic pollution.

In spite the poor perception that respondents generally showed in this study, apparently majority perceived Microplastic pollution as a contemporary problem, as toxic and harmful to human health. This findings was quite similar to the observation of Akyildiz et al. [4]. It is not hard to believe that people's subjective interpretation during response to survey questions may inherently introduce bias. However, since majority believed that people in their neighborhood or community do not know about Microplastic pollution. Hence, that explains the rationale for having a poor a generally poor perception about Microplastic pollution. Education and quality of knowledge attained on issues of public health importance for the most part, has a strong influence on public perception. It suffice to aver that more sensitization programme is direly critical to awake genuine concerns for environmental sustainability and change the public perception and attitudes. The gaps identified in this study clearly shows that it is imperative that proper knowledge-based training, orientation, and sensitization of the public on Microplastic pollution and the potential health risks of exposure be developed.

This study also succinctly brought to our attention that a good number of respondents that were aware about microplastics and its associated risks had the knowledge through social media campaigns, followed by internet sources. Knowledge about sources, contamination, fate and effects of microplastics may be an ultimate guide in enhancing public motivation and sense of environmental responsibility [32]. Previous studies have appraised the significant role of media in not only increasing public participation and awareness, but serving as an instrument for many socio-psychological incentives, all of which could be geared towards mitigating environmental pollution [6, 33]. A previous study gave an account of where public sought information regarding environmental news and updates: 52% (websites), 48% (Television shows) and Newspaper (24%) were reported implying that majority gets environmental information via websites [6]. The findings in this present study hence points clearly that government and civil society actors should consider utilizing other available sources of information (such as Radio/TV show, newspapers/magazines, workshop/seminars etc.) especially in sponsoring environmental awareness campaigns for all, without leaving anyone behind [34].

Conclusion. This present study observed that majority of respondents were aware of microplastics pollution in the Lagos lagoon. Further findings revealed that they have a fairly acceptable knowledge and

poor perception on Microplastic pollution and its ecological health implication. However, the vast majority of respondents sampled interestingly showed willingness to learn more about microplastics and equally expressed a shared commitment to support government to clean up plastic wastes contributing towards Microplastic pollution and to participate in advocacy programs on this subject. This study may be followed up by a more extensive data collection on critical assessment of plastic consumption pattern and perception of fishermen on plastic marine debris.

Based on this findings, the following recommendations were made:

i. Efforts should be concentrated at different levels and tiers of government to educate the public on the impact of inappropriate management of plastic wastes, the underlying drivers of plastic wastes and attitudes to shape consumption patterns (especially to reduce single use of plastics by reduce-reuse and recycle approach) through massive awareness campaign. However, environmental education especially on behaviour change, consumption patterns and waste management policy should well presented in a culturally and emotionally appropriate context.

ii. Efforts should be geared towards promoting zero-waste policies, circular economy perhaps through incentives in favour of compliance and stringent measures (e.g. payment of fines) should be considered for people who deviates from the standard guidelines and practices.

iii. Government should encourage strong partnership with private waste management investors through technical support and funding to procure advanced waste management technologies as well as provide support to government agencies to standardize the manufacturing of quality plastics (biodegradable and durable)

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Reference

- 1 Technical University Munich. How dangerous is microplastics? 2009. Retrieved from <https://phys.org/news/2019-01-dangerous-microplastic.html>
- 2 Jambeck, J.R., Geyer, R., Wilcox, C., Siegler, T.R., Perryman, M., Andrady, A., Narayan, R., Law, K.L. Plastic waste inputs from land into the ocean. *Science* 2015. Vol 347 (6223), 768–771.
- 3 Smith M., D.C. Love, C. M. Rochman and Neff, R. A. Microplastics in Seafood and the Implications for Human Health. *Current Environmental Health Reports* 2018. Vol 5:375–386.
- 4 Akyildiz, O., Calamari, P., Sellman, Z., and Symecko, S. Microplastic pollution in Littoral Environments. 2015 Thesis Project No. C155 submitted to Worcester Polytechnic Institute 89pp.
- 5 WHO. WHO calls for more research into microplastics and a crackdown on plastic pollution. 2019. Retrieved from <https://www.who.int/news/item/22-08-2019-who-calls-for-more-research-into-microplastics-and-a-crackdown-on-plastic-pollution>.
- 6 Henderson, L and Green, C. Making sense of microplastics? Public understandings of plastic pollution. *Marine Pollution Bulletin* 2020 vol. 152, 110908.
- 7 Andrady, A. L. Microplastics in the marine environment. *Marine Pollution Bulletin*, 2011 62(8), 1596-1605.
- 8 Duis K, Coors A. Microplastics in the aquatic and terrestrial environment: sources (with a specific focus on personal care products), fate and effects. *Environ Sci Eur*. 2016;28(1):2
- 9 Baldwin, A. K., Corsi, S. R., & Mason, S. A. Plastic debris in 29 Great Lakes tributaries: Relations to watershed attributes and hydrology. *Environmental Science. Technology*, 2016 50(19) 10377–10355.
- 10 Hartmann, H. Thorsten, R.C. Thompson, M. Hassellöv, V. Verschoor, A.V. Dugaard, S. Rist, T. Karlsson, N. Brennholt, M. Cole, M.P. Herrling, M.C. Hess, N.P. Ivleva, A.L. Lusher, M. Wagner. Are we speaking the same language? Recommendations for a definition and categorization framework for plastic debris. *Environmental Science & Technology*, 2019, 53 (3) pp. 1039-1047
- 11 Eriksen M, Lebreton LCM, Carson HS, Thiel M, Moore CJ, Borerro JC, et al.. Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea. *PLoS One*. 2014. 9(12):e111913.
- 12 Lusher A, Hollman P, Mendoza-Hill J Microplastics in fisheries and aquaculture: status of knowledge on their occurrence and implications for aquatic organisms and food safety. 2017 *FAO Fisheries and Aquaculture Technical Paper*; (615).

- 13 Paulischkis, E., Gutow, L and Saborowski, R. How to get rid of ingested Microplastic fibers? A demonstration by the shrimp *Palaemon varians* In: MICRO 2018 Fate and Impact of Microplastics: Knowledge, Actions and Solutions Lanzarote 2018 Proceedings pp. 359-360.
- 14 Akindele, EO, Ehlers SM, Koop JH First empirical study of freshwater Microplastics in West Africa using gastropods from Nigeria as bioindicators. *Limnologica*. 2019 vol 78:125708
- 15 Pahl, S. Wyles, K. and Thompson, R.C. Channelling passion for the ocean towards plastic pollution *Nat. Hum. Behav.* 2017, 1: 697-699.
- 16 Raimi MO. 21st Century Emerging Issues in Pollution Control. 6th Global Summit and Expo on Pollution Control May 06-07, 2019 Amsterdam, Netherlands
- 17 UNEP. Marine Plastic Debris and Microplastics – Global Lessons and Research to Inspire Action and Guide Policy Change United Nations Environment Programme, Nairobi, Kenya (2016)
- 18 Hartley BL, Pahl S, Veiga J, Vlachogianni T, Vasconcelos L, Maes T, Doyle T, d'Arcy Metcalfe R, Öztürk AA, Di Berardo M, Thompson RC.. Exploring public views on marine litter in Europe: Perceived causes, consequences and pathways to change. *Mar Pollut Bull*. 2018,133:945-955.
- 19 NBS -National Bureau of Statistics. 2006 National Population Census/Federal Republic of Nigeria. 2006. Retrieved online 19 March 2021 from the National Bureau of Statistics <http://www.nigerianstat.gov.ng/nbsapps/Connections/Pop2006.pdf>
- 20 Badejo, O.T, Olaleye, JB., Alademoni, AS. Tidal Characteristics and sounding datum variation in Lagos state. *International Journal of innovative research and studies* 2014. 3(7): 435-457
- 21 Okusipe, O. M. Lagos Lagoon Coastal Profile: Information Database for Planning Theory. Lagos State Environment Report/ 2000. Retrieved from <https://proceedings.esri.com/library/userconf/proc04/docs/pap1579.pdf>
- 22 Yamane, T. *Statistics; An Introductory Analysis*, 1967. 2nd Ed., New York: Harper and Row.
- 23 Abdelal, R. Herrera, Y. M., Johnston, A. I., and McDermott, R.. Introduction. In R. Abdelal, Y. M. Herrera, A. I. Johnston, & R. McDermott (Eds.), *Measuring identity: A guide for social scientists* 2009 (pp. 1–16). New York, NY: Cambridge University Press.
- 24 Deng H, Wei R, Luo W et al Microplastic pollution in water and sediment in a textile industrial area. *Environ Pollut* 2020. 258:113658.
- 25 Omoyajowo, KO, Ogunyebi, AL, Adenekan, OA, Bakare, TI, Omoyajowo, BO, Odipe, OE, Samuel, IA. Awareness of Toxicological Impact and Risk of using Talcum powder as factor for Ovarian Cancer among Women in three Metropolitan Cities of Southwestern States, Nigeria. *J. Appl. Sci. Environ. Manage.* 2021. 25 (7) 1161-1169
- 26 Joseph N, Kumar A, Majgi SM, Kumar GS, Prahalad RB. Usage of plastic bags and health hazards: A study to assess awareness level and perception about legislation among a small population of Mangalore city. *J Clin Diagn Res*. 2016;10(4):LM01-4.
- 27 Adane L, Muleta D.. Survey on the usage of plastic bags, their disposal and adverse impacts on environment: A case study in Jimma City, Southwestern Ethiopia. *J Toxicol Environ Health Sci*. 2011, 3:234-248.
- 28 Turner, B and Sutton, J. Plastic bags: Hazards and mitigation. Available at <http://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1082&context=socssp> Accessed on 19 July 2019.
- 29 Hartley BL, Thompson RC, Pahl S. Marine litter education boosts children's understanding and self-reported actions. *Mar Pollut Bull* 2015, 90(1-2):209-217.
- 30 Leire, C., Thidell, Å. Product-related environmental information to guide consumer purchases—a review and analysis of research on perceptions, understanding and use among Nordic consumers. *J. Cleaner Prod.* 2005 13, 1061– 1070
- 31 Wagner, M., and Lambert, S. (2018). *Freshwater Microplastics: Emerging Environmental Contaminants?* (Vol. 58): Springer. 309pp
- 32 Raab, P and Bogner, F.X. Microplastics in the Environment: Raising Awareness in Primary Education. *The American Biology Teacher*, 2020. Vol. 82, No. 7, pp. 478–487
- 33 McAllister, J. Factors Influencing Solid-Waste Management in the Developing World. All Graduate Plan B and other Reports 2015. 528. Retrieved online <https://digitalcommons.usu.edu/gradreports/528>.
- 34 Omoyajowo, K.O, Raimi, MO, Waleola, T.O, Ogunyebi, A.L. 2021. Public Health Knowledge and Perception of Microplastics Pollution: Lessons from the Lagos Lagoon DOI: 10.21203/rs.3.rs-506361/v1

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ГРОМАДСЬКА ОБІЗНАНІСТЬ, ЗНАННЯ, СТАВЛЕННЯ ТА СПРИЙНЯТТЯ ЩОДО ЗАБРУДНЕННЯ МІКРОПЛАСТИКОМ НАВКОЛО ЛАГУНИ ЛАГОС

Забруднення мікропластиком зараз у всьому світі позначається як головна загроза для засобів до існування, біорізноманіття та здоров'я населення через поширений характер пластикових відходів, недостатню обізнаність про їх вплив на довкілля та неухвалене ставлення до практик сталого поводження з відходами. Отже, ця стаття досліджує обізнаність, знання, ставлення та сприйняття громадськості щодо забруднення мікропластиком та його наслідків для здоров'я навколишнього середовища за допомогою даних опитування, зібраних від мешканців, студентів, рибалок та місцевих туристів навколо Лагуни Лагос, значної території Лагосу. Це дослідження спиралося на психометричну модель дослідження (через непрямі запитання), яка була використана для екстраполяції мети дослідження. Дані були зібрані, закодовані та проаналізовані з використанням описової статистики та індуктивної статистики на IBM SPSS 28. Результати показали, що хоча обізнаність про мікропластик була начебто високою (понад 50%), однак, загальні знання були досить прийнятними, і не спостерігалось стурбованості щодо забруднення мікропластиком. Респонденти (із середнім балом ставлення $3,40 \pm 1,485$) загалом демонструють позитивне ставлення до того, щоб дізнатися більше з цієї теми та спільну відповідальність у підтримуванні уряду за допомогою волонтерства та пропаганди очищення. У цьому дослідженні коротко зазначено, що значна кількість респондентів, які були обізнані про мікропластик та пов'язані з ним ризики, мали знання через кампанії в соціальних мережах, а також із джерел в Інтернеті. У світлі цих результатів, це дослідження рекомендує уряду, науковим колам та відповідним зацікавленим сторонам активізувати зусилля із просвітництва громадськості щодо джерел забруднення, впливу мікропластику на довкілля та інших питань, що мають значення для громадського здоров'я, шляхом масових кампаній, навчальних заходів для громадської та розробки стратегій, які можуть посилити позитивне ставлення населення до навколишнього середовища.

Ключові слова: забруднення мікропластиком, сприйняття громадськості, екологічна освіта, лагуна Лагос.

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