KNOWLEDGE, ATTITUDE, AND PRACTICE OF UNDERGRADUATE STUDENTS TOWARDS PLASTIC POLLUTION AT THE UNIVERSITY OF BENIN, BENIN CITY, EDO STATE

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BENIN CITY, EDO STATE, NIGERIA

SEPTEMBER 2024

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SEPTEMBER 2024

DECLARATION

We hereby declare that this project work titled "**KNOWLEDGE, ATTITUDE, AND PRACTICE OF UNDERGRADUATE STUDENTS TOWARDS PLASTIC POLLUTION IN THE UNIVERSITY OF BENIN, BENIN CITY, EDO STATE**" was conducted under supervision and has not been submitted in part or in full for any purpose.

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DEDICATION

This project is dedicated to God Almighty, who made all these possible. This work is also dedicated to our beloved parents, Mr. and Mrs. E. Isokpehi and Mr. and Mrs. E.F. Iyengunmwena, and our wonderful lecturers whose impact lives forever in us.

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LIST OF ABBREVIATIONS

BPA	Bisphenol A
FUNAAB	Federal University of Agriculture, Abeokuta
FUP	Faculdade UnB Planaltina
HDPE	High-Density Polyethylene
KAP	Knowledge, Attitude and Perception
LDPE	Low-Density Polyethylene
PET	Polyethylene Terephthalate
PP	Poly Propylene
PS	Polystyrene
PVC	Polyvinyl Chloride
SDG	Sustainable Development Goals
SWM	Solid Waste Management
UNIVEN	University of Venda
UI	University of Ibadan
UNILAG	University of Lagos
UTHM	Universiti Tun Hussein Onn Malaysia

DEFINITION OF TERMS

Environment: The natural world includes all living (biotic) and non-living (abiotic) components that interact within a specific area. This includes air, water, soil, plants, animals, and microorganisms.

Plastic Pollution: This is the harmful accumulation of synthetic plastic products and particles in the environment that negatively affects humans, wildlife, and their habitat.

Recycling: This is the process of collecting, processing, and converting waste materials into new products to prevent the waste of potentially useful materials, reduce the consumption of fresh raw materials, minimize energy usage, decrease air and water pollution, and lower greenhouse gas emissions.

Solid Waste Management: This is the collecting, treating, and disposing of solid material discarded because it has served its purpose or is no longer useful.

ABSTRACT

Background: Plastic pollution is considered a global issue, with all environments currently being contaminated by plastics. Therefore understanding the dynamics of plastic pollution is essential for fostering sustainable behaviors. The study investigates the knowledge, attitudes, and practices (KAP) of undergraduate students at the University of Benin regarding plastic pollution. Findings aim to inform targeted educational interventions and policy recommendations to enhance environmental stewardship among the youth, ultimately contributing to broader sustainability efforts.

Objective: To assess the knowledge, attitude, and practice of plastic pollution amongst undergraduate students of the University of Benin with a view to bring about a reduction in plastic pollution.

Methods: A descriptive cross-sectional study design was carried out among university students in Benin City from May 2023 to September 2024. A multistage sampling technique was used to select 520 participants for the study. Data was collected from respondents using a structured, self-administered questionnaire with close-ended and open-ended questions. The questionnaire was adapted from the University of Sharjah online survey questionnaire on plastic pollution. The data was analyzed using IBM SPSS version 27. The level of statistical significance was set at $p < 0.05$. Ethical approval was obtained from the Ethics and Research Committee, University of Benin Teaching Hospital (UBTH).

Results: A total of 520 out of 520 questionnaires administered were retrieved and analyzed, giving a response rate of 100.0%. There were 278 (53.5%) male respondents and 242 (46.5%) female respondents with an average age of 21.28 ± 3.91 years. The study revealed that most 474 (91.2%) of the respondents had good knowledge of plastic pollution. Those who were not studying medicine and those who reside in private residences (on and off campus) were the

statistically significant determinants of knowledge of plastic pollution. Respondents who were not studying medicine were 0.270 times less likely to have good knowledge of plastic pollution than those who were studying medicine (OR = 0.270, 95% CI = 0.125 – 0.582, p = < 0.001). Respondents who reside in private residences (on and off campus) were 0.431 times less likely to have good knowledge as against those who reside in hostels (on and off campus) (OR = 0.431, 95% CI = 0.225 – 0.823, p = 0.011). The majority of the respondents, 501 (96.3%), had an overall positive attitude toward plastic pollution. Those aged 35 - 44 and those in 300 level had the highest proportion of respondents with a positive attitude toward plastic pollution. The majority of them, 428 (82.3%), had appropriate practice toward plastic pollution. Sex, department, and knowledge of plastic pollution were the statistically significant determinants of practice relating to plastic pollution. Male respondents were 0.518 times less likely to have appropriate practices than female respondents (OR = 0.518, 95% CI = 0.316 – 0.849, p = 0.009). Respondents who were not studying medicine were 2.390 times more likely to have appropriate practices than those who were studying medicine (OR = 2.390, 95% CI = 1.188 – 4.809, p = 0.015). Respondents who had good knowledge of plastic pollution were 2.280 times more likely to have appropriate practices than those who had poor knowledge (OR = 2.280, 95% CI = 1.098 – 4.734, p = 0.027).

Conclusion: The study showed that the majority of the respondents had good knowledge of plastic pollution and a positive attitude toward plastic pollution. There was a large majority that had appropriate practice toward plastic pollution.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Plastic is one of the world's most used materials, representing a very large group of individual polymers with different chemical and technical properties. Polymers commonly used include polyethylene terephthalate (PET), high-density polyethylene (HDPE), polyvinyl chloride (PVC), low-density polyethylene (LDPE), polypropylene (PP), and polystyrene (PS).[1,2]

Plastics are extensively utilized in various sectors, from construction and transportation to electronics, healthcare, and agriculture. Their popularity stems from their lightweight nature, durability, affordability, and versatility in terms of shape and color adaptation. As a result, plastics find widespread application in the manufacturing of single-use items like straws, food packaging, beverage containers, cigarette filters, disposable cups, plates, and cutlery.[3]

In the 20th century, researchers invested their efforts in identifying the physicochemical structures and functionalities of plastics to make them suitable for various applications. Plastics serve as valuable resources and provide many benefits to society, such as comfort, hygiene, and safety, leading to the well-being of society.[4]

Because plastics satisfy the countless needs of the growing population, they have become essential for human well-being. Owing to their versatility, durability, and cost-effectiveness, plastics are used in a wide range of industries and consumer products. However, the durability inherent in plastics, while advantageous in product longevity, makes it possible for plastics to persist in the environment for a long time before gradually breaking down into smaller fragments, known as micro-plastics (<5 mm), which in turn can degrade into nanoplastics (<100nm).[5] Unlike other materials, plastic does not biodegrade. It can take up to 1,000 years to break down, so when it is discarded, it builds up in the environment until it reaches a crisis

point. This pollution chokes marine wildlife, damages soil, poisons groundwater, and can cause serious health impacts.[5] As a result, the only way to permanently get rid of plastics is through the use of intensive heat by combustion or pyrolysis.[6]

Plastic pollution is considered a global issue, with all environments currently being contaminated by plastics. This environmental issue is a result of poor domestic and industrial waste management. [7] Approximately half of the plastic items fall under the category of single-use products and packaging materials. However, a significant portion of these plastics are not disposed of properly. Instead of being collected for recycling or proper disposal through facilities like recycling centers, incinerators, or landfills, they are often carelessly scattered or discarded in areas where waste collection is challenging. This irresponsible disposal practice includes throwing plastic bottles and containers on the ground, tossing them out of vehicles, piling them up in narrow passages, or allowing them to be carried away by the wind, leading to littering and pollution of the immediate environment. This continual accumulation of plastic waste poses a significant environmental challenge and threatens the ecosystem in Nigeria and the global community.[8]

Universities, with their large student populations and reliance on various plastic products, contribute significantly to plastic waste generation.[9] These plastic wastes are usually in the form of water bottles and sachets that litter common areas including student housing, restaurants, administrative rooms, classrooms, cafeterias, and laboratories.[10]

As educational institutions, universities have the moral and ethical obligation to act responsibly concerning the environment; they must be leaders in the environmental protection movement, including responsible waste management.[10] They hold principal responsibility in making sure that students are aware of the relevance of sustainable solid waste management practices such as plastic waste sorting as a way of tackling plastic pollution.[9]

As a way of controlling plastic pollution within the university environment, certain institutions put measures to help manage solid and plastic waste disposal. These measures include the 3R waste management approach that deals with reducing, reusing, and recycling plastics. These measures have positive effects on the environmental attitudes and consciousness of undergraduate students toward the need to avoid producing waste in a high community.[11]

1.2 STATEMENT OF THE PROBLEM

Plastic pollution is a global problem.[12] The consequences of plastic pollution eat deeper than mere environmental degradation; they encroach upon the very sustenance of marine ecosystems and the livelihoods of communities reliant on seafood.[13] Every year, it is estimated that 19-23 million tons of plastic waste leak into aquatic ecosystems, polluting lakes, rivers, and seas. Every day, the equivalent of 2,000 garbage trucks full of plastic are dumped into the world's oceans, rivers, and lakes.[12] Despite the transient convenience it offers, the persistent presence of plastic perpetuates a cycle of ecological harm with enduring consequences.[13]

The excessive production and consumption of plastics has led to pollution that has negative effects on both society and the environment.[4] Exposure to toxic chemicals found in plastic, such as bisphenol A (BPA), poly-halogenated compounds, styrene, phthalates, etc., can cause diabetes, cardiovascular disease, and liver illness. The adverse health effects associated with plastic use are many and include dysgenesis, cryptorchidism, infertility, obesity, polycystic ovarian disease in women, and even cancer in animal studies.[4]

Another major problem of plastic waste is the choking of drains when they are leaked into the environment, causing blockage of waterways, which serve as breeding sites for vectors (mosquitoes, pests, vector-borne disease transmission), and also contributing to the spread of malaria in endemic areas, impacting negatively on the health of the population.[14,15]

Undergraduate students are important in the fight against plastic pollution. However, concerning knowledge gaps exist among the group. In-depth knowledge, especially regarding methods of controlling plastic pollution, is deficient in this group. While they may be aware of the harmful effects of plastic pollution, more than half (56.4%) of students lack knowledge of tools that help reduce plastic pollution, while 20.5% are unaware of intervention methods for plastic pollution control. This problem also exists among the staff population.[7]

The attitude of undergraduate students towards plastic pollution remains a barrier to effective plastic waste management. Many youths and students exhibit a lack of commitment towards sustainable practices relating to plastic pollution, its impact on human health, and inappropriate disposal of plastic waste.[16]

The practices of undergraduates as regards plastic use and pollution are poor. Plastic waste ranks as the highest-generated waste in universities. Statistics have shown that close to half (47.6%) of generated waste in universities is from plastic. This stresses the problem of plastic pollution within the university environment.[17] Students residing within the university environment are thus exposed to the negative effects of plastic pollution affecting their health and well-being.[2]

As a means of tackling waste and plastic pollution, several pieces of legislation have already been made internationally and at the domestic level. However, Nigeria does not have a law that addresses the challenge of plastic pollution especially within higher institutions. Only laws that address general waste management exist, and this has not been able to solve the problem of plastic pollution.[18]

1.3 JUSTIFICATION

The study of knowledge, attitudes, and practices of undergraduate students towards plastic pollution is very important as it addresses the pressing environmental crisis posed by plastic waste. This study was carried out to address identified gaps in the knowledge, attitude, and practice of undergraduates towards plastic pollution.

There is a paucity of literature that specifically evaluates the knowledge, attitude, and practice of undergraduates towards plastic pollution, especially in Nigeria, necessitating the need for this study. This study will be beneficial to the university environment as it will improve practices and attitudes towards plastic handling among students and staff.

The findings of this study can inform policy decisions and initiatives aimed at mitigating plastic pollution at both the university level and governmental levels. By identifying areas where interventions are needed, policymakers can develop targeted policies and regulations to promote plastic waste reduction and recycling efforts within higher institutions.

In addition to informing policy-making decisions, our study can contribute to efforts to raise public awareness about the potential health impacts of plastic pollution and promote safer alternatives within the university environment. Also, this study will provide baseline information that will add to already existing knowledge on plastic pollution.

In line with SDG 12, which aims to ensure sustainable consumption and production patterns, this study contributes to the understanding of plastic pollution among undergraduate students and informs strategies for fostering responsible plastic use and waste management practices.[19]

1.4 RESEARCH QUESTIONS

1. What is the level of knowledge of undergraduate students regarding the environmental impact of plastic pollution?
2. What is the attitude of undergraduate students towards plastic use and waste management practices?
3. What are the practices of undergraduate students relating to plastic pollution?
4. What are the factors contributing to undergraduate attitudes towards plastic pollution?

1.5 OBJECTIVES

1.5.1 GENERAL OBJECTIVE

To assess the knowledge, attitude, and practice of plastic pollution amongst undergraduate students of the University of Benin with a view to bring about a reduction in plastic pollution.

1.5.2 SPECIFIC OBJECTIVES

1. To assess the knowledge levels regarding plastic pollution among undergraduate students in the University of Benin.
2. To determine the attitude of University of Benin undergraduate students towards plastic pollution.
3. To ascertain the practice of plastic pollution among undergraduate students in the University of Benin.
4. To identify factors that contribute to plastic pollution among undergraduates in the University of Benin.

CHAPTER TWO

LITERATURE REVIEW

Plastics having a variety of uses, are produced rapidly. However, poor plastic handling has resulted in worrying levels of plastic pollution.[4]. Several pieces of literature exist that explore the concept of plastic pollution among undergraduates.

2.1 KNOWLEDGE LEVELS REGARDING PLASTIC POLLUTION

A prospective cross-sectional study was carried out to assess the knowledge of plastic hazards among dental students in Saveetha Dental College, India, in 2019. The study's findings regarding respondents' awareness of the health risks associated with plastics revealed that most of them had good knowledge of at least one of these risks. A lesser proportion was however aware of the idea of alternative uses instead of plastic bags as a means of reducing plastic pollution.[20]

A cross-sectional Indian study conducted at Annamalai University, Annamalainagar, aimed to assess the level of knowledge and practice of 563 first-year professional course students concerning plastics. Results showed that 46% of the students demonstrated good knowledge, 5.4% of the respondents exhibited inadequate knowledge, and the majority had moderate knowledge levels.[21]

A quantitative research approach employing a cross-sectional research design was utilized to evaluate the knowledge concerning health hazards associated with plastic use among students in a private institution in the district of Sirmour, Himachal Pradesh, in 2019 among 180 students who were selected using a simple random technique. Results indicated that a majority (76%) of participants used plastic items daily. Regarding knowledge concerning health hazards associated with plastic use, 52% of respondents exhibited poor knowledge, 48% displayed average knowledge, and none demonstrated good knowledge. Additionally, the chi-square test

revealed a significant relationship between age and understanding of the health risks associated with plastic use among female students at a significance level of $p < 0.05$. It is important to note that the study's scope was limited by its exclusive focus on selected private institutions.[22]

A descriptive cross-sectional study was conducted to assess the knowledge, attitude, and practice of usage of plastic products among undergraduates in India in 2022. For the study, 400 pupils in total were enrolled. Results of the study revealed an adequate amount of knowledge among respondents, with a mean score of 5.54 out of the 8 questions used to assess knowledge. Males and students from higher levels were shown to have better knowledge of proper plastic usage.[23]

A 2021 mixed study involving both quantitative and qualitative design investigated the knowledge and attitudes toward plastic pollution among youths in Kenya among 271 respondents. Results showed that most respondents viewed single-use plastics as a serious environmental health issue. The majority of them knew that plastic wastes choke drainage systems and that plastics take many years to degrade. The majority of respondents were aware of how detrimental plastic pollution is to the marine ecosystem and human health. Although the study did not focus on undergraduates, the youth population can be used as a proxy to assess undergraduate knowledge of plastic pollution as similar age groups are represented.[24]

2.2 ATTITUDE TOWARD PLASTIC POLLUTION

A cross-sectional study was conducted among 220 students of a tertiary institution in India to assess the awareness, attitude/behavior, and opinions about plastic pollution in 2022. Results on the attitude of respondents revealed a highly positive overall attitude as the majority showed a willingness to pay more for biodegradable plastic alternatives as well as creating awareness about plastic pollution. This positive attitude level was irrespective of gender, level, or course studied.[25]

In 2019, a cross-sectional survey was administered to all enrolled students at the University of Venda (Univen). A total of 376 students were used for the study aimed at examining the knowledge, attitude, and perception (KAP) of students on solid waste management. For students' attitudes, results showed that the majority of respondents (n = 356, 93.6%) claimed that they dispose of their waste adequately using the provided waste bins; some of the respondents, however, complained that the bins are not sufficient (n = 176, 46.8%) for effective solid waste management on campus. Some of the students (44%) reported difficulties associated with the use of the provided bins, with the most commonly reported difficulty being the opening of the bin lid and dirty handles (11.7% and 9.3%).[26]

A 2024 study aimed to assess the awareness and attitudes towards plastic contamination, specifically micro- and nanoplastics among undergraduates in Italy among 220 students. The study revealed that the majority of the undergraduates had a strong attitude/concern towards plastic pollution and its environmental impacts, however, some were skeptical about the effectiveness of individual actions in mitigating plastic pollution, believing that significant changes require systemic policy interventions. Despite having good attitude levels, respondents lacked proactive behavior to control plastic pollution.[27]

A study conducted among undergraduates in South-East, Nigeria in 2020 assessed the perceptions and attitudes of plastic pollution and waste management among undergraduates. Students thought that plastic waste was foul-smelling, bad for human health, and ugly for the environment. While the plastic companies were portrayed favourably as producers who brought about progress and prosperity, students perceived themselves as the cause of plastic pollution (as consumers). Participants were open about their indiscriminate littering practices, taking responsibility for their actions with the potential to correct the poor practice.[28]

A descriptive cross-sectional study was conducted to evaluate the perception of plastic waste management among undergraduates in Nnamdi Azikiwe University, Awka, in 2018. The study assessed the students' attitude and their perceptions toward managing plastic waste and pollution. For the study, 83 students in all were chosen from three separate residence halls at the university. Results showed that most of the respondents perceived that plastic wastes litter the environment, clog drainage channels, and accelerate flooding. This perception and attitude can cause improved plastic handling to prevent plastic pollution.[29]

2.3 PRACTICES CONTRIBUTING TO PLASTIC POLLUTION

A Chinese study conducted at Xi'an Shiyou University in 2023 among 2361 students examined the use of plastics by college students during their academic life cycle. Results from plastic disposal practice showed a notable disparity between the waste generated on weekdays and weekends, primarily stemming from evolving student lifestyle patterns. On weekends, a significant decline in the utilization of teaching buildings and libraries is observed as many students either stay in dormitories or return home. Weekdays see a comparatively high amount of plastic garbage in these two locations, whereas weekends see a relatively low amount. In male and female dorm buildings, the quantity of plastic garbage is correspondingly lower during the week and higher during the weekend. In comparison to other universities, the study also revealed that Xi'an Shiyou University's student waste and plastic usage per capita are at a low level. A strength of this study lies in the fact that it establishes a solid theoretical basis for further exploration and policy formulation.[30]

A descriptive cross-sectional study was conducted to assess the knowledge and practice of university students toward the no-plastic bag campaign as a means of controlling plastic pollution in 2023. A multi-stage sampling technique consisting of cluster and stratified sampling methods was used to recruit the 380 undergraduates that participated in the study.

The study examined the students' practices and whether or not they were geared towards reducing plastic pollution. Results showed that the practice that ranked highest was the reuse and recycling of plastic products. About 63.4% of respondents always practice recycling, while 61.1% always dispose of plastic waste instead of littering them.[31]

In 2019, a study conducted at the Federal University of Agriculture, Abeokuta (FUNAAB), and the University of Ibadan (UI) in western Nigeria aimed to assess the intentions of Nigerian university students regarding plastic waste sorting. The study collected responses from 444 students at FUNAAB and 495 students at UI, all at the undergraduate level and aged between 18 and 34 years old. Results showed that the students had a good attitude towards plastic waste management as they were willing to participate in activities like waste sorting that reduce plastic pollution.[32]

Similarly, a cross-sectional study was carried out at the University of Lagos (UNILAG), Akoka, to ascertain the awareness and practices of students as regards plastic waste. A total of eighty (80) questionnaires were filled, and five (5) groups of ten (10) students were interviewed. Results showed that most students in the faculty of Environmental Sciences use plastic more than once daily, with water bottles and beverage containers (carbonated drinks) being the highest constituents of these wastes. Of the respondents, 65 (65.4%) of the students in the faculty, the majority disposed of their plastic garbage in the general waste bin, 38 percent in the plastic waste bin, 11 percent scattered it around, and the other 2 percent threw it on the floor.[33]

2.4 FACTORS THAT CONTRIBUTE TO PLASTIC POLLUTION

A 2023 cross-sectional study was conducted among a total of 537 university students in Romania to examine the effects of the needs and awareness of university students on their environmental behavior. On the factors affecting plastic pollution, the study directly identified lack of student awareness as a factor that will contribute to plastic pollution, while suggesting that through university policies and educational programs, plastic pollution can be reduced within the university environment.[34]

A study was conducted at the Faculdade UnB Planaltina (FUP) campus of the University of Brasilia in the Federal District, Brazil, in 2021 to determine the quantity, composition, and recycling potential of waste generated within the campus, as well as develop a waste management strategy compatible with national legislation and sustainable global practices. Results from the study identified certain barriers/challenges that hinder proper plastic and waste management, thereby contributing to plastic pollution. These barriers included a lack of personal motivation of students to participate in the selective collection, a lack of knowledge on how to selectively dispose of waste, and the need to institutionalize the actions of extension projects. In a bid to address these challenges, the study highlighted the need to engage the academic and university community towards a focus on socio-environmental responsibility and its role in managing waste effectively. As such, the target audience, including staff operational, academic staff, administrative staff, and undergraduate and graduate students, will be reached out to communicate the need for proper waste disposal. The fact that the study identifies challenges towards proper waste management and ways to tackle these challenges makes it vital research with value.[10]

A cross-sectional study was conducted among 385 students to assess students' attitudes and practices toward plastic use at an Islamic university in Uganda in 2015. The study also assessed

factors that contributed to the practice of plastic use among undergraduates. Results revealed that plastic bag waste appeared in a very high proportion in the solid waste stream on the university campus. Factors that contributed to this finding were ineffective programs on waste littering and illegal dumping, low public awareness, and inadequate accessibility to plastic bag alternatives.[35]

Similarly, a descriptive cross-sectional study assessed the knowledge, attitude, and practices towards plastic waste as an environmental nuisance of students in Vietnam in 2023 among 240 students. The study assessed the factors that affect the reduction of students' use of plastic products as a means of controlling plastic pollution. It revealed four factors that tended to affect students' behavior to reduce plastic product use. The factors are the existence of environmentally friendly alternatives that must be widely used and popularized in the community, specific policies and regulations guiding plastic use, the influence of relatives and friends, and the effect of influential people in society. If these factors are in place, the use of plastic products among undergraduates will be controlled to reduce plastic pollution. However, in the absence of these factors, plastic pollution will persist.[2]

A qualitative study was conducted at the Universiti Tun Hussein Onn Malaysia (UTHM) Pagoh Campus, a new branch of the UTHM Onn campus, focusing on solid waste management (SWM) implementation in 2021. The study focused on solid waste as a whole, of which plastic is a part. The study employed interview sessions as the primary method of data collection, following an initial phase of waste characterization using quantitative methods to identify types and quantities of waste generated on campus. Stakeholders of the campus were selected as target respondents for the interviews, given their familiarity with SWM planning and implementation. The interview questions covered various aspects of SWM practices, challenges faced in practicing proper SWM on campus, and recommendations for improvement. Each interview session lasted approximately 30 minutes, with recordings and

notes taken for analysis. Results showed that factors affecting SWM on campus included low awareness among the university community, issues of laziness, lack of SWM specialists, absence of policies and guidelines, and inadequate facilities for waste segregation.[36]

CHAPTER THREE

MATERIAL AND METHODS

3.1 STUDY AREA

Edo State, one of Nigeria's 36 states, is located in the southern region and is part of the South-South geographical zone. It comprises three senatorial districts and eighteen local government areas. Divided into Edo and Delta in 1991, the state is the 22nd largest by landmass and has a total landmass of 17,802 square miles. Its population is projected to be 4,776,000, with the majority being the Edo people, including Benin, Esan, Owan, and Afemai. Benin City is its capital. There are seven (7) universities in the state, comprising one federal university, two state universities, and four private universities.[37]

Ovia North-East Local Government Area (LGA), one of Edo State's eighteen (18) local government areas, is home to the University of Benin. The Nigerian federal government owns this public university. Initially established as an institute of technology, it was granted full university status on July 1st, 1971, by the National Universities Commission. The institution was formed in 1970. Originally controlled by the state government, the institution was taken over by the federal government on April 1, 1975, at the state government's request, and became a federal university.[38]

The institution's two campuses are in Ugbowo and Ekenwan. Currently serving as Vice Chancellor is Professor Lilian I. Salami. The National Universities Commission (NUC), Nigeria, has granted the university formal accreditation and recognition. It provides courses and programs in several subject areas that lead to legally recognized higher education degrees. There are 38,309 full-time students enrolled, along with 4,000–4,499 academic staff members. Agriculture, Arts, Education, Engineering, Environmental Sciences, Humanities, Life Sciences, Management Sciences, Pharmacy, Physical Sciences, Social Sciences, and

Veterinary Medicine are among the faculties at UNIBEN. The Basic Clinical Sciences, Basic Medical Sciences, Medicine, Dentistry, and Institute of Child Health comprise the College of Medical Sciences.[38]

3.2 STUDY DESIGN

A descriptive cross-sectional study design was used for this study.

3.3 STUDY POPULATION

The study was carried out amongst undergraduate students of the University of Benin, Benin City, Edo State.

3.4 STUDY DURATION

This study was carried out between May 2023 and September 2024.

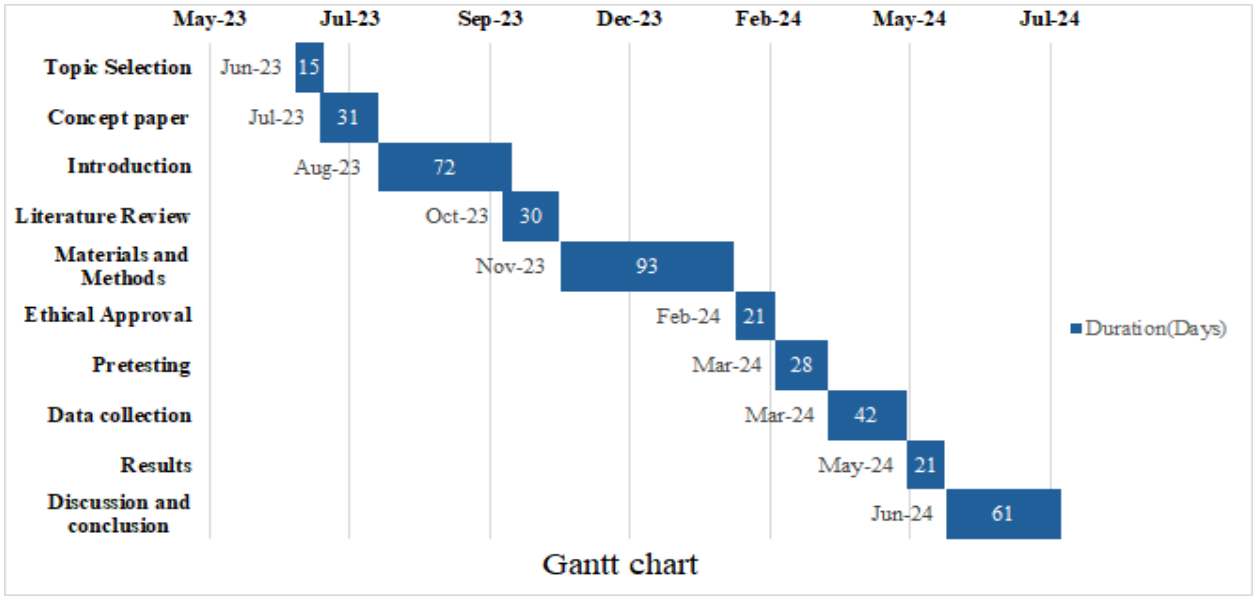

Figure 1: Gantt chart showing the work plan of the one-year project

3.5 SELECTION CRITERIA

3.5.1 Inclusion criteria:

i. Full-time students who were present at the time of data collection.

ii. Students who had spent at least a year in the university.

iii. Students who gave consent for the study.

3.5.2 Exclusion Criteria:

i. Students who were too ill to participate in the study.

3.6 SAMPLE SIZE DETERMINATION

This was calculated using Cochran's formula for descriptive study. [39]

$$n = \frac{Z^2 pq}{d^2}$$

Where:

n = Minimum Sample Size.

Z = Standard normal deviation set at 95% confidence interval (1.96).

p = Prevalence rate of a particular characteristic of the target population

p = 81.4%, which is the proportion of students in a tertiary institution in South Africa who had a negative attitude towards plastic pollution.[26]

p = 0.814

q = 1−p = 1 - 0.814 = 0.186

d = Degree of precision set at 0.05 Confidence interval

Hence:

$$n = \frac{(1.96)^2 \times (0.186) \times (0.814)}{(0.05)^2}$$

$= 233$

To account for non-response, a 10% non-response rate was added to the minimum sample size, utilizing the formula for non-response rate.

$$n_f = \frac{n}{1 - n_r}$$

n = Minimum sample size = 233

n_r = Non-response rate = 10% = 0.10

n_f = Final minimum sample size

$$= \frac{233}{1\text{-}0.10} = \frac{233}{0.90} = 259$$

A design effect of 2 was used.

$= 259 \times 2 = 518$

Thus, the final minimum sample size for this study was 518.

For this study, a sample size of 520 was used.

3.7 SAMPLING METHOD

Respondents for the study were selected using a multi-stage sampling technique that involves four (4) stages.

Stage 1: Selection of Campus

The University of Benin has two campuses – Ugbowo and Ekehuan campuses. The campus of the University of Benin was selected using simple random sampling by balloting.

Stage 2: Selection of Faculties

A list of the faculties on the campus was obtained from the Central Records Processing Unit Division, University of Benin. The faculties of Medicine, Engineering, and Social Sciences were selected using simple random sampling by balloting.

Stage 3: Selection of Department

The total number of departments in the different faculties was obtained. The department of Medicine, Civil Engineering, and Social Works was selected from each of the faculties using simple random sampling by balloting.

Stage 4: Selection of Respondents

The total number of students per department was obtained using a stratified sampling technique. The individual respondents were selected using simple random sampling by balloting. The total number of students was 2031 comprising:

Medicine:	200: 155 students
	300: 154 students
	400: 335 students
	500: 309 students
	600: 125 students
Social Works:	200: 180 students
	300: 120 students
	400: 214 students

Civil engineering: 200: 98 students

300: 84 students

400: 160 students

500: 97 students

Sampling fraction = n/N

Where: n = sample size: 520

N = total population: 2031

Sampling fraction = 520/2031 = 0.256

The sample size of each stratum was calculated using the formula:

Sample size = Sampling fraction x Population of students in each stratum

Proportional allocation of students:

Medicine: 200: 155 x 0.256 = 39.680 ≈ 40

300: 154 x 0.256 = 39.424 ≈ 39

400: 335 x 0.256 = 85.476 ≈ 85

500: 309 x 0.256 = 79.104 ≈ 79

600: 125 x 0.256 = 32.000 ≈ 32

Social Works: 200: 180 x 0.256 = 46.080 ≈ 46

300: 120 x 0.256 = 30.720 ≈ 31

400: 214 x 0.256 = 54.784 ≈ 55

Civil engineering: 200: 98 x 0.256 = 25.088 ≈ 25

300: 84 x 0.256 = 21.504 ≈ 22

400: 160 x 0.256 = 40.960 ≈ 41

500: 97 x 0.256 = 24.832 ≈ 25

Total: 520

3.8 DATA COLLECTION

3.8.1 Tools for Data Collection

Data was obtained with a structured, self-administered questionnaire with close-ended and open-ended questions that sought to answer the study objectives. The questionnaire was divided into four sections to answer the study objectives – knowledge, attitude, practices, and factors of plastic pollution among undergraduate students.

The questionnaire was adapted from the University of Sharjah online survey questionnaire on plastic pollution.[40] The questionnaire is a tool designed to assess the knowledge, attitude, and practice of respondents on plastic pollution. It consists of several questions that measure the various aspects of plastic pollution to portray how much information about plastic pollution their students have acquired during their fundamentals of innovation and entrepreneurship course.

The questionnaire was grouped into five sections as follows:

Section A: Sociodemographic Data, which obtained information on the respondents such as age, sex, faculty, department, level, and socioeconomic status

Section B: Knowledge of plastic pollution

Section C: Attitudes towards plastic pollution

Section D: Practices that relate to plastic pollution

Section E: Factors that contribute to plastic pollution

3.8.2 Method of data collection

The pre-tested, structured questionnaires were self-administered at the University of Benin. The respondents were allowed to answer the questionnaires in or around the lecture theaters, where they would feel safe and their privacy was ensured. Informed consent was obtained from the respondents, who were assured of confidentiality.

3.8.3 Pretesting

The questionnaires were pre-tested at Delta State University, a public institution located in Abraka, Delta State, to determine the comprehensibility, validity, sensitivity, and reliability of the data taken, as it has students with similarities with the study population. Fifty-two questionnaires were used for pretesting, and observed errors were corrected before being utilized in this study.

3.8.4 Research Assistants

No research assistants were employed for this study. The administration of questionnaires, data collection, and data analysis were carried out by the authors of this study.

3.9 DATA ANALYSIS

The meticulous process of data management involved a thorough examination of each questionnaire, wherein manual checks, coding, and subsequent entry into the Statistical Package for the Social Sciences (SPSS) version 27 were meticulously carried out. Following this meticulous data entry phase, the analysis encompassed sociodemographic characteristics

of the respondents, knowledge of plastic, attitude towards plastic pollution, practices that relate to plastic pollution, and factors that contribute to plastic pollution.

Univariate analysis was carried out on sociodemographic variables and presented as frequencies and percentages. Bivariate analysis was carried out for parametric and non-parametric data.

Multivariate analysis using binary logistic regression was carried out to further determine the significant predictors of outcome variables, such as factors that contribute to plastic pollution. Exploratory variables that were associated with the outcome variable in univariate analysis were included in the initial logistic models of multivariable analysis. The crude and adjusted odds ratio together with their corresponding 95% confidence intervals was computed. The level of significance for all statistical associations was set at $p < 0.05$.

SCORING SYSTEM

Knowledge Score

Knowledge was assessed under five domains with a total of 33 questions, which covered knowledge of the meaning of plastic pollution, knowledge of the methods to control plastic pollution, knowledge of the plastic waste materials, knowledge on the causes of plastic pollution, and knowledge on the effects of plastic pollution. Questions with the most appropriate response were assigned a score of 1, and those with inappropriate responses or incorrect answers were assigned a score of 0. Scores were collated and converted to percentages.

The percentage of knowledge scores was categorized into poor knowledge (0–49.9%), which corresponds to 0–16 scores, and good knowledge (≥ 50.0%), which corresponds to 17–33 scores.

Attitude Score

The attitude towards plastic pollution was assessed with twelve (12) questions using different 5-point Likert scales, for example: strongly agree = 5, agree = 4, undecided = 3, disagree = 2, and strongly disagree = 1. Questions with the most appropriate response were assigned a score of 1, and those with inappropriate responses or incorrect answers were assigned a score of 0. The total minimum attainable score was 1, and the maximum was 12. A score of 6 represents the exact midpoint corresponding to the overall neutral attitude against plastic pollution. Respondents having a score of 7 and above were categorized as having a positive attitude toward plastic pollution, while those scoring below 7 were categorized as having a negative attitude toward plastic pollution.

Practices Score

Practice was assessed in six domains with a total of six (6) questions. Questions with the most appropriate response were assigned a score of 1, and those with inappropriate responses or incorrect answers were assigned a score of 0. Scores were collated and converted to percentages.

The percentage of practices score was categorized into the inappropriate practice towards plastic pollution (0%–49.9%), which corresponds to 0–6 score, and the appropriate practice towards plastic pollution (≥ 50.0%), which corresponds to 7–12 score.

Average Monthly Income

This will be scored as <40,000 and ≥40,000 based on the Edo State minimum wage.

3.10 DATA PRESENTATION

The results obtained from the study were comprehensively presented using frequency distribution tables to display the number of occurrences for each category or value, contingency tables to show the relationship between two or more categorical variables, charts (including bar charts, pie charts, line graphs, and histograms) to provide visual representations of data for easier interpretation, and prose to provide a detailed narrative explanation of the data and its implications, summarizing key findings, interpreting results, and discussing their significance.

3.11 ETHICAL CONSIDERATIONS

Ethical approval and permission to carry out the study were obtained from the Health Research Ethics Committee of the University of Benin Teaching Hospital (ADM/E 22/A/VOL. VII/1486549132). Informed consent was taken from the respondents before administering the questionnaires. Confidentiality was maintained, as no name or address will be requested. The respondents were informed that they have the right to withdraw from the study at any time and that withdrawal poses no loss or harm.

3.12 LIMITATIONS

This study relied on information provided by respondents and may be limited by errors that may be introduced due to recall bias. Some respondents may have given false information or even withheld information.

CHAPTER FOUR

RESULTS

Five hundred and twenty (520) questionnaires were distributed, out of which five hundred and twenty (520) were retrieved, giving a response rate of 100.0%.

The result was represented in the following sections:

Section A: Sociodemographic of respondents.

Section B: Knowledge of plastic pollution.

Section C: Attitude towards plastic pollution.

Section D: Practices relating to plastic pollution.

Section E: Factors contributing to plastic pollution.

SECTION A:

SOCIODEMOGRAPHIC CHARACTERISTICS

TABLE 1a: SOCIODEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Variables	Frequency (n=520)	Percent
Age (Years)		
15 – 24	455	87.5
25 – 34	56	10.8
35 – 44	9	1.7
Mean ± St.D: 21.28 ± 3.91		
Sex		
Female	242	46.5
Male	278	53.5
Faculty		
Medicine	275	52.9
Social science	132	25.4
Engineering	113	21.7
Department		
Medicine	275	52.9
Social works	132	25.4
Civil engineering	113	21.7
Level		
200	111	21.3
300	92	17.7
400	181	34.8
500	104	20.0
600	32	6.2
Marital Status		
Single	498	95.8
Married	17	3.3
Cohabiting	2	0.4
Separated/divorced	3	0.6
Religion		
Christianity	498	95.8
Islam	13	2.5
ATR	5	1.0
Others*	4	0.8

*Atheists, Agnostic

Four hundred and fifty-two respondents (87.5%) were between the age of 15 - 24 years while those respondents 35 - 44 years were only 9 (1.7%). The respondents were more males (278 (53.5%) than females 242 (46.5%). More than half of the students, 275 (52.9%), are medical students, while 113 (21.7%) are engineering students studying civil engineering. One hundred and eighty-one (34.8%) respondents were 400 level students, while 32 (6.2%) were 600 level students. The majority (498 (95.8%) of the respondents were single, while only 2 (0.4%) were cohabiting. Four hundred and ninety-eight respondents (95.8%) were Christians, while four (0.8%) were practicing other religions apart from Islam and African traditional religions.

TABLE 1b: SOCIODEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Variables	Frequency (n=520)	Percent
Ethnic group		
Bini	154	29.6
Igbo	103	19.8
Esan	74	14.2
Owan	25	4.8
Etsako	19	3.7
Ibibio	7	1.3
Ijaw	7	1.3
Isoko	7	1.3
Igala	6	1.2
Ika	6	1.2
Hausa	5	1.0
Idoma	4	0.8
Itsekiri	4	0.8
Others*	3	0.6
Place of Residence		
Hostels (on campus)	212	40.8
Hostels (off campus)	162	31.2
Private residence (off campus)	121	23.3
Private residence (on campus)	25	4.8
Average Monthly Income		
< 40,000	309	59.4
≥ 40,000	211	40.6

* Efik, Oza, Somorika,

Most of the respondents were Benin and Edo indigenes. Two hundred and twelve respondents (40.8%) were residing in hostels inside the campus. More than half 309 (59.4%) of the respondents had an average monthly income of less than 40,000.

SECTION B:

KNOWLEDGE OF PLASTIC POLLUTION

TABLE 2: KNOWLEDGE OF PLASTIC POLLUTIONAMONG UNIVERSITY STUDENTS

Variables	Frequency (n=520)	Percent
Definition of Plastic pollution*		
Accumulation of plastic objects in the environment	445	85.6
Plants release plastic into the air	79	15.2
Type of land pollution	14	2.7
Types of plastic*		
Water bottles	424	81.5
Straws	313	60.2
Beverage containers	313	60.2
Nylon bags	308	59.2
Pipes	285	54.8
CDs and DVDs	179	34.4
Styrofoam	142	27.3
Glass	33	6.3
Wood	21	4.0
Causes of plastic pollution*		
Inadequate disposal infrastructure	390	75.0
Unstrict rules and regulation	324	62.3
Availability of plastics	182	35.0
Political views	69	13.3
Religion beliefs	33	6.3
Effects of plastic pollution*		
Destruction of marine habitats	470	90.4
Contamination of soil and water sources	437	84.0
Choking and entanglement of wildlife	414	79.6
Release of toxic chemicals into the environment	381	73.3
Acceleration of climate change	257	49.4
Promotion of biodiversity in ecosystems	132	25.4
Promotion of environmental health	66	12.7
Enhancement of air quality	63	12.1
Promotion of healthy ecosystems	57	11.0
Control of plastic pollution*		
Recycling	457	87.9
Conversion into valuable materials	293	56.3
Incineration	148	28.5
Disposal in landfills	85	16.3
Microbial degeneration	62	11.9
Indiscriminate burning of plastics	37	7.1
Boiling of plastics	19	3.7

***Multiple response questions**

The majority 445 (85.6%) of the respondents chose accumulation of plastic objects in the environment as the meaning of plastic pollution. A large number (424 (81.5%) chose water bottles as a type of plastic, while 21 (4.0%) chose wood. Inadequate disposal infrastructure, 390 (75.0%), unstrict rules and regulations, 324 (62.3%), and availability of plastics, 182 (35.0%) are the major causes of plastic pollution. Destruction of marine habitats, 470 (90.4%), was the major effect of plastic pollution, while promotion of healthy ecosystems, 57 (11.0%), was the least. Four hundred and fifty-seven respondents (87.9%) chose recycling as the method for plastic pollution control, while 19 (3.7%) chose boiling of plastics.

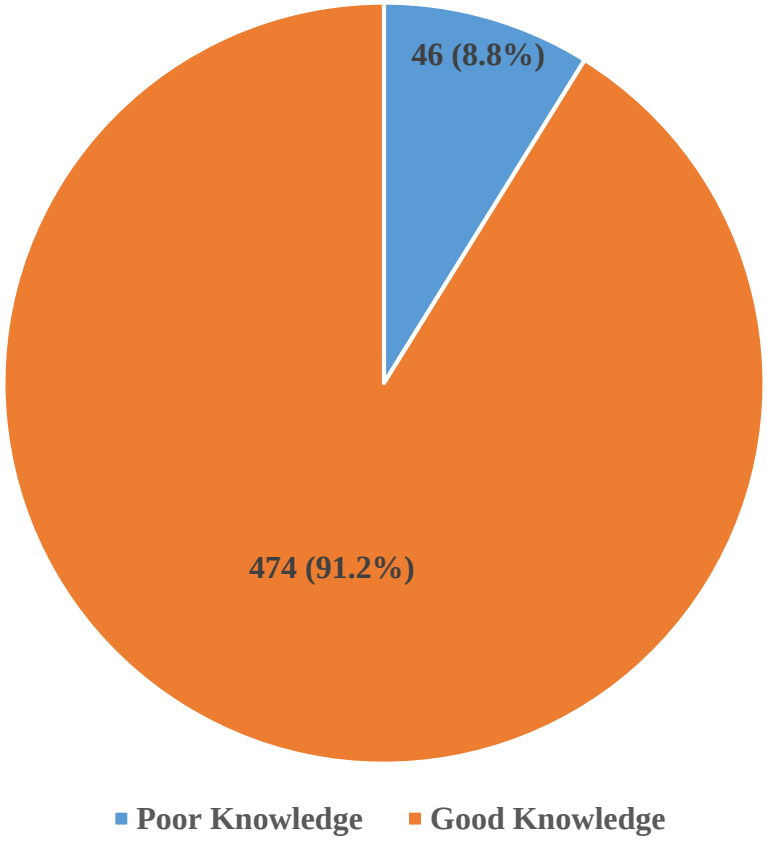

Figure 2: Respondents' overall knowledge of plastic pollution

The majority of the respondents, 474 (91.2%), had good knowledge of plastic pollution, while 46 (8.8%) had poor knowledge of plastic pollution.

TABLE 3a: RELATIONSHIP BETWEEN RESPONDENTS' SOCIODEMOGRAPHIC CHARACTERISTICS BY OVERALL KNOWLEDGE OF PLASTIC POLLUTION

Variables	Overall Knowledge		Statistics	*p*-value
	Good (n=474) n (%)	Poor (n=46) n (%)		
Age (Years)				
15 - 24	419 (92.1)	36 (7.9)	Fishers Exact = 6.852	**0.026***
25 - 34	49 (87.5)	7 (12.5)		
35 - 44	6 (66.7)	3 (33.3)		
Sex				
Female	218 (90.1)	24 (9.9)	$\chi^2 = 0.644$	0.442
Male	256 (92.1)	22 (7.9)		
Department				
Medicine	259 (94.2)	16 (5.8)	$\chi^2 = 8.675$	**0.014***
Social works	119 (90.2)	13 (9.8)		
Civil engineering	96 (85.0)	17 (15.0)		
Level				
200	101 (91.0)	10 (9.0)	$\chi^2 = 6.927$	0.137
300	85 (92.4)	7 (7.6)		
400	158 (87.3)	23 (12.7)		
500	99 (95.2)	5 (4.8)		
600	31 (96.9)	1 (3.1)		
Marital Status				
Single	454 (64.5)	44 (8.8)	Fisher Exact = 0.994	0.785
Married	15 (47.1)	2 (11.8)		
Cohabiting	2 (100.0)	0 (0.0)		
Separated/divorced	3 (100.0)	0 (0.0)		

***Statistically significant, χ^2 = Chi-Square**

Respondents 419 (92.1%) aged 15 - 24 had the highest proportion of respondents with good knowledge; the relationship between age group and knowledge of plastic pollution (fishers exact = 6.852, p = 0.026) was statistically significant. The relationship between sex and knowledge of plastic pollution ($\chi2 = 0.644$, $p = 0.442$) was not statistically significant. A greater proportion of respondents from medicine, 259 (94.2%) were more likely to have good knowledge of plastic pollution. The relationship between the department of the respondents and their knowledge of plastic pollution was statistically significant ($\chi2 = 8.675$, $p = 0.014$). The majority, 31 (96.9%) of the respondents in 600 level had good knowledge of plastic pollution; the relationship between respondent's level and their knowledge of plastic pollution ($\chi2 = 6.927$, $p = 0.137$) was not statistically significant. Respondents 3 (100.0%) and 2 (100.0%) who were separated or divorced and cohabiting, respectively, had the highest proportion with good knowledge; the relationship between marital status and knowledge of plastic pollution (fishers exact = 0.994, p = 0.785) was not statistically significant.

TABLE 3b: **RELATIONSHIP BETWEEN RESPONDENTS' SOCIODEMOGRAPHIC CHARACTERISTICS BY OVERALL KNOWLEDGE OF PLASTIC POLLUTION**

Variables	**Overall Knowledge**		**Statistics**	***p*-value**
	Good (n=474) n (%)	**Poor (n=46) n (%)**		
Religion				
Christianity	454 (91.2)	44 (8.8)	Fisher exact = 3.892	0.201
Islam	13 (100.0)	0 (0.0)		
ATR	4 (80.0)	1 (20.0)		
Others	3 (75.0)	1 (25.0)		
Place of Residence				
Hostels (on campus)	203 (95.8)	9 (4.2)	$\chi^2 = 15.594$	**0.002***
Hostels (off campus)	147 (90.7)	15 (9.3)		
Private residence (on campus)	19 (76.0)	6 (24.0)		
Private residence (off campus)	105 (86.8)	16 (13.2)		
Average Monthly Income				
<40,000	283 (91.6)	26 (8.4)	$\chi^2 = 0.176$	0.754
≥40,000	191 (90.5)	20 (9.5)		

***Statistically significant, χ^2 = Chi-Square**

Respondents 13 (75.0%) who were Muslims had the highest proportion of respondents with good knowledge, the relationship between religion and knowledge of plastic pollution (fishers exact = 3.892, p = 0.201) was not statistically significant. A greater proportion of respondents who reside in hostels on campus, 203 (95.8%), were more likely to have good knowledge of plastic pollution. The relationship between the place of residence and their knowledge of plastic pollution was statistically significant ($\chi 2$ = 15.594, p = 0.002). Most, 283 (91.6%) of the respondents with an average monthly income of <40,000 had good knowledge of plastic pollution; the relationship between the respondent's average monthly income and their knowledge of plastic pollution ($\chi 2$ = 0.176, p = 0.754) was not statistically significant.

TABLE 4: PREDICTORS OF RESPONDENTS' KNOWLEDGE OF PLASTIC POLLUTION

Variable	B coefficient	Exp B (OR)	95% CI		*p*-value
			Min.	Max.	
Age (Years)	- 0.062	0.940	0.881	1.003	0.060
Sex					
Females		1*			
Males	0.618	1.855	0.971	3.542	0.061
Department					
Medicine		1*			
Social works	- 0.736	0.479	0.215	1.067	0.072
Civil engineering	- 1.309	0.270	0.125	0.582	**<0.001****
Place of Residence					
Hostels (on and off campus)		1*			
Private residence (on and off campus)	- 0.842	0.431	0.225	0.823	**0.011****

***Reference Category, **Statistically significant, OR - Odds Ratio, CI - Confidence Interval**

Increasing respondents age was 0.940 times less likely to have good knowledge of plastic pollution with an OR of 0.940 (CI = 0.881 – 1.003, p = 0.060), however, this was statistically insignificant. Male respondents were 1.855 times more likely to have good knowledge than female respondents, with an OR of 1.855 (CI = 0.971 - 3.542, p = 0.061). This was not statistically significant. Respondents in non-medical departments (civil engineering) were 0.270 times less likely to have good knowledge of plastic pollution than those in medical departments with an OR of 0.270 (CI = 0.125 - 0.582, p = <0.001). This was statistically significant. Respondents who reside in private residences (on and off campus) were 0.431 times less likely to have good knowledge of plastic pollution than those who reside in hostels (on and off campus), with an OR of 0.431 (CI = 0.225 – 0.832, p = 0.011); this was statistically significant.

SECTION C:

ATTITUDE TOWARDS PLASTIC POLLUTION

TABLE 5: ATTITUDE OF RESPONDENTS TOWARD PLASTIC POLLUTION AMONG UNIVERSITY STUDENTS

Variable	SA n (%)	A n (%)	U n (%)	D n (%)	SD n (%)
Plastic pollution is a significant environmental issue.	354 (68.1)	155 (29.8)	3 (0.6)	5 (1.0)	3 (0.6)
All plastics can be recycled.	185 (35.6)	211 (40.6)	80 (15.4)	35 (6.7)	9 (1.7)
Individuals have a responsibility to reduce their plastic usage.	212 (40.8)	198 (38.1)	69 (13.3)	31 (6.0)	10 (1.9)
Government regulations should be stricter to reduce plastic pollution.	276 (53.1)	185 (35.6)	29 (5.6)	15 (2.9)	15 (2.9)
Disposing of plastics in gutters is good.	26 (5.0)	30 (5.8)	38 (7.3)	93 (17.9)	333 (64.0)
Using other alternatives in place of plastics is advisable.	148 (28.5)	226 (43.5)	97 (18.7)	28 (5.4)	21 (4.0)
Plastic waste is a problem for health and the environment.	258 (49.6)	206 (39.6)	32 (6.2)	18 (3.5)	6 (1.2)
Do you feel the need to look for a dustbin to dispose of plastic soda cans after use?	263 (50.6)	194 (37.3)	43 (8.3)	14 (2.7)	6 (1.2)
Do you feel concerned when you see people throwing plastic cans into gutters?	208 (40.0)	207 (39.8)	75 (14.4)	21 (4.0)	9 (1.7)
Do you feel like it is your social obligation not to litter the environment with plastic products?	264 (50.8)	193 (37.1)	43 (8.3)	10 (1.9)	10 (1.9)
Environmental sanitation helps reduce plastic pollution.	338 (65.0)	162 (31.2)	8 (1.5)	7 (1.3)	5 (1.0)
Children should not be taught about plastic pollution.	44 (8.5)	30 (5.8)	18 (3.5)	71 (13.7)	357 (68.7)

***(n=520)**

***SA = Strongly Agree, A = Agree, U = Undecided, D = Disagree, SD = Strongly Disagree**

More than half, 354 (68.1%), of respondents strongly agreed that plastic pollution is a significant environmental issue while 3 (0.6%) strongly disagreed with it. Two hundred and eleven (40.6%) of the respondents agreed that all plastics can be recycled, while nine (1.7%) strongly disagreed that all plastics can be recycled. Two hundred and twelve (40.8%) strongly agreed that individuals have a responsibility to reduce their plastic usage; however, 10 (1.9%) strongly disagreed with this. More than half (276 (53.1%) of the respondents strongly agreed that government regulations should be stricter to reduce plastic pollution, while 15 (2.9%) strongly disagreed. Three hundred and thirty-three (64.0%) strongly disagreed that disposing of plastics in gutters is good, while 26 (5.0%) strongly agreed with it. Two hundred and twenty-six (43.5%) of the respondents agreed that using other alternatives in place of plastic is advisable, while 21 (4.0%) strongly disagreed. About half, 258 (49.6%), strongly agreed that plastic waste is a problem for health and the environment; however, 6 (1.2%) strongly disagreed. Two hundred and sixty-three (50.6%) strongly agreed that they feel the need to look for a dustbin to dispose of plastic soda cans after use, while six (1.2%) strongly disagreed. Two hundred and eight (40.0%) strongly agreed that they feel concerned when they see people throwing plastic cans into gutters, while nine (1.7%) strongly disagreed with it. Two hundred and sixty-four (50.8%) strongly agreed that they feel like it is their social obligation not to litter the environment with plastic products; however, 10 (1.9%) strongly disagreed. More than half, 338 (65.0%), of the respondents strongly agreed that environmental sanitation helps reduce plastic pollution, while 5 (1.0%) strongly disagreed. Three hundred and fifty-seven (68.7%) of the respondents strongly disagreed that children should not be taught about plastic pollution, while 18 (3.5%) were undecided.

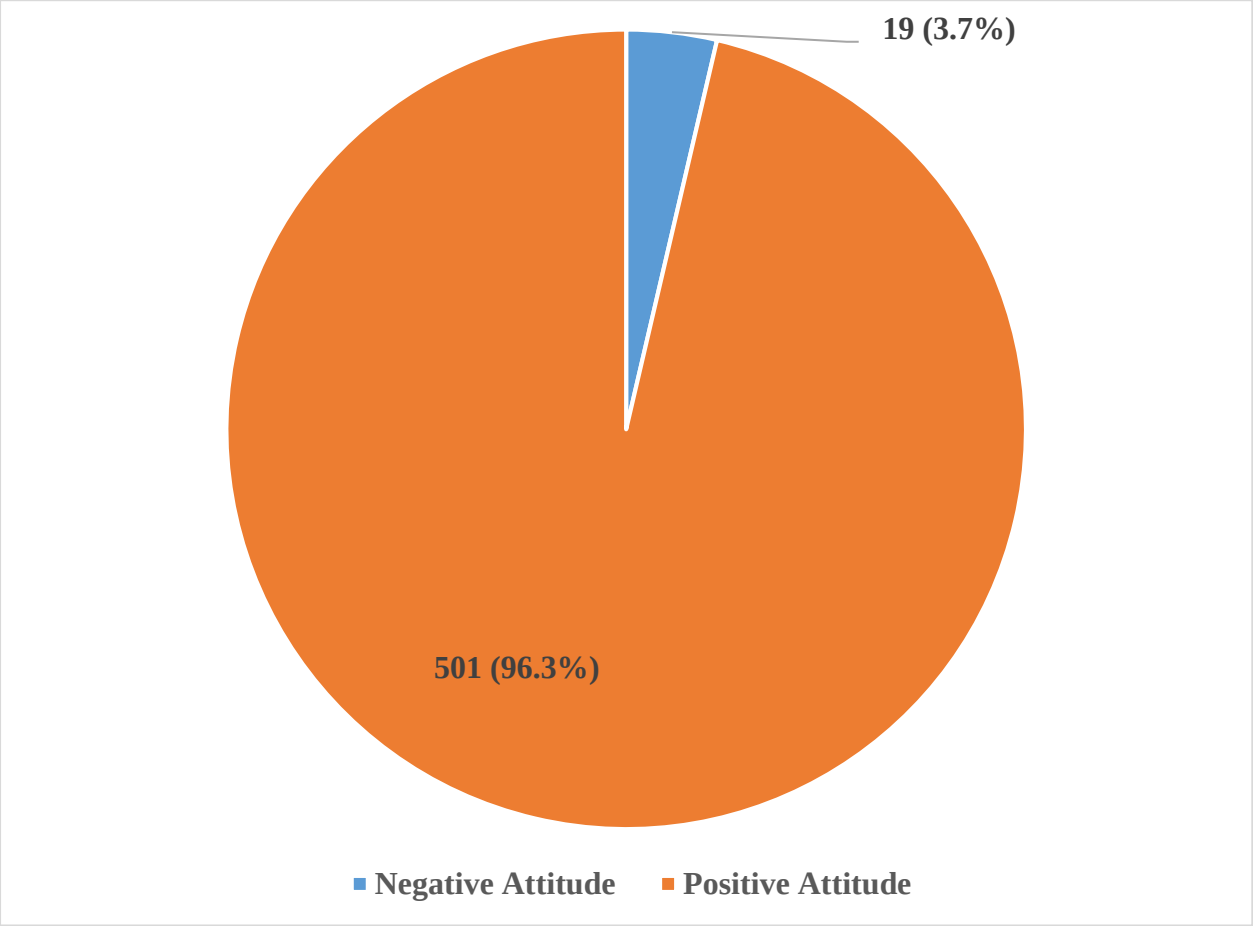

Figure 3: Respondents' overall attitude toward plastic pollution

The majority of the respondents, 501 (96.3%), had a positive attitude toward plastic pollution while 19 (3.7%) had a negative attitude against plastic pollution.

TABLE 6a: ASSOCIATION BETWEEN RESPONDENTS' SOCIODEMOGRAPHIC CHARACTERISTICS BY OVERALL ATTITUDE TOWARD PLASTIC POLLUTION

Variables	Overall Attitude		Statistics	*p*-value
	Positive (n=501) n (%)	**Negative (n=19) n (%)**		
Age (Years)				
15 - 24	443 (97.4)	12 (2.6)	Fishers exact = 10.085	**0.006***
25 - 34	49 (87.5)	7 (12.5)		
35 - 44	9 (100.0)	0 (0.0)		
Sex				
Female	233 (96.3)	9 (3.7)	χ^2 = 0.005	>0.999
Male	268 (96.4)	10 (3.6)		
Department				
Medicine	263 (95.6)	12 (4.4)	Fishers Exact = 0.661	0.706
Social works	128 (97.0)	4 (3.0)		
Civil engineering	110 (97.3)	3 (2.7)		
Level				
200	109 (98.2)	2 (1.8)	Fishers Exact = 10.285	**0.022***
300	92 (100.0)	0 (0.0)		
400	168 (92.8)	13 (7.2)		
500	101 (97.1)	3 (2.9)		
600	31 (96.9)	1 (3.1)		
Marital Status				
Single	479 (96.2)	19 (3.8)	Fishers Exact = 1.617	>0.999
Married	17 (100.0)	0 (0.0)		
Cohabiting	2 (100.0)	0 (0.0)		
Separated/divorced	3 (100.0)	0 (0.0)		

***Statistically significant, χ^2 = Chi-Square**

Respondents 9 (100.0%) aged 35 - 44 had the highest proportion of respondents with positive attitudes, the relationship between age group and attitude towards plastic pollution (fishers exact = 10.085, p = 0.006) was statistically significant. The relationship between sex and attitude towards plastic pollution ($\chi 2$ = 0.005, p = >0.999) was not statistically significant. A greater proportion of respondents from civil engineering, 110 (97.3%), were more likely to have a positive attitude towards plastic pollution. The relationship between the department of the respondents and their attitude towards plastic pollution was not statistically significant (fishers exact = 0.661, p = 0.706). The majority, 92 (100.0%) of the respondents in 300 level had a positive attitude towards plastic pollution; the relationship between the respondent's level and their attitude towards plastic pollution (fishers exact = 10.285, p = 0.022) was statistically significant. Respondents 2 (100.0%), 3 (100.0%), and 17 (100.0%) who were cohabiting, separated, or divorced and married, respectively, had the highest proportion with a positive attitude; the relationship between marital status and attitude towards plastic pollution (fishers exact = 1.617, p = >0.999) was not statistically significant.

TABLE 6b: ASSOCIATION BETWEEN RESPONDENTS' SOCIODEMOGRAPHIC CHARACTERISTICS BY OVERALL ATTITUDE TOWARD PLASTIC POLLUTION

Variables	Overall Attitude		Statistics	*p*-value
	Positive (n=501) n (%)	**Negative (n=19) n (%)**		
Religion				
Christianity	481 (96.6)	17 (3.4)	Fishers Exact = 4.997	0.189
Islam	11 (84.6)	2 (15.4)		
ATR	5 (100.0)	0 (0.0)		
Others	4 (100.0)	0 (0.0)		
Place of Residence				
Hostels (on campus)	207 (97.6)	5 (2.4)	Fishers Exact = 3.567	0.267
Hostels (off campus)	154 (95.1)	8 (4.9)		
Private residence (on campus)	23 (92.0)	2 (8.0)		
Private residence (off campus)	117 (96.7)	4 (3.3)		
Average Monthly Income				
<40,000	298 (96.4)	11 (3.6)	$\chi^2 = 0.019$	>0.999
≥40,000	203 (96.2)	8 (3.8)		
Knowledge				
Poor	43 (93.5)	3 (6.5)	$\chi^2 = 1.179$	0.398
Good	458 (96.6)	16 (3.4)		

χ^2 = Chi-Square

Respondents 5 (100.0%) and 4 (100.0%) who practiced African traditional religion and other religions respectively had the highest proportion of respondents with positive attitudes, the relationship between religion and attitude towards plastic pollution (fishers exact = 4.997, p = 0.189) was not statistically significant. The relationship between indigenes and their attitude toward plastic pollution ($\chi 2$ = 0.002, p = >0.999) was insignificant. A greater proportion of respondents who reside in hostels (on campus), 207 (97.6%), were more likely to have a positive attitude towards plastic pollution. The relationship between the place of residence and attitude towards plastic pollution was not statistically significant (fishers exact = 3.567, p = 0.267). Most, 257 (97.3%) of the respondents with an average monthly income of <30,000 had a positive attitude towards plastic pollution; the relationship between the respondent's average monthly income and attitude towards plastic pollution ($\chi 2$ = 1.530, p = 0.248) was not statistically significant. The majority, 458 (96.6%) of the respondents with good knowledge, had a positive attitude towards plastic pollution; the relationship between respondents' knowledge and attitude towards plastic pollution ($\chi 2$ = 1.179, p = 0.398) was not statistically significant.

TABLE 7: PREDICTORS OF RESPONDENTS' ATTITUDE TOWARD PLASTIC POLLUTION

Variable	B coefficient	Exp B (OR)	95% CI		*p*-value
			Min.	Max.	
Age (Years)	- 0.068	0.934	0.850	1.027	0.161
Sex					
Females		1*			
Males	-0.076	0.876	0.927	2.418	0.876
Department					
Medicine		1*			
Social works	0.361	1.435	0.437	4.710	0.551
Civil engineering	0.553	1.739	0.455	6.653	0.419
Place of Residence					
Hostels (on and off campus)		1*			
Private residence (on and off campus)	0.098	1.103	0.372	3.267	0.860
Knowledge					
Poor		1*			
Good	0.712	2.039	0.525	7.917	0.303

***Reference Category, OR – Odds Ratio, CI - Confidence Interval**

Increasing respondents age was 0.934 times less likely to have positive attitude toward plastic pollution with an OR of 0.934 (CI = 0.850 – 1.027, p = 0.161), however, this was not statistically significant. Male respondents were 0.876 times less likely to have a positive attitude toward plastic pollution than female respondents, with an OR of 0.876 (CI = 0.927 - 2.418, p = 0.876). This was statistically insignificant. Respondents in non-medical departments (civil engineering) were 1.739 times more likely to have a positive attitude toward plastic pollution than those in medical departments, with an OR of 1.739 (CI = 0.455 - 6.653, p = 0.419). This was statistically insignificant. Respondents who reside in private residences (on and off campus) were 1.103 times more likely to have a positive attitude toward plastic pollution than those who reside in hostels (on and off campus), with an OR of 1.103 (CI = 0.372 – 3.267, p = 0.860); this was not statistically significant. Those with good knowledge of plastic pollution were 2.039 times more likely to have a positive attitude toward plastic pollution than those with poor knowledge, with an OR of 2.039 (CI = 0.525 - 7.917, p = 0.303). This was statistically insignificant.

SECTION D:

PRACTICES RELATING TO PLASTIC POLLUTION

TABLE 8: PRACTICES RELATING TO PLASTIC POLLUTION AMONG UNIVERISTY STUDENTS

Variables	Frequency (n=520)	Percent
Plastic use in a week		
1 – 3	179	34.4
4 – 6	136	26.2
7 – 10	70	13.5
>10	135	26.0
Disposal of plastic*		
Dustbins	473	91.0
On the road	47	9.0
In the bush	41	7.9
On the floor	38	7.3
By burning	24	4.6
In gutters	18	3.5
In water bodies	13	2.5
Dispose of plastic indiscriminately.		
Yes	421	75.0
No	99	62.3
How often did you dispose of plastic indiscriminately (n=421)		
Always	196	46.6
Sometimes	196	46.6
Rarely	29	6.9
Disposed of plastics through car windows		
Always	11	2.1
Often	52	10.0
Sometimes	134	25.8
Rarely	224	43.1
Never	99	19.0
Packaging with excessive plastics		
Always	52	10.0
Often	131	25.2
Sometimes	183	35.2
Rarely	123	23.7
Never	31	6.0
Usage of empty plastics		
Always	102	19.6
Often	181	34.8
Sometimes	164	31.5
Rarely	53	10.2
Never	20	3.8

About one-third, 174 (34.4%), of the respondents use 1 - 3 plastic products in a week. Four hundred and seventy-three (91.0%) of the respondents dispose of their plastics in dustbins. More than two-thirds. 421 (75.0%) of the respondents have indiscriminately disposed of their plastics. About half, 196 (46.6%), of the respondents have always disposed of their plastic indiscriminately. Two hundred and twenty-four (43.1%) of the respondents rarely dispose of their plastics on the floor or through the car window. One hundred and eighty-three (35.2%) of the respondents sometimes use excessive plastic for packaging food and other items. About one-third, (34.8%), of the respondents often use their empty plastics to store other items or substances.

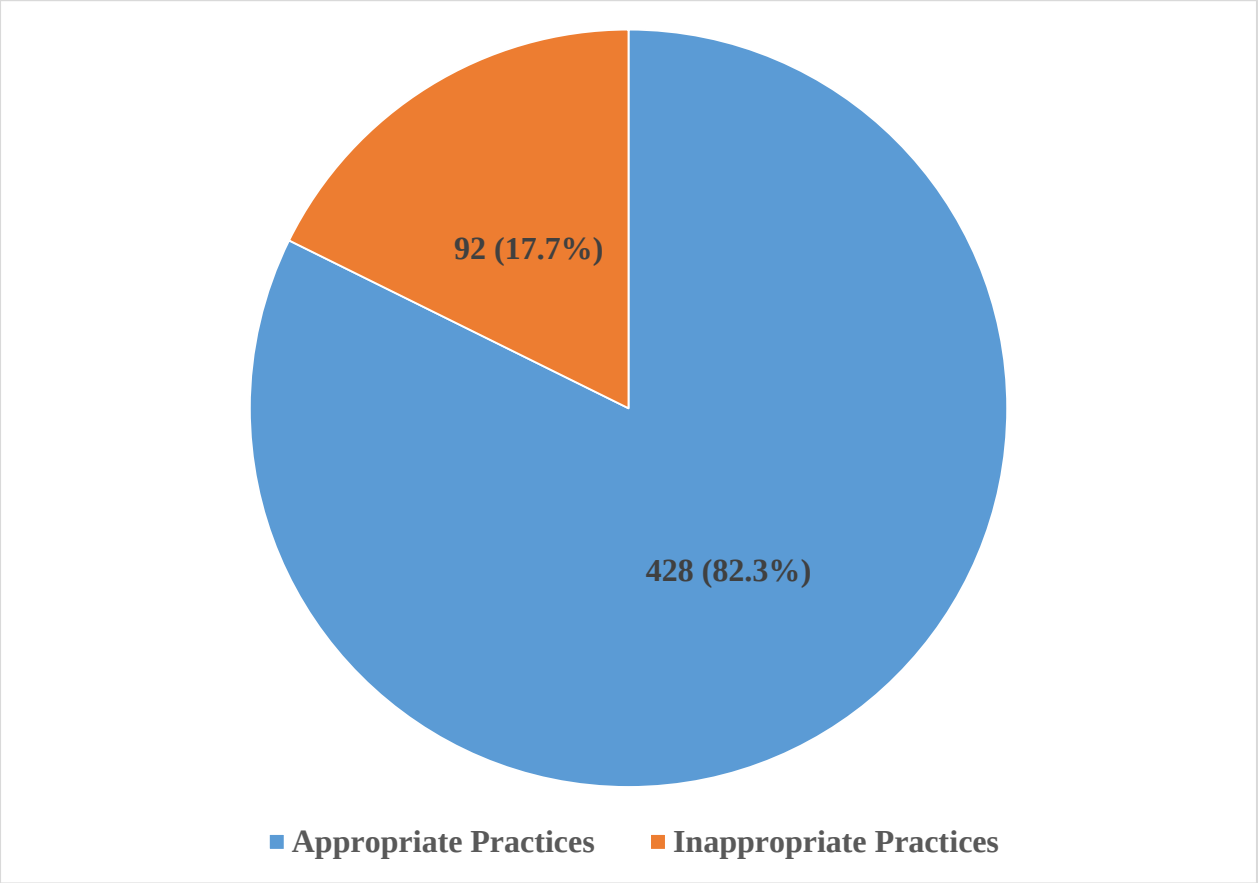

Figure 4: Respondents' overall practice towards plastic pollution

The majority of the respondents, 428 (82.3%), had appropriate practices toward plastic pollution while 92 (17.7%) had inappropriate practices.

TABLE 9a: RELATIONSHIP BETWEEN RESPONDENTS' SOCIODEMOGRAPHIC CHARACTERISTICS BY OVERALL PRACTICES TOWARDS PLASTIC POLLUTION

Variables	Overall Practice		Statistics	*p*-value
	Appropriate (n=428) n (%)	Inappropriate (n=92) n (%)		
Age (Years)				
15 - 24	380 (83.5)	75 (16.5)	$\chi^2 = 3.763$	0.141
25 - 34	41 (73.2)	15 (26.8)		
35 - 44	7 (77.8)	2 (22.2)		
Sex				
Female	209 (86.4)	33 (13.6)	$\chi^2 = 5.114$	**0.028***
Male	219 (78.8)	59 (21.2)		
Department				
Medicine	224 (81.5)	51 (18.5)	$\chi^2 = 4.232$	0.116
Social works	104 (78.8)	28 (21.2)		
Civil engineering	100 (88.5)	13 (11.5)		
Level				
200	95 (85.6)	16 (14.4)	$\chi^2 = 12.437$	**0.014***
300	72 (78.3)	20 (21.7)		
400	140 (77.3)	41 (22.7)		
500	96 (92.3)	8 (7.7)		
600	25 (78.1)	7 (21.9)		
Marital Status				
Single	412 (82.7)	86 (17.3)	Fishers Exact = 4.952	0.131
Married	13 (76.5)	4 (23.5)		
Cohabiting	2 (100.0)	0 (0.0)		
Separated/divorced	1 (33.3)	2 (66.7)		

***Statistically significant, χ^2 = Chi-Square**

Respondent 380 (83.5%) aged 15 - 24 had the highest proportion of respondents with appropriate practices, the relationship between age group and practices towards plastic pollution ($\chi 2 = 3.763$, $p = 0.141$) was not statistically significant. The relationship between sex and practices towards plastic pollution ($\chi 2 = 5.114$, $p = 0.028$) was statistically significant. A greater proportion of respondents from civil engineering, 100 (88.5%) were more likely to have appropriate practices towards plastic pollution. The relationship between the department of the respondents and their practices towards plastic pollution was not statistically significant ($\chi 2 = 4.232$, $p = 0.116$). The majority, 96 (92.3%) of the respondents who were 500-level students, had appropriate practices towards plastic pollution; the relationship between the respondent's level and their practices towards plastic pollution ($\chi 2 = 12.437$, $p = 0.014$) was statistically significant. Respondents 2 (100.0%) who were cohabiting had the highest proportion with appropriate practices; the relationship between marital status and practices towards plastic pollution (fishers exact = 4.952, $p = 0.131$) was not statistically significant.

TABLE 9b: RELATIONSHIP BETWEEN RESPONDENTS' SOCIODEMOGRAPHIC CHARACTERISTICS BY OVERALL PRACTICE TOWARDS PLASTIC POLLUTION

Variables	Overall Practice		Statistics	*p*-value
	Appropriate (n=428) n (%)	Inappropriate (n=92) n (%)		
Religion				
Christianity	414 (83.1)	84 (16.9)	Fishers Exact = 7.546	**0.034***
Islam	9 (69.2)	4 (30.8)		
ATR	2 (40.0)	3 (60.0)		
Others	3 (75.0)	1 (25.0)		
Place of Residence				
Hostels (on campus)	183 (86.3)	29 (13.7)	$\chi^2 = 14.468$	**0.002***
Hostels (off campus)	131 (80.9)	31 (19.1)		
Private residence (on campus)	14 (56.0)	11 (44.0)		
Private residence (off campus)	100 (82.6)	21 (17.4)		
Average Monthly Income				
<40,000	256 (82.8)	53 (17.2)	$\chi^2 = 0.153$	0.726
≥40,000	172 (81.5)	39 (18.5)		
Knowledge				
Poor	33 (71.7)	13 (28.3)	$\chi^2 = 3.871$	0.066
Good	395 (83.3)	79 (16.7)		
Attitude				
Negative	13 (68.4)	6 (31.6)	$\chi^2 = 2.611$	0.123
Positive	415 (82.8)	86 (17.2)		

***Statistically significant, χ^2 = Chi-Square**

Respondent 414 (83.1%) who practiced Christianity had the highest proportion of respondents with appropriate practices, the relationship between religion and practices towards plastic pollution (fishers exact = 8.052, p = 0.034) was statistically significant. The relationship between indigenes and practices towards plastic pollution ($\chi 2$ = 1.803, p = 0.205) was insignificant. A greater proportion of respondents who reside in hostels (on campus), 183 (86.3%) were more likely to have appropriate practices towards plastic pollution. The relationship between the place of residence and practices towards plastic pollution was statistically significant ($\chi 2$ = 14.468, p = 0.002). Most, 256 (82.8%) of the respondents with an average monthly income of <40,000 had appropriate practices towards plastic pollution; the relationship between respondents' average monthly income and practices towards plastic pollution ($\chi 2$ = 0.153, p = 0.726) was not statistically significant. The majority, 395 (83.3%) of the respondents with appropriate knowledge, had appropriate practices towards plastic pollution; the relationship between respondents' knowledge and practices towards plastic pollution ($\chi 2$ = 3.871, p = 0.066) was not statistically significant. The majority, 415 (82.8%) of the respondents with positive attitudes, had appropriate practices towards plastic pollution; the relationship between respondents' attitudes and practices towards plastic pollution ($\chi 2$ = 2.611, p = 0.123) was not statistically significant.

TABLE 10: PREDICTORS OF RESPONDENTS' PRACTICES TOWARD PLASTIC POLLUTION

Variable	B coefficient	Exp B (OR)	95% CI		*p*-value
			Min.	Max.	
Age (Years)	0.027	1.027	0.965	1.094	0.395
Sex					
Females		1*			
Males	-0.658	0.518	0.316	0.849	**0.009****
Department					
Medicine		1*			
Social works	0.108	1.114	0.641	1.937	0.702
Civil engineering	0.871	2.390	1.188	4.809	**0.015****
Religion					
Christians		1*			
Non-christians	- 0.869	0.419	0.167	1.051	0.064
Place of Residence					
Hostels (on and off campus)		1*			
Private residence (on and off campus)	-0.303	0.738	0.444	1.229	0.243
Knowledge					
Poor		1*			
Good	0.824	2.280	1.098	4.734	**0.027****
Attitude					
Negative		1*			
Positive	0.721	2.057	0.736	5.752	0.169

***Reference Category, **Statistically significant, OR – Odds Ratio, CI - Confidence Interval**

Increasing respondents age was 1.027 times more likely to have appropriate practice toward plastic pollution with an OR of 1.027 (CI = 0.965 – 1.094, p = 0.395), however, this was not statistically significant. Male respondents were 0.518 times less likely to have appropriate practice toward plastic pollution than female respondents with an OR of 0.511 (CI = 0.316 - 0.849, p = 0.009). This was statistically significant. Respondents in non-medical departments (civil engineering) were 2.390 times more likely to have appropriate practice toward plastic pollution than those in medical departments with an OR of 2.390 (CI = 1.188 - 4.809, p = 0.015). This was statistically significant. Respondents who were non-Christians were 0.419 times less likely to have appropriate practice toward plastic pollution than those who were Christians, with an OR of 0.419 (CI = 0.167 - 1.051, p = 0.064). This was statistically insignificant. Respondents who reside in private residences (on and off campus) were 0.738 times less likely to have appropriate practice toward plastic pollution than those who reside in hostels (on and off campus), with an OR of 0.738 (CI = 0.444 – 1.229, p = 0.243); this was not statistically significant. Those with good knowledge of plastic pollution were 2.280 times more likely to have appropriate practice toward plastic pollution than those with poor knowledge with an OR of 2.280 (CI = 1.098 - 4.734, p = 0.027). This was statistically significant. Respondents with a positive attitude toward plastic pollution were 2.057 times more likely to have appropriate practice toward plastic pollution than those with a negative attitude toward plastic pollution, with an OR of 2.057 (CI = 0.736 - 5.752, p = 0.169). This was statistically insignificant.

SECTION E:

FACTORS CONTRIBUTING TO PLASTIC POLLUTION

TABLE 9: FACTORS CONTRIBUTING TO PLASTIC POLLUTION AMONG UNIVERSITY STUDENTS

Variables*	Frequency (n=520)	Percent
Rules against plastic pollution	308	59.2
Dustbins around school	487	93.7
Signs against littering	337	64.8
Waste disposal units	398	76.5
Lack of awareness	458	88.1
Plastic is cheap	230	44.2
Lack of plastic alternatives	399	76.7
Excessive packaging with plastic	417	80.2

***Multiple response questions**

More than half, 308 (59.2%) of the respondents said there are rules in place to dither plastic pollution in their school. The majority, 487 (93.7%), of the respondents said there are dustbins around the school. Two-thirds, 337 (64.8%), of the respondents said some signs show plastics should not be littered around the school. Three hundred and ninety-eight (76.5%) of the respondents said that the waste disposal units around their school are emptied when due. Most, 458 (88.1%), of the respondents said that the lack of awareness about plastic pollution affects how to dispose of plastics. More than half, 290 (55.8%), of the respondents said that their use of plastic is not because they are cheap. Two-thirds, 399 (76.7%), of the respondents said that lack of alternative materials to plastics leads to plastic pollution. Four hundred and seventeen (80.2%) of the respondents said that excessive packaging of goods with plastic contributes to plastic pollution.

CHAPTER FIVE

DISCUSSION

Plastic is one of the most used materials in the world, representing a very large group of individual polymers with different chemical and technical properties. [1] This study surveyed a public federal university in Benin City, Nigeria, to ascertain the knowledge, attitude, practice, and factors contributing to plastic pollution among the participants.

The majority were within the age range of 15–24 years, with a mean age of 21.28 ± 3.91 years. This is in contrast to the official school age for university school students.[42] More than half of the participants were males. This is similar to a study conducted in Western Nigeria in 2021 to assess plastic waste sorting intentions among university students, which showed a higher proportion of male respondents. [43] Females are more likely to have a good KAP of plastic pollution, which maybe because females are naturally more conscious about the cleanliness of their environment as compared to males.

The predominant ethnic group of the respondents was Benins. This is expected because the study area is predominantly inhabited by Benins. Most of the respondents were Christians who were single. This is in contrast to a study done in Western Nigeria in 2021 to assess plastic waste sorting intentions among university students, where the majority of the respondents were Yoruba. [43] This is expected as the study was done in the western part of the country, where the populace is made up of Yorubas. Some cultures, such as Hausa, practice indiscriminate disposal of waste as a way of life, as opposed to some cultures with strong morals on hygiene. Religious influences plastic pollution, as Christians consider cleanliness to be next to holiness.

This study showed that the majority of respondents had overall good knowledge of plastic pollution; this could be due to sufficient enlightenment from school and media outlets. This is similar to a study carried out in 2021 on public awareness, knowledge, attitude, and perception

of microplastic pollution around lagoons, where the majority of the respondents had good knowledge. [44] A minority of respondents had poor knowledge of plastic pollution, which could be a consequence of their misconception of what plastic is, which is in contrast to a study done on the investigation of knowledge and attitude towards plastic pollution in Nairobi, Kenya, where the majority of respondents had good knowledge of plastic pollution. [24] Good knowledge of plastic pollution reduces the propensity of students to dispose of plastic waste indiscriminately, thereby preventing the clogging of drains and serving as a breeding ground for disease vectors such as mosquitoes capable of causing malaria.

There was a significant relationship between age, department, level, and place of residence with knowledge of plastic pollution. Respondents aged 15 – 24 years and medical students had a higher proportion of respondents with good knowledge. Similarly, those who resided on campus and belonged to the 600-level classes made up a higher proportion of respondents with good knowledge of plastic pollution. The multivariate analysis shows that the determinants of knowledge levels were departments, and place of residence.Those who are non medical students as well as those who reside at private residence (on and off campus), had less likelihood of good knowledge of plastic pollution, this could be as a result of the structure of their curriculum and exposure to more information on plastic pollution on campus residence respectively.This is in contrast with a study done in Egypt in 2023 to explore the knowledge, attitude, and practice of adults towards the use and hazards of plastic products, which showed that participants' marital status was statistically significant and influenced their knowledge of plastic pollution. [45] It is essential that the students have a thorough understanding of plastic pollution so that they can take proper measures to fight against it.

In addition, the majority of the respondents had a positive attitude towards plastic pollution; this could be a result of awareness created in school by lecturers and social media. This is in

tandem with a preliminary survey on the knowledge and attitudes of university students regarding microplastic pollution and its impact on the environment carried out in 2023 in Malaysia, where the majority of respondents had a positive attitude towards plastic pollution. [46] Public health initiatives promoting proper plastic disposal can prevent negative outcomes, create safe environments, and foster supportive communities, contributing to the overall well-being of adolescents and their communities.

There was a notable and significant relationship between the age and class of respondents and their attitudes towards plastic pollution. Those aged 35–44 and in the 300-level classes had the highest proportion of positive attitudes towards plastic pollution. This could be as a result of more experience that comes with age and a longer exposure to the school system. This is in contrast to a study done in Portugal in 2024 on the knowledge, concerns, and attitudes toward plastic pollution, which showed that level of education was the statistically significant sociodemographic in relation to respondents' attitudes toward plastic pollution.[47] A positive attitude towards plastic pollution equates to better plastic disposal practices and also discourages others from practicing plastic pollution, which in turn results in a more sanitary environment that is free of diseases.

Furthermore, the majority of respondents had appropriate practices towards plastic pollution; this could be a result of the availability of waste bins around the school, which promoted environmental sanitation. This is in tandem with a study on plastic waste awareness and practices among students of the Faculty of Environmental Sciences, University of Lagos, in the year 2019, which showed that the majority of students had a good practice in plastic waste disposal. [32] The increase in bad practices will lead to the continuation of plastic pollution, which will affect the actualization of SDG 12, which talks about responsible consumption and production.

There was a significant relationship between sex, class, religion, and place of residence with the practice of plastic pollution, as those respondents who lived on campus in hostels, were in the 500-level class, and were Christians, had a better practice of waste disposal. This could be a result of stricter rules and regulations in such residences and classes. The multivariate analysis also showed a significant relation between the practice of plastic pollution and sex and departments. Those who had good knowledge of plastic pollution also were predictors of good practices towards plastic pollution. Those who were not studying medicine and those who had good knowledge of plastic pollution were less likely to have appropriate practice which maybe because females and those studying medicine have more exposure to information on plastic pollution. This contrasts a study on plastic waste sorting intentions among university students in Abeokuta and Ibadan, Nigeria, in 2021, where no significant relationship was found to have existed between plastic pollution and gender. [33] Addressing plastic pollution among individuals is crucial for public health, requiring targeted interventions, policy advocacy, and community involvement to create a safer environment and improve overall health.

CONCLUSION

This study showed that the majority of the respondents had good knowledge of plastic pollution. Good knowledge was higher among those aged 15 - 24, medical students, and those who reside in hostels (on campus).

The majority of respondents held positive attitudes toward combating plastic pollution; it was higher amongst those aged 35 - 44 and those who were 300-level students. There were no significant predictors of respondents attitudes.

Additionally, while most students engaged in good waste disposal practices, it was higher amongst the female respondents, those who were 500-level students, Christians, and resided in hostels (on campus). The effectiveness of these practices varied based on their place of residence, department, and gender.

Lack of awareness, excessive packaging with plastic, and lack of alternatives were the major factors contributing to plastic pollution in the school environment.

RECOMMENDATION

The following recommendations were made based on the findings from this study with the hope that if implemented, will improve public health outcomes and mitigate the risks associated with plastic pollution in universities.

The State Government

Recommendations to the government play a crucial role in addressing public health concerns. Here are recommendations for the government:

1. Enhance Public Awareness Campaigns: Utilize diverse media channels to reach different demographics and ensure that the messaging is clear and impactful.
2. Implement and Enforce Environmental Policies: Develop and enforce stricter regulations on plastic use and waste management. This includes policies that promote recycling, reduce single-use plastics, and support the development of alternative materials.
3. Promote Research and Innovation: Fund research initiatives aimed at understanding plastic pollution and developing innovative solutions. Encourage partnerships between academic institutions, industry, and government bodies to foster the development of sustainable alternatives to plastics.
4. Encourage Community Involvement: Facilitate community-based programs and initiatives that involve residents in plastic waste management and recycling efforts. Support grassroots organizations and local campaigns that address plastic pollution at the community level.

The School Authorities

1. Integrate Environmental Education: Incorporate comprehensive environmental education, with a focus on plastic pollution and sustainability, into the school curriculum. Ensure that this education is age-appropriate and relevant to students' daily lives.

2. Organize Workshops and Seminars: Host regular workshops, seminars, and guest lectures on plastic pollution and environmental stewardship. Invite experts to speak and engage students in interactive learning experiences.

3. Implement Campus Recycling Programs: Establish and maintain effective recycling programs on campus. Provide clearly labeled bins for different types of waste and educate students on proper recycling practices.

4. Encourage Student Participation: Support and promote student-led environmental initiatives and organizations. Provide resources and funding for student projects and activities that aim to reduce plastic use and improve waste management.

5. Foster Collaboration with Local Communities: Partner with local communities and organizations to extend environmental education beyond the campus. Engage students in community cleanup events and other activities that address plastic pollution.

The Individuals

1. Monitor and Educate: Individuals, particularly those in community or residential settings, should observe and engage with friends and neighbors who contribute to plastic pollution. By initiating conversations in informal settings, such as during gatherings or neighborhood meetings, they can share information about the harmful effects of plastic waste. Providing practical tips and resources can empower others to adopt more sustainable practices and foster a collective commitment to reducing plastic pollution.

2. Reduce Plastic Use: Make a conscious effort to minimize personal plastic consumption by choosing reusable alternatives, avoiding single-use plastics, and supporting products with minimal packaging.

3. Embrace Reuse: Individuals, particularly students and community members, should practice reusing plastic products in their daily lives, such as at home and on campus. By creatively repurposing items like containers and bags, they can extend the life-cycle of these products. Organizing workshops or sharing ideas through social media can further encourage this sustainable habit within their communities.

4. Promote Responsible Disposal: Households should implement the provision of designated waste bins in various areas, such as kitchens and gardens, to curb indiscriminate disposal. By ensuring that these bins are clearly labeled for different types of waste—recyclables, compost, and general trash—family can encourage responsible disposal practices.

5. Stay Informed and Involved: Keep up-to-date with developments in plastic pollution and environmental sustainability. Stay involved in local and national efforts to combat plastic pollution and contribute to a broader movement for environmental change.

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APPENDIX I

QUESTIONNAIRE

DEPARTMENT OF COMMUNITY HEALTH, UNIVERSITY OF BENIN, BENIN CITY
KNOWLEDGE, ATTITUDES, AND PRACTICES OF UNDERGRADUATE STUDENTS TOWARDS PLASTIC POLLUTION IN THE UNIVERSITY OF BENIN, BENIN CITY, EDO STATE.

We are 600-level medical students of the University of Benin, Benin City. This questionnaire assesses undergraduate students' knowledge, attitudes, and practices towards plastic pollution and its implications for environmental conservation in the University of Benin, Benin City, Edo State. All information given will be treated as confidential. Please mark and fill in any areas as appropriate. Thank you.

SECTION A: SOCIODEMOGRAPHIC DATA

1. Age in years (as of last birthday): _____
2. Sex: Male ( ) Female ( )
3. Faculty: _____
4. Department: _____
5. Level (please specify): _____
6. Ethnic group: Igbo ( ) Benin ( ) Esan ( ) Owan ( ) Etsako ( ) Yoruba ( ) Urhobo ( ) Ijaw ( ) Isoko ( ) Hausa ( ) others, specify _____
7. Religion: Christianity ( ) Islam ( ) African Traditional religion ( ) others _____
8. Marital status: Single ( ) Married ( ) Cohabiting ( ) Separated/Divorced ( ) Widowed ( )
9. Place of residence: Hostels (on campus) ( ) Hostels (off campus) ( ) Private residence (on campus) ( ) Private residence (off campus) ( )
10. Average monthly allowance: Less than 10,000 ( ) 10,000-19,999 ( ) 20,000-29,999 ( ) 30,000-39,999 ( ) 40,000-49,999 ( ) 50,000-59,999 ( ) 60,000-69,999 ( ) 70,000-79,999 ( ) 80,000-89,999 ( ) 90,000-99,999 ( ) 100,000 and above ( )

SECTION B: KNOWLEDGE OF PLASTIC POLLUTION

11. What is plastic pollution? This is a natural process that occurs when plants and trees release plastic into the air ( ) The accumulation of plastic objects in the environment negatively impacts humans, animals, and their habitats ( ) This is a type of land pollution caused by oil spills ( )
12. Which of the following are methods to control plastic pollution? (multiple responses allowed) Recycling ( ) Disposal in landfills ( ) Boiling of plastics ( ) Incineration ( ) Microbial degeneration ( ) Indiscriminate burning of plastics ( ) Conversion into valuable materials ( )
13. Which of the following can be considered as plastic waste materials? (multiple responses allowed) Water bottles ( ) Glass ( ) Nylon bags ( ) Styrofoams ( ) Straws ( ) Wood ( ) Pipes ( ) CDs and DVDs ( ) Beverage containers ( )
14. Which of the following can result in plastic pollution? (multiple responses allowed) Availability of plastics ( ) Political views ( ) Inadequate disposal infrastructure ( ) Religious beliefs ( ) Unstrict rules and regulations ( )
15. Which of the following can be considered as effects of plastic pollution?

		Yes	No
i.	Destruction of marine habitats		
ii.	Contamination of soil and water sources		
iii.	Choking and entanglement of wildlife		
iv.	Release of toxic chemicals into the environment		
v.	Promotion of biodiversity in ecosystems		
vi.	Acceleration of climate change		
vii.	Enhancement of air quality		
viii.	Promotion of healthy ecosystems		
ix.	Promotion of environmental health		

SECTION C: ATTITUDE TOWARDS PLASTIC POLLUTION

For questions 16 to 27, On a scale of 1 to 5, with 1 being "Strongly Disagree" and 5 being "Strongly Agree," please indicate your level of agreement with the following statements:

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
16. Plastic pollution is a significant environmental issue.					
17. All plastics can be recycled.					
18. Individuals have a responsibility to reduce their plastic usage.					
19. Government regulations should be stricter to reduce plastic pollution.					
20. Disposing of plastics in gutters is good.					
21. Using other alternatives in place of plastic is advisable.					
22. Plastic waste is a problem for the health and environment.					
23. Do you feel the need to look for a dustbin to dispose of plastic soda cans after use.					
24. Do you feel concerned when you see people throwing plastic cans into gutters.					
25. Do you feel like it is your social obligation not to litter the environment with plastic products.					
26. Environmental sanitation helps reduce plastic pollution.					
27. Children should not be taught about plastic pollution.					

SECTION D: PRACTICES THAT RELATE TO PLASTIC POLLUTION

26. How many plastic products do you use in a week? 1 – 3 ( ) 4 – 6 ( ) 7 – 10 ( ) >10 ( )
27. Where do you use the maximum number of plastics? Hostel ( ) Class ( ) Campus ( )
28. How do you dispose of your plastic products? In dustbins ( ) In water bodies ( ) In gutters ( ) On the floor ( ) By burning ( ) In the bush ( ) On the road ( ) others; specify_____
29. Have you ever disposed of plastics indiscriminately? Yes ( ) No ( )
30. If yes, how often? Always ( ) Sometimes ( ) Rarely ( )
31. How often do you throw your plastic containers on the floor or through the car window after use? Always ( ) Often ( ) Sometimes ( ) Rarely ( ) Never ( )
32. How often do you package your food or other items with excessive plastic products? Always ( ) Often ( ) Sometimes ( ) Rarely ( ) Never ( )
33. How often do you use your empty plastic containers to store other items or substances? Always ( ) Often ( ) Sometimes ( ) Rarely ( ) Never ( )

SECTION E: FACTORS THAT CONTRIBUTE TO PLASTIC POLLUTION

34. Are there rules in place to dither plastic pollution in your school? Yes ( ) No ( )
35. Are there dustbins around your school? Yes ( ) No ( )
36. Are there signs that show plastics should not be littered around your school? Yes ( ) No ( )
37. Are the waste disposal units around your school emptied as when due? Yes ( ) No ( )
38. The lack of awareness about plastic pollution affects how to dispose of plastics? Yes ( ) No ( )
39. Do you use plastic products because they are cheap? Yes ( ) No ( )
40. Lack of alternative materials to plastics leads to plastic pollution? Yes ( ) No ( )
41. Does excessive packaging of goods with plastics contribute to plastic pollution? Yes ( ) No ( )

APPENDIX II

ETHICAL CLEARANCE

HEALTH RESEARCH ETHICS COMMITTEE (HREC)

UNIVERSITY OF BENIN TEACHING HOSPITAL

P.M.B. 1111 BENIN CITY NIGERIA Telephone: 052-600418 Website: ubth.org

CHIEF MEDICAL DIRECTOR
Prof.Darlington E. Obaseki
E-mail: darlobaseki@gmail.com

DIRECTOR OF ADMINISTRATION
Jim Uwadie, Esq

CHAIRMAN
Prof. (Mrs.) Antoinette N. Ofili

HREC OFFICE:
Committee email: ubthresearchethics@gmail.com
Registration Number:
NHREC-UBTH-HREC/24/12/2022B

PROTOCOL NUMBER: ADM/E 22/A/VOL. VII/1486549132

PROPOSAL TITLE: **"KNOWLEDGE, ATTITUDE, AND PRACTICE OF UNDERGRADUATE STUDENTS TOWARDS PLASTIC POLLUTION AT THE UNIVERSITY OF BENIN TEACHING HOSPITAL, BENIN CITY, EDO STATE"**

PRINCIPAL INVESTIGATOR(S): **ISOKPEHI EDWARD BRIGHT, IYENGUMWENA EBENEZER OSADEBAMWEN**

DEPARTMENT/INSTITUTION: **DEPARTMENT OF PUBLIC HEALTH AND COMMUNITY MEDICINE, SCHOOL OF MEDICINE, UNIVERSITY OF BENIN, BENIN CITY, EDO STATE, NIGERIA.**

DATE CONSIDERED: SEPTEMBER 3RD, 2024

DECISION OF THE COMMITTEE: APPROVED

THIS APPROVAL DATES 03/9/2024 TO 02/9/2025. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI **SIGNATURE & DATE** 03/9/2024

SUPERVISOR (S): PROF. (MRS) A.N. OFILI

UNIVERSITY OF BENIN TEACHING HOSPITAL ETHICS & RESEARCH COMMITTEE Date BENIN CITY P.M.B. 1111

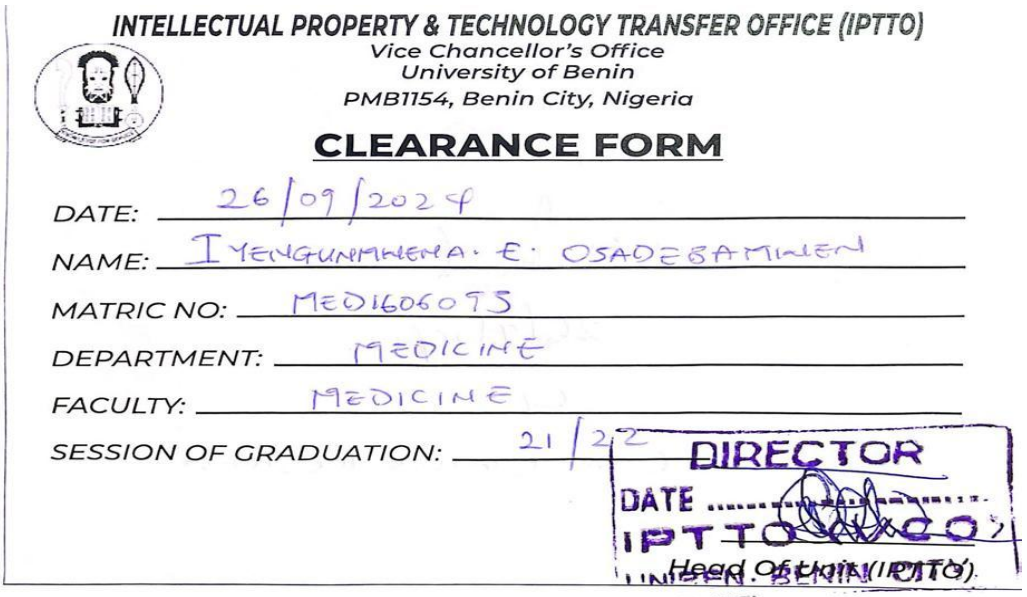
DECLARATION BY INVESTIGATOR(S):
PROTOCOL NUMBER (please quote in all enquiries)
Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study. In multiyear research, endeavor to submit your annual re-port to the HREC early in order to obtain renewal of your approval and avoid disruption of your research. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit your research site without previous notification

Signature & Date 03/9/2024

ubthresearchethics@gmail.com Registration Number: NHREC/24/01/2020

APPENDIX III

PLAGIARISM CLEARANCE FORM

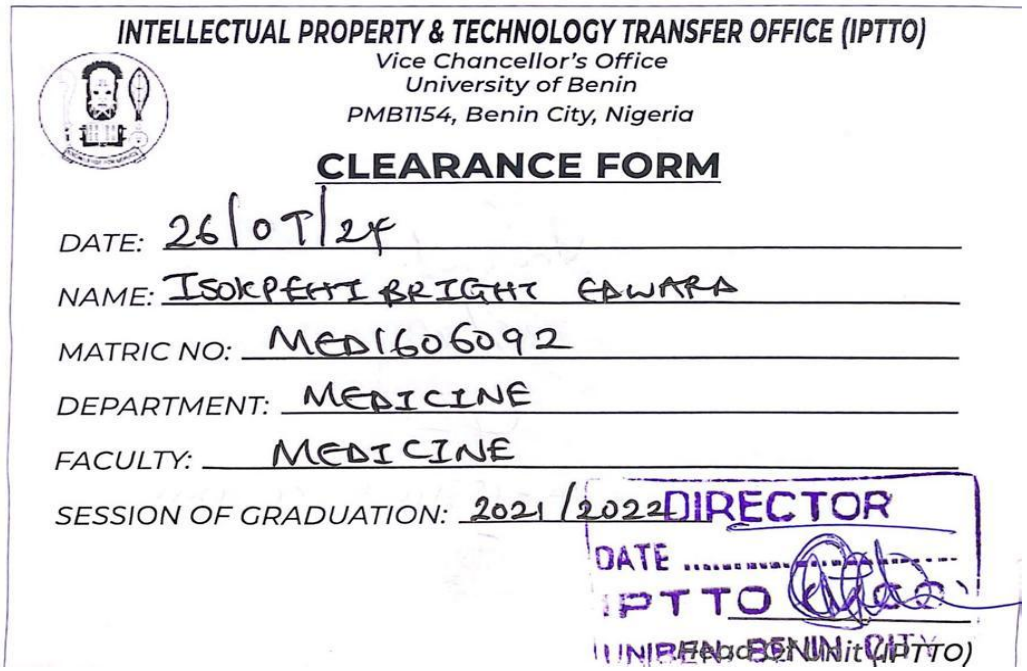


INTELLECTUAL PROPERTY & TECHNOLOGY TRANSFER OFFICE (IPTTO)
Vice Chancellor's Office
University of Benin
PMB1154, Benin City, Nigeria

CLEARANCE FORM

DATE: 26/09/2024
NAME: IYENGUNMWENA E. OSADEBAMWEN
MATRIC NO: MED1606075
DEPARTMENT: MEDICINE
FACULTY: MEDICINE
SESSION OF GRADUATION: 21/22

DIRECTOR
DATE .....
IPTTO
UNIBEN. BENIN CITY
Head Of Unit (IPTTO)



INTELLECTUAL PROPERTY & TECHNOLOGY TRANSFER OFFICE (IPTTO)
Vice Chancellor's Office
University of Benin
PMB1154, Benin City, Nigeria

CLEARANCE FORM

DATE: 26/07/24
NAME: ISOKPEHI BRIGHT EDWARD
MATRIC NO: MED1606092
DEPARTMENT: MEDICINE
FACULTY: MEDICINE
SESSION OF GRADUATION: 2021/2022

DIRECTOR
DATE .....
IPTTO
UNIBEN. BENIN CITY
Head Of Unit (IPTTO)

APPENDIX IV

THE MAP OF THE AREA

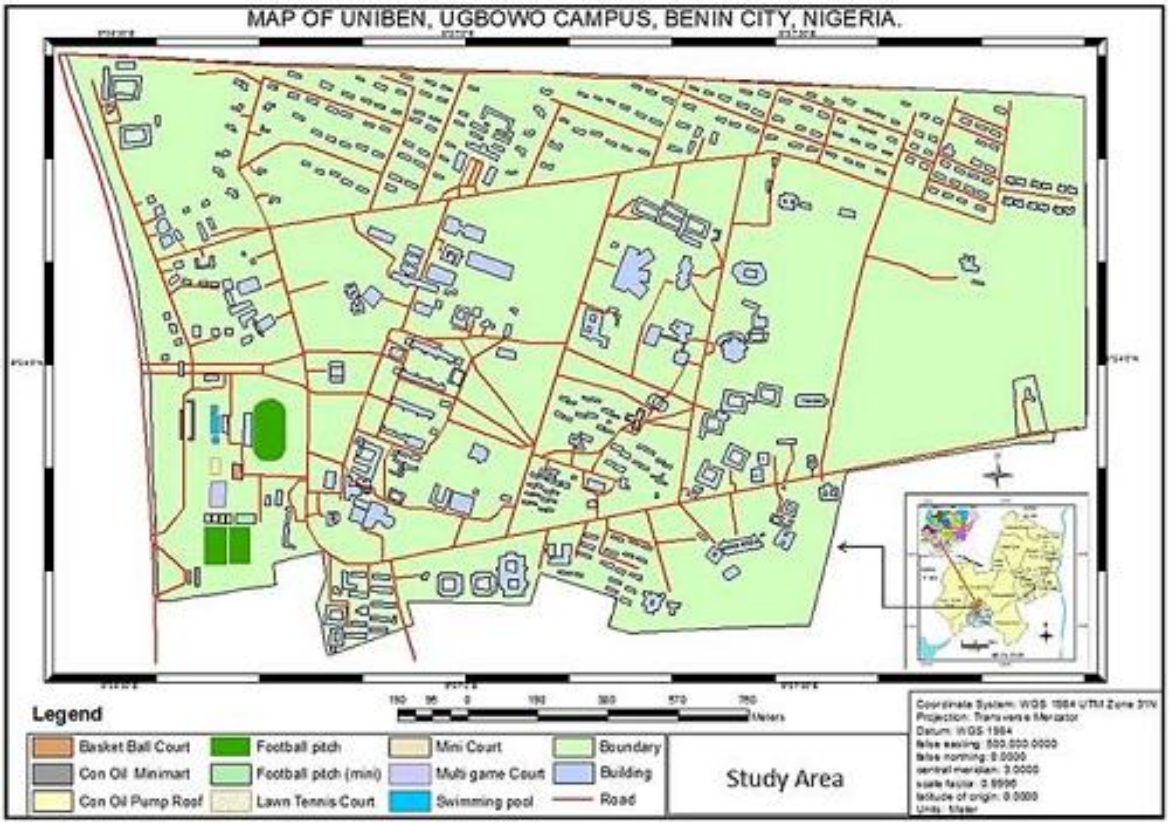


Figure 2: A Map Showing the Main (Ugbowo) Campus of the University of Benin.[41]

APPENDIX V

INFORMED CONSENT FORM

TITLE OF STUDY: Knowledge, attitudes, and practices of undergraduate students towards plastic pollution at the University of Benin, Benin City, Edo State.

INSTITUTION

The Department of Public Health and Community Medicine, College of Medical Sciences, University of Benin, Benin City.

PRINCIPAL INVESTIGATORS

Bright Edward ISOKPEHI

Osadebamwen Ebenezer IYENGUNMWENA

SUPERVISORS

Prof. A.N. Ofili

Dr. O.H.N. Okwara

FINANCIAL SPONSORSHIP

This research work is financially sponsored by the principal investigators.

PURPOSE OF RESEARCH

This study aims to assess undergraduate students' knowledge, attitudes, and practices toward plastic pollution at the University of Benin, Benin City, Edo State.

PROCEDURES INVOLVED IN THE STUDY

Participants (undergraduates at the University of Benin) will be asked questions regarding their knowledge, attitude, practice, and factors that contribute to plastic pollution.

CONFIDENTIALITY

All information collected will be kept confidential and stored securely. The data collected will be anonymized and only accessible to the research team.

COMPENSATION

Participants will not receive any compensation for their participation.

VOLUNTARY PARTICIPATION

Your participation in this study is voluntary. You may withdraw from the study at any time, without any consequences.

RISK

There are no risks associated with participation in this study.

BENEFIT

Participants would contribute to important research that may help improve public health promotion strategies. The results obtained from this research work would help assess the knowledge, attitude, practice, and factors that contribute to plastic pollution among undergraduates at the University of Benin.

CONTACT INFORMATION

If you have any questions or concerns regarding this research work, please contact:

Bright Edward ISOKPEHI

Email: bright.isokpehi@med.uniben.edu

Phone Number: 08100937664

OR

Osadebamwen Ebenezer IYENGUNMWENA

Email: osadebamwen.iyengunmwena@med.uniben.edu

Phone Number: 09026108115

Department of Public Health and Community Medicine, UBTH, Benin City, Edo State, Nigeria.

Ethics and Research Committee,

Email: ubthresearch@gmail.com

Phone Number: 07063331337

IF THERE IS ANY PORTION OF THIS CONSENT AGREEMENT THAT YOU DO NOT UNDERSTAND, ASK THE FIELD WORKER OR INVESTIGATOR BEFORE SIGNING.

Please sign below if you have agreed to participate in the study.

CERTIFICATION OF CONSENT

I, ……. having full capacity to consent for myself, I thereby consent to my participation in the research study.

The methods and means by which the study will be conducted have been explained to me by the ethical committee. I have been given the opportunity to ask questions concerning this investigatory study, and any such questions have been answered to my complete satisfaction.

I understand that I may, at any time during the course of this study, revoke this consent and withdraw myself from this study without prejudice.

Participant's Signature: _____

Date: _____