



Article

Investigating the Knowledge and Attitudes towards Plastic Pollution among the Youth in Nairobi, Kenya

Nicholas Oguge, Francis Oremo * and Salome Adhiambo

Centre for Advanced Studies in Environmental Law and Policy, University of Nairobi, P.O. Box 30197, Nairobi 00100, Kenya; nicholas.oguge@uonbi.ac.ke (N.O.); salomeadhiambo94@gmail.com (S.A.)

* Correspondence: oremo2007@gmail.com

Abstract: Kenya has made many attempts to regulate the production of single-use plastics through partial bans and the imposition of hefty taxes. Whereas government initiatives are crucial to resolving single-use plastic pollution, commitments made by youths can be an important part of the solution. Yet, youths are habituated to using single-use plastics without understanding fully their negative impacts. Understanding the knowledge and attitudes of youths is of the utmost importance in the effort to turn the tide against plastic pollution. This study set out to investigate knowledge and attitudes towards single-use plastics among youths in Nairobi, Kenya. This was a mixed study approach, where both qualitative and quantitative data were derived. The results showed that youths perceive single-use plastics as a serious environmental and health issue. Most respondents expressed willingness to switch to reusable alternatives if provided with financial incentives. In addition, the results showed stronger support for enhanced awareness campaigns and plastic recycling infrastructure. Social media was the most preferred channel to disseminate plastic pollution messaging among the youth. These findings are important in policy development for intensifying awareness and targeting a range of communication and financial support to reduce single-use plastic pollution.

Keywords: single-use plastics; Kenya; recycling; reusable alternatives; youths



Citation: Oguge, Nicholas, Francis Oremo, and Salome Adhiambo. 2021. Investigating the Knowledge and Attitudes towards Plastic Pollution among the Youth in Nairobi, Kenya. *Social Sciences* 10: 408. <https://doi.org/10.3390/socsci10110408>

Academic Editors: Rosalind Malcolm and Katrien Steenmans

Received: 19 August 2021
Accepted: 11 October 2021
Published: 22 October 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Plastic pollution is a serious global environmental and health issue. Poor plastic waste management, from manufacturing processes to products' end life, poses serious risks to the environment and human health (Geyer et al. 2017; Ritchie and Roser 2018). Most plastic materials discarded, disposed or abandoned in terrestrial environments after a single use "leak" into aquatic ecosystems, killing thousands of marine creatures (Derraik 2002). Images of fish, sea birds, turtles and marine mammals entangled in, suffocated or dead from ingesting plastic debris are alarming (Nielsen et al. 2019). On land, plastic pollution manifests in many ways such as the deterioration of the natural beauty of the environment, blockage of drainage systems, reduced percolation of water and aeration in soils and death of domestic and wild animals due to the ingestion of plastic litter (Ellis et al. 2005; GESAMP 2015; Murray and Andrady 2004; Njeru 2006; Uddin et al. 2018; UNEP 2018).

Plastics pollute the land and sea to the detriment of human health. Plastic materials degrade into micro-plastics—plastic materials under 5 mm in size—when exposed to environmental elements such as sunlight and wave action (Smith et al. 2018). This leads to the leaching of toxic chemical constituents into food, drinks and water (Alabi et al. 2019; Lusher et al. 2017). Both bottled and tap water are the largest single source of plastic ingestion by human beings (World Wide Fund for Nature (WWF) 2019).

Global awareness of single-use plastic pollution has grown in recent years (Nielsen et al. 2019; UNEP 2018), and many countries have passed legislation to ban or impose economic instruments to control the production, distribution and use of plastics (Adeyanju

et al. 2021; Amenábar Cristi et al. 2020; Anastasia et al. 2021; Ayalon et al. 2009; Gupta 2011; Nyangena et al. 2017; Opondo 2020). Similarly, voluntary initiatives have been attempted to address plastic pollution (UNEP 2018). Despite such efforts, the production and use of single-use plastics have increased, outstripping current waste management and recycling capabilities (Plastics Europe 2020). With the continuous growth in the volume of open disposal of single-use plastics and in light of projected future increases, it is obvious that plastic pollution needs urgent action. Scaling up innovative practices in plastic waste management, such as reusability, recoverability and recyclability, can turn the tide against single-use plastic pollution. Recycling is a key strategy for end-of-life plastic waste management. There is a strong ecological case for recycling and a growing trend in the rate of recovery and recycling of plastic wastes (Hopewell et al. 2009). This trend is likely to continue if adequate recycling infrastructure and appropriate policies are put in place, particularly in developing countries. Currently, plastics recycling is practiced by private actors, individual waste pickers, yard shop owners and small-scale traders. However, the social environment for informal waste recycling is deplorable with informal workers suffering harassment and social stigmatisation and enduring significant exposure to hazardous and toxic materials.

Over the years, Kenya has made many attempts to regulate the production of single-use plastics through partial bans and the imposition of hefty taxes (Opondo 2020; UNEP 2018). In 2020, the government imposed a ban on plastic bottles, straws and related products in national parks, reserves and conservation areas to protect wildlife resources from deadly plastic pollution (Republic of Kenya 2019a). The momentous decision followed a nationwide ban, in 2017, on the use, manufacture and importation of all plastic carrier bags and flat bags used for commercial and household packaging. However, plastic materials used for industrial primary packaging at the source of the product as well as disposal bags for handling of biomedical and hazardous waste, garbage bin liners and plastic carrier bags in duty free shops are exempted from the ban (Republic of Kenya 2017). These measures have been implemented with mixed success. For instance, there has been a serious challenge in monitoring and enforcement of the ban, and it is not uncommon to see some road-side traders in urban and rural areas still selling plastic carrier and flat bags. The establishment of voluntary take-back and recycling schemes by the private sector and current efforts to develop Extended Producer Responsibility Regulations are likely to bring about an improvement in the performance of plastic products through their life cycle, hence, supporting a circular approach.

Despite such a conducive regulatory approach, single-use-type plastics, particularly PET bottles and packaging materials, have continued to be the main products of concern in Kenya. Prior to the 2017 ban, approximately, 24 million plastic carrier and flat bags were consumed in the country monthly (Ong'unya et al. 2014). Plastic wastes generated in Kenyan urban areas constituted up to 21 percent of the solid wastes (Kimani et al. 2014; Oyake-Ombis et al. 2015). Due to inadequate waste management and recycling capabilities by local authorities, single-use plastic wastes continue to build up in open dump sites, open spaces, roadsides and drainage systems (Nyangena et al. 2017).

Government initiatives are crucial to resolving single-use plastic pollution. However, commitments from the youth can be a critical part of the solution. Yet, youths are habituated to using plastics without understanding fully their negative impacts. Understanding the knowledge and attitudes of youths is of the utmost importance in the effort to turn the tide against plastic pollution. Most of the past studies to date have focused on the determinants of an individual's motivation to recycle plastic materials (Best and Kneip 2011; Huffman et al. 2014; Nixon and Saphores 2014); behaviours relating to the reuse and recycling of plastics (Babader et al. 2016; Khan et al. 2019); awareness of the environmental impacts of bioplastics (Filho et al. 2021); behavioural intentions of people to switch to reusable alternatives such as cloth bags (Amenábar Cristi et al. 2020); factors that affect single-use plastic behavioural intentions (Van et al. 2021); efficacy of legal frameworks on behaviour change against use of disposable plastics (Adeyanju et al. 2021); awareness and attitudes of

secondary school students towards plastic pollution (Hammami et al. 2017); perceptions of beachgoers on single-use plastics (Van Rensburg et al. 2020); and public beliefs and attitudes towards plastics (Dilkes-Hoffman et al. 2019). However, there is scant evidence on how knowledge of single-use plastics among the youth affects attitude and practices in plastic waste management. This study set out to investigate knowledge and attitudes towards single-use plastics among the youth in Nairobi. Our analysis identified existing gaps in knowledge and interventions necessary to scale-up innovative practices in waste management among the youth. We also identified conditions that may enhance interactions between youths and policy makers in the management of single-use plastic waste.

2. Theoretical Framework

The theoretical structure informing this study was drawn from the theory of reasoned action which posits that volitional behaviours are influenced directly by behavioural intentions, which are a function of individual and normative influence (Fishbein 1979; Fishbein and Ajzen 1975). The individual influence on intention is a person's attitude towards performing the volitional behaviour. The normative influence on intention is one's subjective norm (Hale et al. 2003).

Attitude is a valenced response towards performing behaviour. If the objective of a plastic pollution communication campaign is to induce the youth to avoid single-use-type plastics, the attitude will be the degree to which individuals felt positively or negatively towards avoiding single-use-type plastics. A subjective norm is an individual's belief that important referent individual or groups approve or disapprove the performance of a target behaviour. The theory of reasoned action is premised on the assumption that a person will have a high intention to perform a particular action if he/she evaluates it positively and believe that significant others think he/she should do it (Sutton 2001).

The theory of reasoned behaviour shows the target points for persuasive appeals (Hale et al. 2003). As a result, it has widely been applied to design and assess the effectiveness of communication interventions (Nguyen et al. 2018). In the waste management domain, the theory of reasoned action has been used to explain recycling behaviour.

In the context of this study, consumption of single-use-type plastics among youths can be reduced by targeting individuals' intentions, attitudes and/or subjective norms. Educational campaigns can aim to influence individuals' intention to switch to reusable alternatives and participate in efforts to promote recovery and recycling of single-use plastic wastes. Similarly, single-use plastic pollution can be reduced by targeting individuals' attitudes through educational campaigns that seek to enhance knowledge and awareness of plastic alternatives and recycling. In the same way, enhanced understanding and awareness can influence an individual's belief regarding how other people would feel about his/her decision to give up single-use plastics.

Despite its application in the design of communication interventions, the theory of reasoned action is faulted on account that an individual's intention does not always lead to a desired behaviour (Dilkes-Hoffman et al. 2019; Mimiaga et al. 2009). Some actions are not just influenced by intentions but also by the availability of relevant skills, opportunities and resources (Ajzen 1991; Boldero 1995; Sommer 2011). With appropriate capabilities, individuals would be better able to perform the desired behaviour (Ajzen 1991). As a result, the theory of reasoned action has been modified to incorporate direct and indirect determinants of behaviour including facilitating conditions. It underscores the critical role of information and knowledge in establishing norms for behavioural change.

3. Materials and Methods

3.1. Study Area

This study was carried out between May and July 2021 in Nairobi—the capital and the largest city in Kenya with a population of 4,397,073 (Republic of Kenya 2019b). The city is a major commercial, financial, manufacturing and tourist centre and, reportedly, the largest in East and Central Africa. It hosts international organisations, such as the UN

headquarters, and serves as the administrative centre of two UN programmes: The United Nations Environment Programme (UNEP) and The United Nations Centre for Human Settlements (UN-Habitat). Nairobi is the only city in the world with a National Park on “its doorstep”. Similarly, there are other parks, forests and open areas in the city conferring critical ecosystem services. Despite its importance, the city is characterised by poor waste management arrangements, leading to the open disposal of large amounts of solid wastes, much of which are plastics (Ong’unya et al. 2014). Single-use plastic wastes build up in open areas, line the streets and choke storm water drains and other waterways, especially in low-income settlements (Kimani et al. 2014).

3.2. Methods

This was a mixed study approach, where both qualitative and quantitative data were derived. Primary data were collected through household surveys and focus group discussions. A survey of 271 youths was undertaken using semi-structured questionnaires, while interview schedules were used in focus group discussions. The questionnaire was composed of three sections. The first one was the consent form which introduced the respondents to the study’s objective and sought their permission to participate in the survey. Respondents were informed that their participation in the study was not presenting any benefit or risk, and that there were no personal details that would be reported. The second part contained questions which sought to assess knowledge and attitudes towards single-use plastics among the youths. This part was further divided into three sub-sections consisting of questions measuring knowledge, attitude and practices towards single-use plastics (Table 1). The final part included questions pertaining to socio-demography, the purpose of which was to check if it played any role in influencing attitudes and behaviour towards single-use plastics. The target populations of the study were youths in three purposely selected settlements in Nairobi: Kayole, Njiru and Dandora. The proximity of these settlements to the only waste dumpsite in the city has seen many unemployed youths engaging in waste picking as a means of earning a living.

Table 1. Questionnaire items.

Variables
<i>Knowledge of single-use plastics (rating on a scale from of 1(not serious) to 5 (very serious)</i>
Single-use plastics are harmful to marine ecosystems
Single-use plastics are harmful to marine terrestrial ecosystems (wildlife)
Single-use plastics are harmful to human health
Single-use plastics are harmful to local economy
<i>Attitude towards single-use plastics (Yes/No answer)</i>
Giving up single-use plastics for reusable alternatives
Paying an extra amount to use reusable alternatives
Returning single-use plastics to designated points of collection
Participating in efforts to promote recovery and recycling of single-use plastic wastes
<i>Practice towards plastics (Yes/No answer)</i>
Volunteer for an environmental cause
Donate for an environmental cause
Stop throwing away waste
Recover single-use plastic wastes
Doing nothing

In our study, “knowledge of single-use plastics” refers to an understanding of the environmental and health impacts of single-use plastics among the youth. Their responses

were rated using four measures on a Likert scale which offered five levels of seriousness for respondents (i.e., 1, not at all serious; 2, slightly serious; 3, somewhat serious; 4, serious; 5, very serious). “Attitude” towards single-use plastics was assessed as the willingness to switch to plastic alternatives, pay extra for alternatives, return single-use plastics to designated points of collection and participate in efforts to promote recovery and recycling of single-use plastic wastes. The respondents were provided with options and asked to provide a “Yes/No” answer. “Practices” in plastic waste management was tested as measures already taken to reduce single-use plastic pollution. Five measures were considered: (i) voluntary participation in environmental clean-up exercises, (ii) voluntary donation for an environmental cause, (iii) disposal of plastic wastes in a dustbin, (iv) recovery of plastic wastes and (v) doing nothing. The knowledge, attitude and practice variables were adapted from established literature (Adam et al. 2021; Amenábar Cristi et al. 2020; Babader et al. 2016; Filho et al. 2021; Huffman et al. 2014; Khan et al. 2019; Nixon and Saphores 2014). Data were analysed using SPSS software (IBM, Portsmouth, UK), and it entailed descriptive statistics for the socio-economic characteristics of the respondents. The chi-square (χ^2) test was used to inspect the relationships between variables of knowledge, attitudes and practices regarding single-use plastics and socio-economic characteristics.

4. Results and Discussion

4.1. Socio-Demography

A total of 271 youths participated in the survey (Table 2), mainly male respondents (55%). With a mean age of 25 years old, most respondents were single (60%), engaged in small-scale businesses and casual employment as the primary occupation (71%) and had attained twelve years of schooling and above (91%). The level of education among respondents shows that majority of the youths are moderately to highly educated. This implies that they were better able to understand local environmental challenges. Nearly one-third (32%) of the sample respondents had a mean monthly income of over US 100.

Table 2. Distribution of demographic variables.

Variables	Categories	Respondents	
		Frequency (<i>n</i> = 271)	Percentage (%)
Sex	Male	148	55
	Female	123	45
Residency (Location)	Kayole	91	34
	Dandora	91	34
	Njiru	89	32
Highest completed level of education	No formal	3	1
	Some primary	9	3
	Completed primary	15	5
	Secondary	162	60
	College	61	23
Occupation	University	21	8
	Small-scale businesses	77	28
	Formal employment	28	10
	Casual employment	113	43
	Student	44	16
Monthly household income	Other	9	3
	Up to US 50	98	36
	51–100	65	24
	101–150	36	13
	151–200	25	10
	201–300	13	5
Marital status	301 and over	10	4
	None	24	8
	Single	163	60
	Married	104	39
	Divorced/separated	1	0
	No answer	3	1

4.2. Types and Sources of Single-Use Plastics

The main types of single-use plastics are shown in Table 3. Plastic water and soda bottles (30.1%) were the most frequently used at home or the workplace followed by plastic bags. Retail shops, supermarkets and grocery stores were the main sources of single-use plastics products (Table 3). This shows that most youths consume single-use-type plastics daily. This is comparable to studies by [Dilkes-Hoffman et al. \(2019\)](#) and [Filho et al. \(2021\)](#).

Table 3. Type and source of single-use plastics.

Domains	(%)
Types of single use plastics	
Plastic juice straws	10.8
Thin plastic paper for take-away	6.3
Plastic coffee cups	10.4
Plastic plates	13.2
Plastic cutlery	6.7
Plastic food/take-away containers	9.2
Plastic soda bottles	13.5
Plastic water bottles	16.6
Plastic bags	13.2
Others	
Main sources of single-use plastics	
Supermarkets	23.3
Grocery store	20.9
Retail shops	29.7
Meat stalls/butchery	11.5
Hotels and restaurants	8.1
Others	0.5

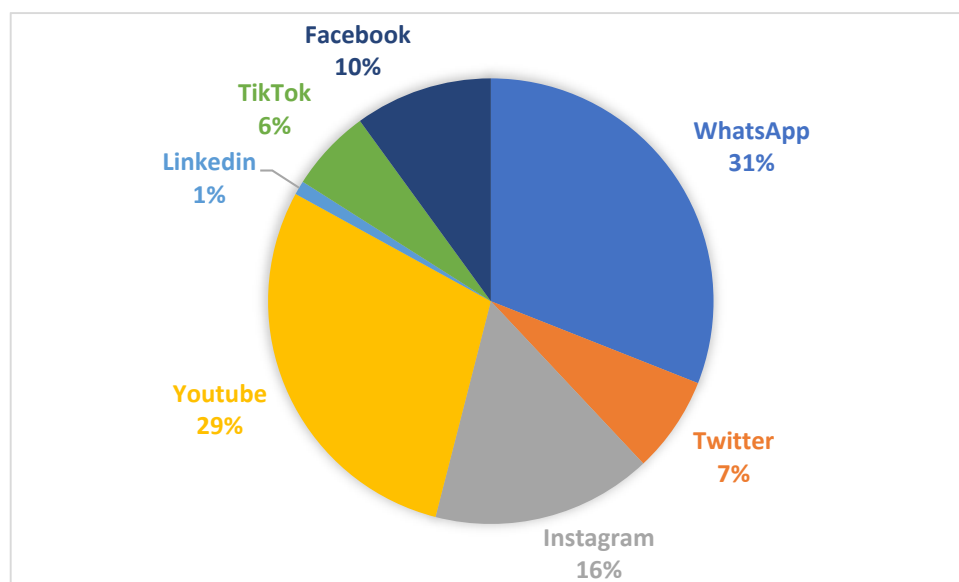
4.3. Knowledge of Plastics

Most respondents view single-use plastics as a serious environmental and health issue. Ninety-seven (97%) of the respondents agreed that millions of tons of single-use plastics are thrown out openly, 99% that single-use plastic wastes choke drainage systems and other water ways and 90% that plastics take many years to degrade. The seriousness of the single-use plastics' impact on the environment was rated on a 5-point Likert scale from 1 (not serious) to 5 (very serious) (Table 1). Plastic's impact on human health had the highest rating for seriousness with 83% of the respondents rating it as either 4 or 5 and only three percent rating it as 3 or less (Table 4). Plastic's impact on marine environments was rated by 72% of the respondents as either serious or very serious. Past studies ([Adam et al. 2021](#); [Dilkes-Hoffman et al. 2019](#); [Filho et al. 2021](#); [Geyer et al. 2017](#); [Hammami et al. 2017](#); [Van Rensburg et al. 2020](#)) show that many people perceive plastic's impact on marine environments as serious, because oceans are commonly cited by research and media as ecosystems most affected by single-use plastic pollution.

Table 4. Ratings on the seriousness of threats from the use of single-use plastics on the environment, human health and economy.

Plastics Impacts	Response Selection (%)						Mean Rating	Standard Deviation
	Not at All Serious	Slightly Serious	Moderately Serious	Serious	Very Serious	Don't Know		
Marine environments	2.2	7.0	5.5	14.8	57.1	13.4	4.35	1.09
Terrestrial environment	1.1	3.7	5.5	20.0	55.4	14.0	4.46	0.89
Human health	0.4	2.2	0.4	10.3	72.3	14.4	4.78	0.63
Local economy	3.4	10	7	25.1	40.2	14.8	4.06	1.16

Social media (36%), TV (29%) and radio (15%) were the main media channels through which knowledge about plastic's impacts on the environment and human health were acquired by the youth. This finding is comparable to a study in South Africa (Sommer 2011) which shows social media as the most popular channel for disseminating information on plastic pollution. WhatsApp (31%) and YouTube (29%) (Figure 1) were the most preferred social media platforms. These findings show that a tactical selection of media for a specific social group is required in any effort to reduce single-use plastic pollution. The ratings on the seriousness of plastic's impacts on marine environments were significantly associated with educational attainment ($p = 0.048$) and monthly income ($p = 0.000$), suggesting a high level of awareness on the health and environmental impacts of single-use plastics among the youth in Nairobi, Kenya. Well-educated individuals have a better understanding of plastic's impacts because they encounter limited stressors that would curtail their knowledge on environmental issues.

**Figure 1.** Preferred social media channels for disseminating plastic pollution messages.

4.4. Attitudes towards Single-Use Plastics

There was a strong willingness to reduce the consumption of single-use plastics among the youth. The majority of the respondents expressed the desire to switch to reusable alternatives (94.8%) and pay extra for their use (73%). Cloth bags, reusable food containers and water cans were the most preferred alternatives (Figure 2). This finding aligns with a past study (Dilkes-Hoffman et al. 2019) that alternatives to plastics, such as paper bags and glass, were considered as more environmentally friendly packaging materials. The willingness to switch to plastic alternatives was significantly associated

with educational attainment ($p = 0.013$), and payment for alternatives was significantly associated with mean monthly income ($p = 0.000$).

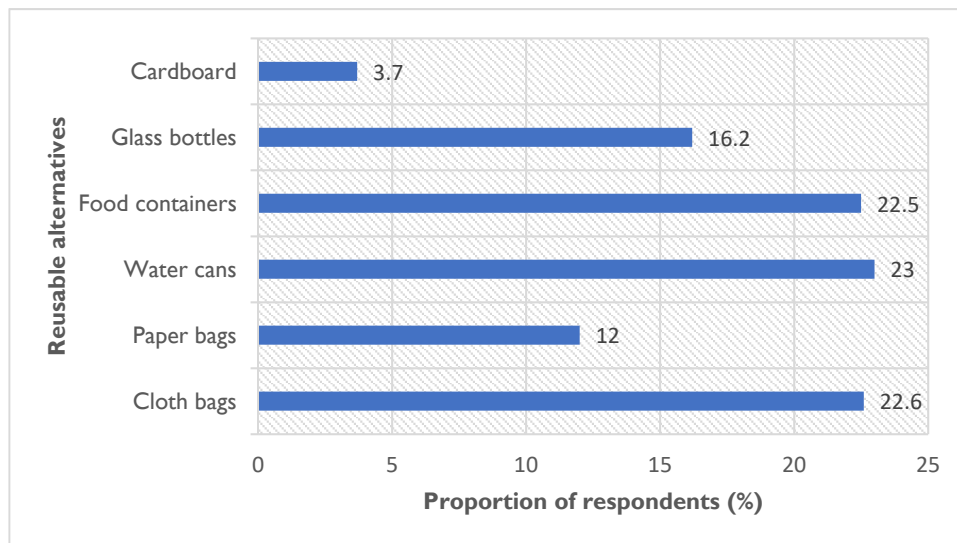


Figure 2. Distribution of respondents by reusable alternatives.

Most respondents (94%) were in favour of monetary incentives to promote the uptake and use of alternatives to plastics. This finding places the onus of action on government to provide appropriate incentive mechanisms for plastic waste reduction. It is also supported by findings from previous studies (Boldero 1995; Mimiaga et al. 2009; Sommer 2011) that behavioural change is not only a function of personal intentions but availability of relevant skills, opportunities and resources. While enhanced awareness and understanding of plastic's impact on the environment and human health can internalise norms for behavioural change, individuals may lack the capacity and incentives to adopt and scale up innovative practices in plastic waste management. With appropriate capabilities, individuals would be better able to perform the desired behaviour (Ajzen 1991). The government has a key role to play in bridging the attitude–behaviour gap through putting in place an adequate incentive structure.

The willingness to participate in efforts to promote recovery and recycling of single-use plastic wastes obtained 97% of the overall responses. Additionally, 73% of the respondents expressed willingness to return single-use plastics to designated points of collection.

4.5. Measures to Reduce Single-Use Plastics

Various actions taken to curb single-use plastic pollution including waste recovery, participation in environmental clean-up exercises, donating to environmental campaigns and disposal of plastic wastes in dustbins. Twenty-five percent (25.3%) of the respondents were already disposing plastic wastes in dustbins, 24% were participating in environmental clean-up exercises and 17% were donating to environmental campaigns (Figure 3). However, 21% of the respondents had not taken any measures to reduce single-use plastics. The influence of educational attainment, mean monthly income and occupation on measures already taken to reduce single-use plastic pollution was negligible.

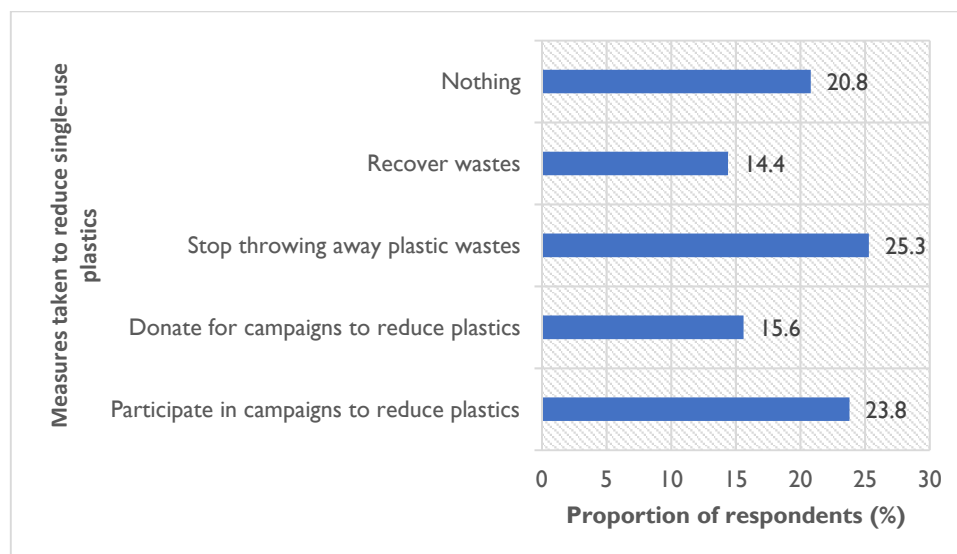


Figure 3. Measures taken to reduce single-use plastic pollution.

Respondents indicated various measures that could potentially reduce single-use plastic pollution. They included imposing a total ban, enhancing “green consciousness” and providing an infrastructure for waste recovery and recycling. Overall, 55% of the respondents indicated that a total ban would offer a more sustainable solution than voluntary action. This finding aligns with previous studies (Adeyanju et al. 2021; Van Rensburg et al. 2020) that public policy can significantly influence sustainable waste management practices. However, this observation is at odds with a study (Walker et al. 2020) that showed voluntary action as a more sustainable solution than a plastic ban. A blanket ban on single-use plastics may not be an appropriate policy option in developing countries where enforcement agencies have a limited capacity for “command and control” measures (Gupta 2011). Voluntary extended producer responsibility, the availability of eco-friendly and fit-for-purpose plastic alternatives and subsidies on alternatives would constitute an important policy mix.

Another key finding was strong support for enhanced awareness campaigns. Public awareness of plastic waste management has grown in recent years to promote the scaling up of innovative practices such as waste recovery, reuse and recycling. However, awareness campaigns have not been tactical and targeted to achieve desirable outcomes. In addition, there was stronger support for recycling infrastructure. This finding is aligned with (Filho et al. 2021), which showed that accessibility to an adequate recycling infrastructure can reduce single-use plastic pollution. Moreover, it is comparable to past studies (Nixon and Saphores 2014; Van Rensburg et al. 2020) which supported innovative waste management strategy (e.g., Container Deposit System) and infrastructure (e.g., curb side recycling services and drop-off recycling centres in residential areas). These findings put the onus of action on government and industry to provide infrastructure for plastics recycling that is technically, economically and environmentally sound. Developing countries require a framework that would allow for the improvement of the economics and quality of plastics recycling, create demand for recycled plastics and develop a harmonised separate collection and sorting system for plastic wastes.

4.6. Relationship between Knowledge, Attitudes and Practices in SUP Management

Knowledge of plastic’s impacts on the environment and humans among the youth was statistically significant in relation to attitude and practice variables. Chi-square (χ^2) tests showed a significant relationship between knowledge of plastic’s impact on the terrestrial environment and willingness to switch to alternative materials ($p = 0.025$), pay extra to switch to such alternatives ($p = 0.002$) and participate in efforts to promote recovery and

recycling ($p = 0.041$). Likewise, the relationship between knowledge of plastic's impacts on marine environments and willingness to pay extra to switch to alternative materials ($p = 0.000$) and return single-use plastic wastes to designated collection points ($p = 0.035$) was statistically significant. Further, the association between willingness to give up single-use plastics and participation in voluntary environmental clean-up exercises ($p = 0.022$) was significant. These results show that better understanding of plastic's impacts on the environment can be a pre-condition for sustainable practices in plastic waste management. This finding is consistent with previous studies (Asmuni et al. 2021; Best and Kneip 2011) which showed that individuals with favourable environmental attitudes tend to participate in efforts to reduce single-use plastic pollution. These findings provide a basis for targeted awareness campaigns on single-use plastic waste management. However, our finding contrasts with a previous study (Dilkes-Hoffman et al. 2019) that good knowledge on the ill effects of plastics does not necessarily translate to environmentally friendly behaviours.

4.7. Limitations of the Study

There are a number of limitations to this study. First, the scope of respondents involved was limited to youths. It would be ideal to conduct interviews with key informants from government, private sector, non-governmental organisations and community-based groups to obtain further insights on knowledge and attitudes towards single-use plastics among the youth. Nonetheless, the data gathered from the study were robust. It offers unprecedented insights into the knowledge and attitude of the youth towards single-use plastics. Second, the survey questions used a few measures to test the knowledge of single-use plastics and a limited set of dependent variables for attitudes and practices in plastic waste management. Possible consideration of a wide range of indicators could have provided additional richness to this study. Additionally, the survey relied on self-reported practices. This, however, did not affect the study's outcomes, because data collection methods were triangulated to verify the authenticity of responses.

5. Conclusions

This study investigated knowledge and attitudes towards single-use plastics among youths in Nairobi. The results showed that youths perceived single-use plastics as a serious environmental and health issue, and they supported measures to cut back on their usage. However, they placed the onus of action on government to reduce single-use plastic wastes through an appropriate incentive framework. Plastic's impacts on human health and oceans had higher ratings for seriousness. This shows that youths were more concerned about the impacts of single-use plastic pollution. As a result, a great majority (95%) expressed willingness to switch to reusable alternatives if provided with financial incentives. In addition, the results showed stronger support for enhanced awareness campaigns, plastic recycling infrastructure and the imposition of a total ban on single-use plastics. This study shows that knowledge of plastic's impacts on the environment and human health informs attitude and practice. Thus, targeted awareness campaigns are necessary to bridge the knowledge–practice gap. Respondents indicated various communication channels to disseminate plastic pollution messages with social media as the most preferred channel. Inadequate recycling infrastructure and irrational selection of media channels to disseminate plastic messages were the main barriers to the adoption of innovative practices in plastic waste management. Based on the findings, the recommendations emphasise the need to incentivise plastic alternatives, ensure tactical selection of media for a specific social group, raise awareness about recycling and put in place an adequate recycling infrastructure. This study can contribute towards developing adequate communication and governance strategies to reduce single-use plastic pollution.

Author Contributions: Conceptualisation, methodology, data curation, data analysis and original draft preparation: F.O.; data collection and resources: F.O. and S.A.; writing—review and editing, and supervision: N.O. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by UKRI-funded Building Collective Ownership of Single-Use Plastics Waste in Youth Communities: Case Studies from Kenya, Jamaica and Malawi Project.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: This statement is excluded.

Acknowledgments: We are grateful to the Surrey Centre for International and Environmental Law for the conceptualisation of Building Collective Ownership of Single-Use Plastics Waste in Youth Communities: Case Studies from Kenya, Jamaica and Malawi Project. We would also like to thank the Governing Plastic Network Team for their invaluable insights and advice during the conceptualisation of the study. We are equally grateful to everyone who participated in our study and provided valuable information and statistics. Finally, we wish to thank, the anonymous reviewers and the editor for their thoughtful and invaluable input to this manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

References

- Adam, Issahaku, Tony Robert Walker, Andrea Clayton, and Joana Carlos Bezerra. 2021. Attitudinal and behavioural segments on single-use plastics in Ghana: Implications for reducing marine plastic pollution. *Environmental Challenges* 4: 100185. [\[CrossRef\]](#)
- Adeyanju, Gbadebo Collins, Teslin Maria Augustine, Stefan Volkmann, Usman Adetunji Oyebamiji, Sonia Ran, Oluyomi Osobajo, and Afolabi Otitoju. 2021. Effectiveness of intervention on behaviour change against use of non-biodegradable plastic bags: A systematic review. *Discover Sustainability* 2: 1–15. [\[CrossRef\]](#)
- Ajzen, Icek. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50: 179–211. [\[CrossRef\]](#)
- Alabi, Okunola, Kehinde Ologbonjaye, Oluwaseun Awosolu, and Olufiropo Alalade. 2019. Public and Environmental Health Effects of Plastic Wastes Disposal: A Review. *Journal of Toxicology and Risk Assessment* 5: 021.
- Amenábar Cristi, María, Camila Holzapfel, Medina Nehls, Diamela De Veer, Camila Gonzalez, Geraldine Holtmann, Daniela Honorato-Zimmer, Tim Kiessling, Ailin Leyton Muñoz, Martin Thiel, and et al. 2020. The rise and demise of plastic shopping bags in Chile—Broad and informal coalition supporting ban as a first step to reduce single-use plastics. *Ocean and Coastal Management* 187: 105079. [\[CrossRef\]](#)
- Anastasia, Charitou, Roxani Naasan Aga-Spyridopoulou, Zoi Mylona, Rahel Beck, Fabienne McLellan, and Anna Maria Addamo. 2021. Investigating the knowledge and attitude of the Greek public towards marine plastic pollution and the EU Single-Use Plastics Directive. *Marine Pollution Bulletin* 166: 112182. [\[CrossRef\]](#)
- Asmuni, Shahariah, Sabariah Yusoff, and Nur Liyana Asyiqin Mohd Jafri. 2021. Predictors of intention to use reusable drinking straw. *Journal of Emerging Economies and Islamic Research* 9: 88. [\[CrossRef\]](#)
- Ayalon, Ofira, Tal Goldratha, Gad Rosenthal, and Michal Grossman. 2009. Reduction of plastic carrier bag use: An analysis of alternatives in Israel. *Waste Management* 29: 2025–32. [\[CrossRef\]](#) [\[PubMed\]](#)
- Babader, Ahmed, Jun Ren, Karl Jones, and Jin Wang. 2016. A system dynamics approach for enhancing social behaviours regarding the reuse of packaging. *Expert Systems with Applications* 46: 417–25. [\[CrossRef\]](#)
- Best, Henning, and Thorsten Kneip. 2011. The impact of attitudes and behavioral costs on environmental behavior: A natural experiment on household waste recycling. *Social Science Research* 40: 917–30. [\[CrossRef\]](#)
- Boldero, Jennifer. 1995. The Prediction of Household Recycling of Newspapers: The Role of Attitudes, Intentions, and Situational Factors. *Journal of Applied Social Psychology* 25: 440–62. [\[CrossRef\]](#)
- Derraik, José. 2002. The pollution of the marine environment by plastic debris: A review. *Marine Pollution Bulletin* 44: 842–52. [\[CrossRef\]](#)
- Dilkes-Hoffman, Leela Serena, Steven Pratt, Bronwyn Laycock, Peta Ashworth, and Paul Andrew Lant. 2019. Public attitudes towards plastics. *Resources, Conservation and Recycling* 147: 227–35. [\[CrossRef\]](#)
- Ellis, Sara, Sarah Kantner, Ada Saab, and Mary Watson. 2005. Plastic grocery bags: The ecological footprint. *Environmental Changes Are Spreading Infectious Diseases-UN Study, Victoria*, 1–19.
- Filho, Walter Leal, Amanda Lange Salvia, Alessandra Bonoli, Ulla Saari, Viktoria Voronova, Marija Klôga, Sonali Suraj Kumbhar, Katharina Olszewski, Daniela Müller De Quevedo, and Jelena Barbir. 2021. An assessment of attitudes towards plastics and bioplastics in Europe. *Science of the Total Environment* 755: 142732. [\[CrossRef\]](#) [\[PubMed\]](#)
- Fishbein, Martin. 1979. A theory of reasoned action: Some applications and implications. *Nebraska Symposium on Motivation* 27: 65–116.
- Fishbein, Martin, and Icek Ajzen. 1975. *Intention and Behaviour: An Introduction to Theory and Research*. Reading: Addison-Wesley.
- GESAMP. 2015. *Sources, Fate and Effects of Microplastics in the Marine Environment: A Global Assessment*. Edited by P. J. Kershaw. (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). London: International Maritime Association.
- Geyer, Roland, Jenna Jambeck, and Kara Lavender Law. 2017. Production, use, and fate of all plastics ever made. *Science Advances* 3: 25–29. [\[CrossRef\]](#) [\[PubMed\]](#)

- Gupta, Kanupriya. 2011. *Consumer Responses to Incentives to Reduce Plastic Bag Use: Evidence from a Field Experiment in Urban India*. SANDEE working papers, 65–11. Kathmandu: SANDEE.
- Hale, Jerold, Brian Householder, and Kathryn Greene. 2003. The theory of reasoned action. *The Persuasion Handbook: Developments in Theory and Practice* 14: 259–86.
- Hammami, Mohammad Bakri, Eman Qasem Mohammed, Anas Hashem, Mina Amer Al-Khafaji, Fatima Alqahtani, Shaikha Alzaabi, and Nihar Dash. 2017. Survey on awareness and attitudes of secondary school students regarding plastic pollution: Implications for environmental education and public health in Sharjah city, UAE. *Environmental Science and Pollution Research* 24: 20626–33. [CrossRef] [PubMed]
- Hopewell, Jefferson, Robert Dvorak, and Edward Kosior. 2009. Plastics recycling: Challenges and opportunities. *Philosophical Transactions of the Royal Society of London. Series B Biological Sciences* 364: 2115–26. [CrossRef] [PubMed]
- Huffman, Ann Hergatt, Brittney Van Der Werff, Jaime Henning, and Kristen Watrous-Rodriguez. 2014. When do recycling attitudes predict recycling? An investigation of self-reported versus observed behavior. *Journal of Environmental Psychology* 38: 262–70. [CrossRef]
- Khan, Farhana, Waqar Ahmed, and Arsalan Najmi. 2019. Understanding consumers' behavior intentions towards dealing with the plastic waste: Perspective of a developing country. *Resources, Conservation and Recycling* 142: 49–58. [CrossRef]
- Kimani, Mary, Bernard Njoroge, and Dorcas Ndunge. 2014. Review of Municipal Solid Waste Management: A Case Study of Nairobi, Kenya. *Research Inventory: International Journal of Engineering and Science* 4: 16–20.
- Lusher, Amy, Peter Hollman, and Jeremy Mendoza-Hill. 2017. *Microplastics in Fisheries and Aquaculture: Status of Knowledge on Their Occurrence and Implications for Aquatic Organisms and Food Safety*. FAO Fisheries and Aquaculture Technical Paper 2017, (615). Rome: FAO.
- Mimiaga, Matthew, Sari Reisner, Laura Reilly, Nafisseh Soroudi, and Steven Safren. 2009. Individual interventions. In *HIV Prevention*. New York: Academic Press, pp. 203–39. [CrossRef]
- Murray, Gregory, and Anthony Andrady. 2004. *Plastics in the Marine Environment*. Hoboken: John Wiley & Sons, Inc., pp. 379–97.
- Nguyen, Quynh Anh, Luc Hens, Charlotte MacAlister, Lester Johnson, Boripat Lebel, Sinh Bach Tan, Hung Manh Nguyen, Ninh Nguyen, and Louis Lebel. 2018. Theory of Reasoned Action as a Framework for Communicating Climate Risk: A Case Study of Schoolchildren in the Mekong Delta in Vietnam. *Sustainability* 10: 2019. [CrossRef]
- Nielsen, Tobias Dan, Karl Holmberg, and Johannes Stripple. 2019. Need a bag? A review of public policies on plastic carrier bags—Where, how and to what effect? *Waste Management* 87: 428–40. [CrossRef] [PubMed]
- Nixon, Hilary, and Jean-Daniel Saphores. 2014. How effective are current household recycling policies? Results from a national survey of U.S. households. *Resources Conservation and Recycling* 92: 1–10.
- Njeru, Jeremia. 2006. The urban political economy of plastic bag waste problem in Nairobi, Kenya'. *Geoforum* 37: 1046–58. [CrossRef]
- Nyangena, John, Augustus Muluvi, and Ann Gitonga. 2017. Ban on Plastic Bags: Plastics ban finally takes effect in Kenya. *Policy Monitor* 9: 8.
- Ong'unya, Raphael, Cathrine Aurah, Joanne Nabwire, and Ruth Songok. 2014. The Plastic Waste Menace in Kenya: A Nairobi City Situation. *International Journal of Current Research* 6: 6175–79.
- Opondo, Gerphas. 2020. *The Legal, Policy and Institutional Frameworks Governing Marine Plastics in Kenya*. Bonn: IUCN Environmental Law Centre, 18p.
- Oyake-Ombis, Leah, Bas van Vliet, and Arthur Mol. 2015. Managing plastic waste in East Africa: Niche innovations in plastic production and solid waste. *Habitat International* 48: 188–97. [CrossRef]
- Plastics Europe. 2020. *Plastics—the Facts 2020: An Analysis of European Plastics Production, Demand and Waste Data*. Brussels: Plastics Europe.
- Republic of Kenya. 2017. Gazette Notice No. 2334/2017, 28 February 2017. Available online: https://www.nema.go.ke/images/Docs/Awarness%20Materials/Gazette_legal_Notice_on_carrier_bags.pdf (accessed on 3 June 2011).
- Republic of Kenya. 2019a. Gazette Notice No. 4858, 5 June 2019. Available online: http://kenyalaw.org/kenya_gazette/gazette/notice/202209/ (accessed on 3 June 2011).
- Republic of Kenya. 2019b. *2019 Kenya Population and Housing Census Volume I: Population by County and Sub-County*. Nairobi: Republic of Kenya.
- Ritchie, Hannah, and Max Roser. 2018. Plastic Pollution. Published online at OurWorldInData.org. Available online: <https://ourworldindata.org/plastic-pollution> (accessed on 11 August 2021).
- Smith, Madeleine, David Love, Chelsea Rochman, and Roni Neff. 2018. Microplastics in Seafood and the Implications for Human Health. *Current Environmental Health Report* 5: 375–86. [CrossRef] [PubMed]
- Sommer, Lutz. 2011. The Theory of Planned Behaviour and the Impact of Past Behaviour. *International Business & Economics Research Journal (IBER)* 10. [CrossRef]
- Sutton, Stephen. 2001. Health Behavior: Psychosocial Theories. In *International Encyclopedia of the Social & Behavioral Sciences*. Edited by N. Smelser and P. Baltes. Amsterdam: Elsevier.
- Uddin, Minhaz, Mashfiqul Hasan, Shahadat Hossen, and Badiuzzaman Khan. 2018. People perceptions about using polythene bag and its impact on environment at Mymensingh in Bangladesh. *International Journal of Natural and Social Sciences* 42: 37–43.
- UNEP. 2018. *SINGLE-USE PLASTICS: A Roadmap for Sustainability*. (Revised edition. pp. vi, 6). Athens: UNEP.

-
- Van Rensburg, Melissa, S'phumelele Nkomo, and Timothy Dube. 2020. The 'plastic waste era'; social perceptions towards single-use plastic consumption and impacts on the marine environment in Durban, South Africa. *Applied Geography* 114: 102132. [[CrossRef](#)]
- Van, Lee, Norhadilah Abdul Hamid, Fauzi Ahmad, Ahmad Nur Aizat Ahmad, Rumaizah Ruslan, and Puteri Fadzline Muhamad Tamyez. 2021. Factors of Single Use Plastic Reduction Behavioral Intention. *Emerging Science Journal* 5: 269–78. [[CrossRef](#)]
- Walker, Tony, Eamonn McGuinty, Sylvain Charlebois, and Janet Music. 2020. Single-use plastic packaging in the Canadian food industry: Consumer behavior and perceptions. *Humanities and Social Sciences Communications* 8: 1–11. [[CrossRef](#)]
- World Wide Fund for Nature (WWF). 2019. *No Plastic in Nature: Assessing Plastic Ingestion from Nature to People*. Gland: WWF.