RESEARCH ARTICLE

Market traders' knowledge, attitude, and practices of solid waste disposal in Calabar Municipality, Nigeria: New implications for global health education

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Abstract

Poor environmental sanitation practices in markets are a serious public health concern, as solid waste poses municipal level and global health risks. Solid wastes also add to the growing issue of global climate change. This study sought to determine the sociodemographic correlates of solid waste disposal knowledge, attitude, and practices among market traders in Calabar Municipality, Nigeria. This was a cross-sectional study of 480 traders across six markets in Calabar Municipality. Data were collected using semi-structured questionnaire and analyzed using descriptive and inferential statistics. Overall, 54% of respondents had good knowledge, 45% had an acceptable attitude, and a significantly low number of respondents (16%) practiced good solid waste disposal. Sociodemographic characteristics that were statistically significant in the bivariate analyses were modeled for the outcomes. The multivariable analyses found that age, primary education, being married, being separated/divorced, being Muslim, and being a traditionalist were statistically significantly associated with knowledge, attitude, and practices of solid waste disposal among market traders. Solid waste disposal practices were poor. Market sensitizations on environmental sanitation need to be carried out. There is also a need to enforce laws stating disciplinary measures for offenders who dump wastes indiscriminately.

Keywords: Knowledge; Attitude; Practices; Traders; Solid wastes; Waste disposals; KAP; Health; Markets; Nigeria

1. Introduction

As population density per capita waste accumulation rises, the available space for disposal of waste decreases accordingly and as an implication sanitation has emerged as a critical sector for maintaining healthy cities and populations (Iwu *et al.*, 2016). Solid wastes comprise organic and inorganic unwanted materials that are usually free-flowing as derivatives of human and animal action (Chengula *et al.*, 2015). Solid wastes have become one of society's major problems of the 21st century as it has led to several outbreaks of diseases such as dengue fever, cholera, Lassa fever, and malaria as well as contributing significantly to the global climate change. In many cities around the

world, inadequate waste collection and disposal facilitate the multiplication of disease pathogens and provide breeding channels for disease vectors (Chengula *et al.*, 2015). Globally, 2.6 billion people lack access to proper sanitation. The world generates 2.01 billion tonnes of municipal solid waste annually with this figure projected to double by 2050 with the current trends (World Bank, 2022). These numbers have been projected to increase to 3.4 billion tonnes by 2050 (Agbefe *et al.*, 2019). Increased generation of solid wastes is triggered by increasing urbanization, population growth in major cities, change in food consumption patterns, and improvement in the wealth quartiles of some nations (Agbefe *et al.*, 2019). The disposal of solid wastes in developing nations has continually posed a threat to the health and quality of life of the human population due to the non-existence of organized waste disposal facilities, culture, and technology that are determined largely by financial constraints. Sub-Saharan Africa generates about 62 million tonnes of solid waste annually, a serious issue that implicates several factors, chief among them being a lack of political will (Chinedu *et al.*, 2018). Because the increased human population has been implicated severally in the generation of solid wastes, the United Nations Habitat Watch opined that this problem may escalate beyond what it is, as Africa's population is projected to more than triple over the next 4 decades (Bakare, 2021). The United Nations Habitat (2022) stated that municipal solid wastes make the cities unattractive to investors as well as causing flooding, water, and air pollution, and many health conditions. This will cause the slow achievement of the United Nation Sustainable Development Goal (SDG)-17 aimed at sustaining cities and communities.

In Nigeria, waste generation rates amount to 0.65 – 0.95 kg/capita/day with a mean of 42 million tonnes of solid waste generated every year (Chinedu *et al.*, 2018). These high volumes of solid wastes have overwhelmed many cities' waste collection structures and have defied many solutions while only 20 – 30% are collected (Bakare, 2021; Sunday, 2013). The collection of wastes in the country has been monopolized by state/province actors who possess limited capacity to handle the waste management problems in their respective cities (Chinedu *et al.*, 2018). In addition, the lack of knowledge and awareness among the general public on waste management has also played a role in the problem of indiscriminate waste disposal from commercial sources in Nigeria. In a Nigerian study, it was found that despite the high knowledge level of market traders toward market sanitation (62.8%), there were still poor practices of open dumping and other forms of indiscriminate dumping of market wastes (Abejegah *et al.*, 2013). This, however, is perceived to be a function of poor knowledge of available waste disposal systems in the surrounding and poor attitude or perceptions of market traders toward

indiscriminate dumping. In essence, perceptions are said to be learned attributes and can, therefore, be modified through education for proper knowledge acquisition (Chengula *et al.*, 2015). In another instance, the level of education of individuals has played a role in their ability to comprehend relevant details about their environmental and how to preserve its structures. Chengula *et al.* (2015) found that the perceptions and attitudes of a significant number of persons override their knowledge of population health in such a way that these persons would not partake in the cleaning of their environments due to the perceptions that the municipal council bore that responsibility.

Markets are important centers of the economic landscape of every nation as they serve as locations for not only commodity exchange but for information sharing, health education, health promotion, traffic generation, and other forms of social interactions. Due to the increasing population in urban enclaves and a proportionate increase in the market population, waste generation around the markets is inevitable (Worlanyo, 2013). However, the handing of solid wastes in and around markets has posed a threat to human health and the environment as the market remains a vulnerable structure with the convergence of many individuals, attracting significantly large gatherings of sellers and buyers. The poor handling of waste in many markets across Nigeria may be due to poor knowledge of solid waste disposal and a lack of educational programs to modify traders' attitudes toward favorable sanitation practices (Iwu *et al.*, 2016). Formal education emerging from different levels can aid good understanding of proper waste management practices (Chengula *et al.*, 2015).

In essence, it is imperative that a complex waste management strategy that bridges identified gaps in knowledge, attitude, and practices (KAP) toward traders' waste disposal process is critically important. There is a paucity of studies on the KAP of market traders in the ever-busy Calabar. To the best of our knowledge, this present study is the first to conduct KAP among traders regarding solid waste management in the study area while studying demographic correlations of these outcomes.

Accordingly, this study aimed to assess market traders' KAP toward solid waste disposal in the ever-busy markets in Calabar Municipality, Nigeria. We also hypothesized that there was no statistically significant relationship between sociodemographic characteristics and KAP of the study's respondents.

2. Methods

2.1. Data sources

The study was conducted among traders in markets in Calabar Municipality Local Government Area, Cross

River State, Nigeria. Calabar municipality is a Local Government Area in Cross River State, South Nigeria. It is the capital city of Cross River State bounded to the North by Odukpani LGA; to the West by Akpabuyo LGA; to the East by Kwa River; and in the South by Calabar South LGA. The common occupation practiced among the people is trading and fishing. Christianity is the widely practiced religion in the area. From a census conducted in 2006, Calabar Municipality has a population of 183,681 people. The following markets are found in the area; 8 miles Market, Marmi Market, Ikot Ishie market, Marian market, Akim market, and Edim-otop Market.

This cross-sectional descriptive study employed a quantitative approach to determine the KAP of 480 sampled market traders toward solid waste disposal in the study area. The sample size was determined using Fisher's formula for estimating the sample size for cross-sectional studies as cited in Charan & Biswas (2013). A semi-structured questionnaire which was the interviewer administered was utilized. Distribution of the questionnaires for data collection was done based on a derived interval from one shop or stand in each selected line to another until the required number of respondents in each of the markets was reached.

2.2. Measurements

Data were first entered into Microsoft Excel 2016 to compute the knowledge scores. Data were transferred to and analyzed using SPSS Version 23. The outputs were subjected to descriptive and inferential statistical analysis and quantitative data were summarized in means and standard deviation while being presented on frequency tables. Seven practical questions assessed the knowledge of respondents with the questions requiring "yes," "no," or "I don't' know" responses. The questions elicited information on traders' knowledge of appropriate measures, types of disease outbreaks that can occur, disease transmission, and health implications. The expected maximum total knowledge score was 7. A higher score implied a better knowledge of solid waste disposal. Each correct knowledge response was allotted a score of 1 while incorrect responses were allotted a score of 0. Four practical questions were used to assess the attitude of participants. This section elicited information on reactions due to proximity of appropriate disposal points, lack of sanctions, use of abandoned lands, and time factor when considering dumping waste. A correct statement with options "Strongly agree," "Agree," "Disagree," or "Strongly disagree" was given 4, 3, 2, and 1, respectively. The expected maximum total attitude score was 16 and the minimum score was 4. Four practical questions were used to assess the practice of participants. This section elicited information on dumping

routes and methods of disposing wastes such as burning, dumping in gutters, or dumping in open places. A correct statement with options "Always," "sometimes," or "never" was given 3, 2, and 1, respectively. The expected maximum total practice score was 12 and the minimum score was 4. The Cronbach's alpha coefficients of the KAP were 0.84, 0.85, and 0.90, respectively, denoting acceptable internal consistency (Taber, 2018). Mean scores were used to categorize KAP into two levels such that respondents who scored within and above the mean had good knowledge, acceptable attitude, and good practice while those who scored below the mean had poor knowledge, unacceptable attitude, and poor practice of solid waste disposal.

2.3. Analytical strategy

Associations between respondents' sociodemographic characteristics (gender, age, educational level, marital status, and religion) and KAP level were analyzed using a Chi-square of independence. These variables were selected based on our theoretical assumption that these factors are relevant in studying solid waste management in the specified population (Agwu, 2012; Al-Khatib *et al.*, 2009; Jatau, 2013). All sociodemographic characteristics and their respective categories are found in Table 1. Variables identified to be statistically significant in the Chi-square analyses were inputted in three separate multivariable logistic regression models for all three outcome variables (KAP). The statistical significance threshold was set at $\alpha = 0.05$.

3. Results

3.1. Sociodemographic data of respondents

Four hundred and eighty respondents ($n = 480$) participated in this study accounting for a 100% response rate. The sociodemographic characteristics of the participants are presented in Table 1. Slightly over half (54.4%) of the respondents were female. The average age of participants was 28.35 years ± 8.73 (with a range of 16 – 50 years). A little over half of the respondents (51.0%) had attained secondary education. More respondents in this present study were single (47.9%). In terms of religion, most of the respondents (77.3%) were Christians.

Table 2 outlines the KAP levels of respondents according to the scores obtained. Slightly over half of the market traders (54.0%) had good knowledge of solid waste disposal and management after obtaining satisfactory knowledge scores (M = 3.66, SD = 1.70). Almost half of the market traders (46%) had poor knowledge of solid waste disposal and management. In terms of attitude, most of the market traders (55.0%) had an unfavorable attitude toward solid waste disposal and management (M = 9.22, SD = 2.41). Regarding practices, a high 84% of

Table 1. Sociodemographic characteristics of the study participants

Variables	Frequency (n = 480), n (%)
Gender	
Male	219 (45.6)
Female	261 (54.4)
Age (years), mean age ± SD	28.35±8.73
15 – 19	90 (18.8)
20 – 29	182 (37.9)
30 – 39	158 (32.9)
≥ 40	50 (10.4)
Educational attainment	
No formal education	52 (10.8)
Primary	47 (9.8)
Secondary	245 (51.0)
Tertiary	136 (28.3)
Marital status	
Single	230 (47.9)
Married	182 (37.9)
Widowed	47 (9.8)
Divorced/separated	21 (4.4)
Religion	
Christianity	371 (77.3)
Islamic	51 (10.6)
Traditional	58 (12.1)

SD: Standard deviation

Table 2. Level of knowledge, attitude, and practice on solid waste management among respondents

Level of KAP	Minimum and maximum scores	Frequency, n (%)
Knowledge level		
Good	3.5–7	259 (54.0)
Poor	0.0–3.4	221 (46.0)
Mean ± SD	3.66 ± 1.70	
Attitude level		
Acceptable	10–16	216 (45.0)
Unacceptable	4.0–9.9	264 (55.0)
Mean ± SD	9.22 ± 2.41	
Practice level		
Good	8.0 – 16	77 (16.0)
Poor	4.0-7.9	403 (84.0)
Mean ± SD	5.65 ± 1.49	

SD: Standard deviation, KAP: Knowledge, attitude, and practice

the respondents had poor practices of solid waste disposal and management (M = 5.65, SD = 1.49).

3.2. Relationship between KAP levels toward solid waste disposal and sociodemographic factors of market traders in Calabar Municipality

From the cross-tabulated *P*-values presented in Table 3, significant associations were found between educational attainment (χ^2 = 17.74, df = 3, P < 0.001), religion (χ^2 = 30.07, df =2, P < 0.001), and marital status (χ^2 = 22.09, df = 3, P < 0.001) with the knowledge of solid waste management in the study area. We, however, reject the null hypothesis of no significant relationship between educational level, religion, and marital status with the knowledge of market traders on solid waste management in the study area. Other sociodemographic such as age and gender of respondents had no significant associations with the outcome of interest.

Furthermore, in Table 3, significant associations were found between the age (χ^2 = 8.74, df = 3, P = 0.033) and education (χ^2 = 12.74, df = 3, P = 0.005) of the market traders and their attitude toward solid wastes disposal in the study area. We, however, reject the null hypothesis of no significant relationship between age and educational level with the attitude of market traders toward solid waste management in the study area. All other sociodemographic factors were not significant.

Finally, Table 3 also highlights the Chi-square analysis of the association between respondents' practices of solid waste management and their sociodemographic characteristics. Age (χ^2 = 9.52, df = 3, P = 0.023) and religion (χ^2 = 8.91, df =2, P = 0.045) were found to be statistically significantly associated with the practice of solid waste disposal and management among market traders. We, therefore, reject the null hypothesis of no statistically significant association between age, religion, and the practices of solid waste disposal among traders in the study area. All other sociodemographic factors were not significant.

Table 4 presents data regarding the multivariate logistic regression analysis of the demographic characteristics and KAP of respondents following the inclusion of all covariates that were identified to be statistically significant in the bivariate analyses. Age and gender were factored into all three models due to their biological importance. Age was inputted into the model as a continuous variable. The multivariable analysis showed that respondents who had attained primary education were 1.07 times more likely than those with no formal education to express good knowledge of solid waste management, P = 0.045, AOR =1.07 (95% CI: 1.02, 2.11). Respondents who were married were less likely than single respondents to express good knowledge of solid waste management, P = 0.002, AOR =0.47 (95% CI: 0.29, 0.76). Furthermore,

Table 3. Bivariate analysis of sociodemographic characteristics and knowledge, attitude, and practice toward solid waste management among respondents

Sociodemographic characteristics	Knowledge level			Attitude level			Practice level		
	Good, *n* (%)	Poor, *n* (%)	*P*	Acceptable, *n* (%)	Unacceptable, *n* (%)	*P*	Good, *n* (%)	Poor, *n* (%)	*P*
Gender									
Male	113 (43.6)	106 (48.0)	0.342	98 (45.4)	121 (45.8)	0.496	29 (37.3)	190 (47.1)	0.126
Female	146 (56.4)	115 (52.0)		118 (5.6)	143 (54.2)		48 (62.3)	213 (52.9)	
Age (years)									
15 – 19	45 (17.4)	45 (20.4)	0.249	43 (19.9)	47 (17.8)	0.033*	10 (13.0)	80 (19.9)	0.023*
20 – 29	108 (41.7)	74 (33.5)		69 (31.9)	113 (42.8)		23 (29.9)	159 (39.5)	
30 – 39	78 (30.1)	80 (36.2)		74 (34.3)	84 (31.8)		30 (39.0)	128 (31.8)	
≥ 40	28 (10.8)	22 (10.0)		30 (13.9)	20 (7.6)		14 (18.2)	36 (8.9)	
Educational attainment									
No formal education	21 (8.1)	31 (14.0)	< 0.001**	25 (11.6)	27 (10.2)	0.005**	10 (13.0)	42 (10.4)	0.080
Primary	16 (6.2)	31 (14.0)		10 (4.6)	37 (14.0)		2 (2.6)	45 (11.2)	
Secondary	134 (51.7)	111 (50.2)		112 (51.9)	133 (50.4)		38 (49.4)	207 (51.4)	
Tertiary	88 (34.0)	48 (21.7)		69 (31.9)	67 (25.4)		27 (35.1)	109 (27.0)	
Marital status									
Single	147 (56.8)	83 (37.6)	< 0.001**	98 (45.4)	132 (50.0)	0.736	37 (48.1)	193 (47.9)	0.454
Married	87 (33.6)	95 (43.0)		85 (39.4)	97 (36.7)		33 (42.9)	149 (37.0)	
Widowed	20 (7.7)	27 (12.2)		22 (10.2)	25 (9.5)		4 (5.2)	43 (10.7)	
Divorced/separated	5 (1.9)	16 (7.2)		11 (5.1)	10 (3.8)		3 (3.9)	18 (4.5)	
Religion									
Christianity	225 (86.9)	146 (66.1)	< 0.001**	169 (78.2)	202 (76.5)	0.673	66 (85.7)	305 (75.7)	0.045*
Islamic	18 (6.9)	33 (14.9)		20 (9.3)	31 (11.7)		6 (7.8)	45 (11.2)	
Traditional	16 (6.2)	42 (19.0)		27 (12.5)	31 (11.7)		5 (6.5)	53 (13.2)	

*$P < 0.05$, **$P < 0.01$. *P*: Probability value, Chi square statistic analysis was used to obtain the *P* value.

separated/divorced respondents were less likely than single respondents to express good knowledge of solid waste disposal in the study area, $P = 0.005$, AOR =0.18 (95% CI: 00.06, 0.60). Muslims ($P = 0.048$, AOR =0.52; 95% CI: 0.27, 0.99) and traditionalists ($P = 0.001$, AOR =0.30; 95% CI: 0.15, 0.61) were statistically significantly less likely to express good knowledge about solid waste disposal compared to Christians in the study area.

In terms of attitude, respondents with primary education were 1.06 times more likely than those with no formal education to possess an acceptable attitude toward solid waste disposal in the study area, $P = 0.017$, AOR = 1.03 (95% CI: 1.03, 1.88). Regarding practice, for every one point increase in age, the log-odds of respondents engaging in good practice of solid waste disposal significantly increased by 0.049 (B = 0.049, $P = 0.001$). In other words, with every point increase in age, the odds of engaging in good practice of solid waste disposal increased, $P < 0.001$, AOR = 1.08 (95%

CI: 1.04, 1.17). Respondents who had attained primary education were 1.49 times more likely than those with non-formal education to engage in good solid waste disposal practices, $P = 0.022$, AOR = 1.49 (95% CI: 1.29, 2.76). Widowed respondents were 1.19 times more likely than single respondents to engage in good practice, $P = 0.011$, AOR = 1.19 (95% CI: 1.05, 1.68). Finally, traditionalists were significantly less likely than Christians to engage in good solid waste disposal practices in the study area, $P = 0.031$, AOR = 0.34 (95% CI: 0.13, 0.91).

4. Discussion

The present study explored the KAP of market traders toward solid waste disposal in Calabar Municipality, Nigeria. To the best of our knowledge, this is the first study exploring the KAP of solid waste disposal across all markets in the ever-busy and increasingly populated Calabar Municipality. In general, the study's results identified a slightly good knowledge of solid waste disposal. Good

Table 4. Multivariable analysis of sociodemographic characteristics and KAP toward solid waste management among respondents

Sociodemographic characteristics	Knowledge level			Attitude level			Practice level		
	AOR	95% CI	*P*	AOR	95% CI	*p*	AOR	95% CI	*P*
Gender									
Male	1	-	-	1	-	-	1	-	-
Female	1.31	0.88 – 1.93	0.183	0.98	0.68 – 1.42	0.982	1.608	0.95 – 2.73	0.080
Age (years)	1.02	0.99 – 1.05	0.207	1.02	0.99 – 1.04	0.085	1.08	1.04 – 1.17	< 0.001**
Educational attainment									
No formal education	1	-	-	1	-	-	1	-	-
Primary	1.07	1.02 – 2.11	0.045*	1.06	1.03 – 1.88	0.017*	1.49	1.29 – 2.76	0.022*
Secondary	1.08	0.57 – 2.14	0.857	1.04	0.55 – 1.99	0.896	0.76	0.33 – 1.77	0.524
Tertiary	1.63	0.79 – 3.33	0.183	1.20	0.63 – 2.29	0.581	0.83	0.35 – 2.00	0.683
Marital status									
Single	1	-	-	1	-	-	1	-	-
Married	0.47	0.29 – 0.76	0.002*	0.99	0.63 – 1.57	0.978	0.59	0.31 – 1.12	0.108
Widowed	0.50	0.22 – 1.12	0.096	0.91	0.42 – 1.98	0.803	1.19	1.05 – 1.68	0.011*
Divorced/separated	0.18	0.06 – 0.60	0.005*	1.16	0.42 – 3.22	0.781	0.33	0.08 – 1.39	0.131
Religion									
Christianity	1	-	-	1	-	-	1	-	-
Islamic	0.52	0.27 – 0.99	0.048*	0.87	0.46 – 1.66	0.678	0.66	0.27 – 1.62	0.362
Traditional	0.30	0.15 – 0.61	0.001*	0.92	0.49 – 1.73	0.788	0.34	0.13 – 0.91	0.031*

*$P < 0.05$, **$P < 0.01$. CI: Confidence interval, AOR: Adjusted odds ratio, P: Probability value

knowledge of solid waste disposal has proven to improve individuals' overall knowledge about the population health and has also helped to reduce their propensity to indulge in poor waste disposal (Orhorhoro & Oghoghorie, 2019). Good overall knowledge found in this study, however, did not translate to the respondents' attitude and practice as the study found poor attitude and extremely poor practices toward solid waste disposal among the respondents. This finding is consistent with cross-sectional studies by Abejegah *et al.* (2013) and Oladejo & Amosu (2013) which found that despite the high knowledge of market traders and residents regarding solid waste disposal in Benin City and Lagos, Nigeria, the practice of indiscriminate dumping of wastes was high (60%). Another cross-sectional study in North Thailand by Laor *et al.* (2018) found that despite the market traders' high overall level of knowledge, their practices toward proper solid waste disposal were nearly below average. This may be a portrayal of the lack of policies that guide the disposal of waste in public places. In essence, where policies against indiscriminate dumping of solid wastes do not exist or are sparsely enforced, market users, and indeed traders who know the proper way of discarding wastes will rather dump them indiscriminately for convenience's sake since no penalties accrue for their actions. Furthermore, there may be issues of lack of facilities for waste separation and prompt collection; lack of will

power by waste agencies to engage in the right practice; and lack of motivation driven by poor incentives for waste disposal companies to discharge the duties judiciously.

This present study did not find any associations between secondary or tertiary education and better knowledge of solid waste disposal. This contrasts a study by Laor *et al.* (2018) which found higher educational attainment to be statistically significantly associated with good knowledge of solid waste disposal among traders. Another cross-sectional study in Jos, Nigeria, by Jatau (2013) found a higher level of education to be associated with traders' increased knowledge level of solid waste disposal. This association can be attributed to a different level of exposure achieved on the academic ladder whereby individuals are exposed to different levels of teachings and awareness leading them to develop a better overall understanding of hygiene. The improvement in knowledge of market traders toward solid waste disposal through formal education or other means is necessary to improve the perceptions of traders toward bearing responsibility for the hygienic situation of their environments (Chengula *et al.*, 2015). The reasons for this contrasting finding are not clear and require further investigation. However, respondents who had attained primary education had better knowledge than those with non-formal education. In addition, being married was associated with poorer knowledge. This

contrasts with findings by Al-Khatib *et al.* (2009) which suggested that married persons had better knowledge of solid waste disposal than other marital groups. The association between being married and knowledge level found in this study requires further scientific investigation. Furthermore, being divorced or separated was significantly associated with poor knowledge of solid waste disposal among the study respondents. This is consistent with a study Al-Khatib *et al.* (2009) which found that divorcees were more likely to have poorer knowledge of solid waste management. Furthermore, Muslims and traditionalists expressed poorer knowledge of solid waste disposal in the study area. This disagrees with research by Al-Khatib *et al.* (2009) who found that Muslims possessed high overall knowledge of solid waste disposal because their religion places a strong emphasis on neatness to the extent that this is done as an act of worship. The association found between Islamic religion and knowledge of solid waste disposal in this present study is, however, unclear, likewise the association with traditionalism.

This study identified a significant correlation between traders' acceptable attitude toward solid waste disposal and educational level. In essence, higher educational attainment was associated with higher attitude scores. This is consistent with two observational studies which found a positive correlation between the attitude of individuals toward solid waste management and educational attainment (Iwu *et al.*, 2016; Laor *et al.*, 2018). Higher education creates better exposure for individuals, hence this finding. Age was found to influence the good practice of solid waste management in the study area. In essence, as age increased, respondents were more likely to engage in good practice of solid waste disposal. This agrees with an observational study Agbefe *et al.* (2019) that found good waste disposal practices to be strongly associated with increasing age. This agrees with another study by Laor *et al.* (2018). This could be attributed to maturity and social stability with increasing age which may have reduced their tendency to litter. The younger populations are, in turn, more likely to litter. We also found that traders who had attained primary education were more likely than those with no formal education to engage in good practice toward solid waste disposal, whereas those who had attained secondary or tertiary education had no difference in practice than those with no formal education. The reasons for this finding are unclear, which deserve more research.

Our study found no significant relationship between higher levels of education and practices of solid waste disposal, hence a need for further research on this subject. In addition, those who were widowed were more likely than those who were single to engage in good practice in this study. This is consistent with findings by Al-Khatib *et al.* (2009) who found that compared to singles, widowed respondents were more likely to get involved in environmental sanitation. This finding may be attributed to the fact that widowed respondents who are more commonly at advanced ages are expected to be at a higher level of maturity, thus reducing their tendency to be involved in indiscriminate waste disposal. Finally, traditionalists in this present study were more likely to have poor practices. Poor practices are connected to their poor knowledge as found in this present study. No previous studies have been found to contrast or support this finding.

4.1. Limitations

This was a cross-sectional study which is non-temporal nature, and causality cannot be inferred. Furthermore, other factors such as market location and waste bin availability were not analyzed in this study, giving room for bias due to confounding.

4.2. Implications for intervention and future research

The implications of these findings highlight and set the pace for evidence-based studies that outline the determinants of the complex phenomenon of solid waste disposal and the need to mitigate health risks for the wider population exposed to disease outbreaks in the ever-busy resource-poor settings. The study shows the interaction between KAP and demographic factors. Other factors, in addition to demographic characteristics, need to be considered in future research to complement this present study. This study should also enlighten all actors in the socioecological niche about the progress level of the SDG-11 in our markets so as to develop sustainable means of solving the problem of indiscriminate waste disposal in and around the markets, which are major locations for several types of exchanges and interactions.

5. Conclusion

Calabar has experienced rapid urbanization over the past decades and this situation has increased the population in markets, the generation of solid wastes, and changed the characteristics of these solid wastes around the markets. This study highlights the KAP of market traders toward solid waste management in Calabar Municipality, Nigeria. The findings suggest that the low attitude level and very poor practices toward solid waste management are related to the sociodemographic characteristics of market traders. These create a looming outbreak of diseases and may cause an increase in the morbidity and mortality burden on the economy of Cross River State and Nigeria as a whole. Regularly planned health education should be presented to the traders where the benefits of proper solid waste disposal will be emphasized. There is also a

need to expound health promotion activities to traders in markets through social marketing campaigns and advocacy meetings with the market leaders. Furthermore, there is a need to enforce laws stating disciplinary actions for offenders who dump solid wastes indiscriminately. To further reduce the chances of poor practices, compulsory ownership of temporal waste containers by all traders should be implemented in markets.

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Conflict of interest

There are no conflicts of interest to declare.

Author contributions

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Ethics approval and consent to participate

This study involves human participants and was approved by Ethics and Research Committee of the Department of Public Health, University of Calabar, Nigeria, with approval number UC/CM/PUH/ETH/1916. Participants gave informed consent to participate; hence, this study was in line with the 1964 Declaration of Helsinki and its later amendments.

Consent for publication

Not applicable.

Availability of data

Data have been made available in the results section of this study.

References

Abejegah, C., Abah, S., Awunor, N., Duru, C., Eluromma, E., Aigbiremolen, A., *et al.* (2013). Market sanitation: A case study of Oregbeni market Benin-city Edo State, Nigeria. *International Journal of Basic Applied and Innovative Research*, 2(2):25-31.

Agbefe, L.E., Lawson, E.T., & Yirenya-Tawiah, D. (2019). Awareness on waste segregation at source and willingness to pay for collection service in selected markets in Ga West Municipality, Accra, Ghana. *Journal of Material Cycles and Waste Management*, 21(4):905-914.

https://doi.org/10.1007/s10163-019-00849-x

Agwu, M. (2012). Issues and challenges of solid waste management practices in port-Harcourt city, Nigeria-a behavioural perspective. *American Journal of Social and Management Sciences*, 3(2):83-92.

https://doi.org/10.5251/ajsms.2012.3.2.83.92

Al-Khatib, I.A., Arafat, H.A., Daoud, R., & Shwahneh, H. (2009). Enhanced solid waste management by understanding the effects of gender, income, marital status, and religious convictions on attitudes and practices related to street littering in Nablus Palestinian territory. *Waste Management*, 29(1):449-455.

https://doi.org/10.1016/j.wasman.2008.02.004

Bakare, W. (2021). Solid Waste Management in Nigeria. Brussels: BioEnergy Consult. Available from: https://www.bioenergyconsult.com/solid-waste-nigeria [Last accessed on 2022 Aug 02].

Charan, J., & Biswas, T. (2013). How to calculate sample size for different study designs in medical research? *Indian Journal of Psychological Medicine*, 35(2):121-126.

https://doi.org/10.4103/0253-7176.116232

Chengula, A., Lucas, B.K., & Mzula, A. (2015). Assessing the awareness, knowledge, attitude and practice of the community towards solid waste disposal and identifying the threats and extent of bacteria in the solid waste disposal sites in Morogoro municipality in Tanzania. *Journal of Biology Agriculture and Healthcare*, 5(3):54-65.

Chinedu, I., Ezeibe, C., Anijiofor, S., & Daud, N. (2018). Solid waste management in Nigeria: Problems, prospects, and policies. *Journal of Solid Waste Technology and Management*, 44(2):163-172.

https://doi.org/10.5276/JSWTM.2018.163

Iwu, A.C., Duru, C.B., Uwakwe, K.A., Diwe, K.C., Merenu, I.A., Emerole, C.A., *et al.* (2016). Assessment of waste management practices among traders in major markets in Owerri, Imo state, Nigeria. *International Journal of Health Sciences and Research*, 6:7-17.

Jatau, A.A. (2013). Knowledge, attitudes and practices associated with waste management in Jos South Metropolis, Plateau State. *Mediterranean Journal of Social Sciences*, 4(5):119.

https://doi.org/10.5901/mjss.2013.v4n5p119

Laor, P., Suma, Y., Keawdounglek, V., Hongtong, A., Apidechkul, T., & Pasukphun, N. (2018). Knowledge, attitude and practice of municipal solid waste management among highland residents in Northern Thailand. *Journal of Health Research*,

32(2):123-131.

https://doi.org/10.1108/JHR-01-2018-013

Oladejo, J.A., & Amosu, A.M. (2013). Knowledge, Perception and Solid Waste Management Practices among Residents of Oshodi-Isolo Local Government Area, Lagos State Nigeria. *Texila International Journal of Public Health*, 4:1-8.

Orhorhoro, E., & Oghoghorie, O. (2019). Review on solid waste generation and management in sub-Saharan Africa: A case study of Nigeria. *Journal of Applied Sciences and Environmental Management*, 23(9):1729-1737.

https://doi.org/10.4314/jasem.v23i9.19

Sunday, I. (2013). Waste disposal problems and management in Ughelli, Nigeria. *Journal of Environmental Protection*, 4(4):4-11.

https://doi.org/10.4236/jep.2013.44A002

Taber, K.S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, 48(6):1273-1296.

https://doi.org/10.1007/s11165-016-9602-2

United Nations Habitat. (2022). Waste Wise Cities. Nairobi: United Nations Habitat. Available from: https://www.unhabitat.org/waste-wise-cities [Last accessed on 2022 Oct 12].

Worlanyo, E.K. (2013). Knowledge, Attitudes and Practices of Sanitation Among Market Users at the Dome Market in the Ga East Municipality. Ghana: University of Ghana.

World Bank. (2022). Trends in Solid Waste Management. Washington, DC: World Bank. Available from: https://www.datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html#:text=The%20world%20generates%202.01%20billion,from%200.11%20to%204.54%20kilograms [Last accessed on 2022 Oct 12].