

HOUSEHOLDS' PERCEIVED EFFECTS OF BLACK SOOT ON HEALTH AND AGRICULTURAL PRODUCE IN PORT HARCOURT METROPOLIS, RIVERS STATE.

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Abstract

This study examined the socio-economic effects of black soot on agricultural produce among households in Port Harcourt metropolis, Rivers State, Nigeria. Data were collected by the use of structured questionnaire administered to two hundred and seventy-eight (278) respondents from selected households' heads, in a stratified random fashion. Descriptive statistics such as Percentages and mean scores were used in the analysis. Majority (60.4%) of the respondents were males, 62.2% of them were between the age range of 21-30 years, 79.1% of them attained tertiary education, 60.4% were married, 62.2% of them had a household size within 1-5 persons, 40.3% of the respondents sourced information on black soot from friends/relatives/neighbours /personal observation, 25.9% of the respondents' income level between ₦11,000-₦20,000 with mean of ₦15,500.00. Causes of soot as perceived by households were: during dry season black soot is more intense in the atmosphere ($\bar{x} = 3.27$), Crude oil is illegally cooked/distilled to produce kerosene which is highly flammable ($\bar{x}=3.19$), among others. Majority of the respondents were aware that Black soot could result in birth defects/reproductive problems ($\bar{x}=3.33$). Inhaling black soot could aggravate asthma ($\bar{x}=3.33$), Black soot causes an increased risk of heart attack ($\bar{x}=3.27$). In ways of tackling black soot, the households revealed always washing hands before eating any food ($\bar{x}=3.25$), and night bath with soap and water to wash off black soot on skin ($\bar{x}=2.92$). Effects of black soot on agricultural produce include: vegetables visibly masked and hardened with black tar ($\bar{x}=3.33$), agricultural produce masked with black tar ($\bar{x}=3.27$), Mature harvested fruits look black, dirty and unattractive to buy in the market ($\bar{x}=3.18$). It is recommended that environmental cleaning and mopping up of oil spills be carried to reduce black soot in the atmosphere and on agricultural produce.

Keywords: Black soot, agricultural produce, households, Port Harcourt.

Introduction

It was in the wake of 2016 in Niger Delta, Nigeria that the rain of black soot took over the atmospheric air in Port Harcourt city, Rivers State. It was a mayhem which households in Port Harcourt and environment could not understand. As years go by, the intensity of soot worsened to masking window blinds in houses, clothes in the wardrobe, spread

clothes on hanger lines, on cars and to foot wears which seem dyed with black soot. plates in the kitchen were not without black soot masked, books in bookshelves, to human nostrils and to agricultural produce, green vegetables, oranges, mangos, etc. This soot has so masked agricultural produce that the natural beauty of harvested, ripened fruits remains unattractive, even after being washed with water.

The Niger Delta region seem to be known for its abundant natural resources, ranging from crude oil, varied ecological and numerous aquatics, terrestrial organisms (Ezenwaka and Graves, 2014). For many years past, environmental pollution and degradation have affected both the region and human inhabitants in the region. The people of Niger Delta main occupation or sources of livelihood are farming and fishing. It is worldwide recognized that Niger Delta has the widest spread of mangrove in the world with its natural benefits (Ezenwaka and Graves, 2014). Accumulated years of Land degradation and widespread environmental pollution without much check, seemed to have devastated the environment. Browne *et al.* (2015) noted that variations in the chemical structure of soot are reached due to heterogenous oxidation reactions in the environment. It is noted that the principal quantity of soot comes from developing countries such as Latin America, Asia, and Africa. In the phase of natural endowment, the people have been rendered landless without farmlands due to environmental and land pollution. Human activities in Niger Delta have brought untold destruction on the soil, water and air which are natural life support system, given to mankind uncontaminated (Chijioke, Ebong, and Ufomba, 2018). There is lack of infrastructure, ranging from pipe borne safe drinking water, to lack of quality schools for learning, to lack of roads.

In exploring potentials of petroleum, man over the years systematically seem to have degraded the ecosystems (Yakubu, 2017). According to Ghorani-Azam, Riahi-Zanjani, and Balali-Mood (2016), the popular gaseous, liquid and solid substances emitted into the environment are suspended particles of carbon monoxide, hydrocarbons, nitrogen oxides, sulphur oxides, ozone and lead. Environmental pollution in developing countries is viewed as one of the fourth most critical global premature deaths at one in 10 deaths worldwide (World Bank, 2018). These pollutants that are found along with carbon dioxide in biomass smoke have been identified as mutagenic compounds while some others are carcinogenic (Oguntoke, Opeolu, and Babatunde,

2010). With these pollutants settling on households, fruits, vegetables and agricultural produce, are deadly dangerous case to be glossed over. Microscopic contaminants in the air can penetrate human respiratory system, damaging the lungs and vital organs.

There are other health problems that could arise from soot such as eyes, nose, ear, throat irritation, nausea and long-term chronic health effects. According to Bhargava and Bhargava (2013), acid rain contains high levels of nitric and sulfuric acids which damage trees and acidifies soils and water bodies, making the water too acidic for fish and other aquatic life. The effects of pollution can be seen every day, destroying ecosystems and drinking water, and wreaking havoc on human and environmental health (Ghorani-Azamet *al.* 2016).

Black soot affects and masks the surface of agricultural produce and water resources such as rivers, streams and swimming pool water surfaces. Most developing countries, especially sub-Saharan African countries critically depend on agriculture for their livelihood. According to Acharya, Mishra, Berg-Beckhoff (2015), black soot interfering on the prevailing food and water structures might mean shattering already structured development and livelihood. Consequently, black soot poses threat to food security and nutrition of the households in these regions. By the backdrops, there is need to examine the effects of black soot on agricultural produce among households in Port Harcourt metropolis.

Purpose of the study

The broad objective of the study was to examine households perceived effects of black soot on health and agricultural produce in Port Harcourt metropolis, Rivers State. Specifically, the study was designed to:

1. examine the socio-economic characteristic of households in Port Harcourt metropolis,
2. identify causes of black soot in the study area,
3. determine the level of awareness of health effects of black soot by the households,
4. determine the effects of black soot on agricultural produce as perceived by households in the study area; and
5. identify adaptive measures of black soot among households in the study area.

Methodology

The research was conducted in Port Harcourt Metropolis of Rivers State, Nigeria. The State lies between longitude 6.50E of Greenwich meridian and 50N-60N of the equator (Emodi, Obiora and Okere, 2014). Rivers state has twenty-three Local Government Areas with Port Harcourt as the capital. All the households in Port Harcourt L.G.A formed the population for the study. Purposive and simple random sampling techniques were used for the study. First, two (Port Harcourt City and Obia-Akpor)

Local Government Areas (LGAs) were selected because they are the major LGAs in Port Harcourt City Metropolis. Secondly, Amadi Ama, Ogbunabali, Nkpolu-Oroworukwo, Elekahia, Borokiri, Abuloma and Diobu communities were selected from Port Harcourt city LGA, while Rumuekini, Alakahia, Choba, Ozuoba, Elioparanwo, Rumueme, and Rumualogu communities were selected from Obio-Akpor LGAs. Port Harcourt has an area of 52 kilometres southeast of Ahoada and about 40 kilometres northwest of Bori. It is bounded to the south by Okrika, to the east by Eleme, to the north by Obio-Akpor and to the west by Degema. It has a total size of 109 square kilometres. The people in Rivers state are mainly civil servants who are mostly working in companies and government establishments. There are scanty farm lands and backyard gardens in Port Harcourt City and Obio-Akpor LGAs. However, most agricultural produce especially yam, cassava, cocoyam, maize, rice and beans, fruits and vegetables are brought from neighbouring towns and sold in Rivers State.

Seven (7) communities were selected from Port Harcourt City and Obio-Akpor LGAs, respectively for the study. Twenty (20) household members were purposively selected from each of the communities from the two selected LGAs. This was because the actual population of these households at the time of the study was not available. A total sample size of 278 household members were actually used for the study. Interview schedule and structured questionnaire were used to obtain data from the respondents. Perceived effects of black soot and its adaptive measures among households were determined using a 4-point Likert rating scale of 'strongly agree =4', 'agree=3', 'disagree=2' and 'strongly disagree=1'. The mean was calculated thus: $4+3+2+1=10/4=2.5$. In the decision rule, any variable with mean score of 2.50 and above were considered as effects of black soot and adaptive measures whereas any variable less than 2.50 were not considered. Socioeconomic profile of the respondents was analyzed with percentage. Data on effects and adaptive measures of black soot were analyzed using mean.

Results and Discussion

Socio-economic characteristics of households

Sex

Entries in Table 1 shows that majority (60.4%) of the household were males, while 39.6% of them were females. This implies that both males and females are habitats in Port Harcourt metropolis. It infers that gender does not segregate them from living together.

Age

Majority (62.2%) of the households were between the age range of 21-30 years, with mean age of 25.5 years. The finding implies that greater proportion of the households are young active persons contributing

to labour force in the study area. Being young could help them cope with activities in a metropolitan city.

Educational level

A greater proportion (79.1%) of the respondents attained tertiary education, while 8.6% of them had no formal education. This implies that about 91.4 of the households are literate. The result could infer that the households are learned, can read, write and communicate information on agricultural produce without much difficulty.

Marital status

Data in Table 1 reveal that majority (60.4%) of the households were single, 31.7% of them are married, 4.7% of the respondents were divorced, while 3.2% of them were widower/widow. This implies that they are mature, adults and to the age of reasoning and bearing responsibilities. Ranging from feeding themselves and attending to their daily needs.

Household size(persons)

A greater proportion (62.2%) of the respondents had a household size within 1-5persons, while 1.1% of the respondents had least household size of 16 and above. In a metropolitan city households' size are less in number compare to rural areas. This could be partly due to the fact that most households' families are settled in their rural communities. They come into the study area to work and earn their wages and monthly pay.

Members of cooperatives

Majority (65.1%) of the respondents were not members of co-operative, while 34.9% of them are members of cooperative. This implies that most of the respondents are salary earners and are not fully engaged in agricultural production where cooperative association are formed for extension services and for credit facilities in supply of farm inputs.

Primary occupation

Greater proportion (61.9%) of the respondents are civil servants, 29.9% of them are farmers, while 8.3% of them are self-employed. This implies that the respondents are mainly employees of ministries and oil companies in the study area.

Farming experience (years)

Majority (56.5%) of the households had farming experience of 1-5years, 27.3% of them had farming experience of 6-10years, 9.4 % of them had farming experience of 16 and above years, while 6.8% of them had farming experience of 11-15 years. The mean years of farming experience was 3 years. This implies that many of the households are quite young in farming.

Sources of information on black soot

About 40.3% of the respondents sourced information on black soot from Friends/relatives/neighbours /personal observation, 39.6% of them sourced information from radio, 10.4% of them sourced information from newspaper, while 1.1% of the respondents sourced information from bulletin. This infers that the respondents are literate (Table 1), observant to changes in their environment and sensitive to food consumed.

Income level

About 25.9% of the respondents' income level was between ₦11,000-₦20,000. The mean income level was ₦15,500.00. About 23.4% of the respondents earned income above ₦40,000, 20.1% of them earned income Below ₦10,000, 16.2 % of them earned income between ₦21,000-₦30,000, while 14.4% of them earned income between ₦31,000-₦40,000. This implies that the respondents are mainly salary and wage earners.

Table 1: Socio-economic characteristics of households in Port Harcourt metropolis

Variable		Frequency (n=278)	Percentage (100%)	Mean (\bar{x})
Gender	Male	168	60.4	
	Female	110	39.6	
Age (years)	21-30	173	62.2	25.5years
	31-40	73	26.3	
	41-50	13	4.7	
	51-60	16	5.8	
	61years and above	3	1.1	
Educational level	No formal education	24	8.6	
	Primary education	13	4.7	
	Secondary education	21	7.6	
	Tertiary education	220	79.1	
Marital status	Single	168	60.4	
	Married	88	31.7	
	Divorced	13	4.7	
	Widower/widow	9	3.2	
Household size (Persons):	1-5	173	62.2	3 persons

	6-10	87	31.3	
	11-15	15	5.4	
	16 and above	3	1.1	
Primary occupation	Farmer	83	29.9	
	Civil servant/Oil company employee	172	61.9	
	Self employed	23	8.2	
Member of co-operative:	Yes	97	34.9	
	No	181	65.1	
Farming experience: (years)	1-5	157	56.5	3years
	6-10	76	27.3	
	11-15	19	6.8	
	16 and above	26	9.4	
Source of information on black soot	Friends/relatives/neighbours/personal observation.	112	40.3	
	Radio	110	39.6	
	Television	24	8.6	
	Newspaper	29	10.4	
	Bulletin	3	1.1	
Income level (₦)	Below 10,000	58	20.1	
	11,000-20,000	72	25.9	₦ 15,500.00
	21,000-30,000	45	16.2	
	31,000-40,000	40	14.4	
	Above 40,000	65	23.4	

Source:Field survey, 2019

Causes of black soot as perceived by the households

Table 2 shows the causes of black soot on agricultural produce as perceived by the households in Port Harcourt metropolis. 8 out of the 9 items investigated were perceived by the households as causes of black soot on agricultural produce and the environment. The most highly perceived causes of black soot by the households were: during dry season black soot is more intense in the atmosphere ($\bar{x} = 3.27$), crude oil are illegally cooked/distilled to produce kerosene which are highly flammable ($\bar{x}=3.19$), Farm lands are destroyed by oil spillage($\bar{x} = 3.06$), the police set ablaze illegal crude oil depot at the Niger Delta creek emitting black smoke into the atmosphere ($\bar{x}=3.03$). This implies

that during dry season the pollutant masked in muddy water dries up and saturates the atmosphere and agricultural produce such as fruits and vegetables.

The following were also perceived as causes of black soot by the households: youths are engaged in illegal drilling of crude oil($\bar{x}=2.95$), people operate businesses which entails burning and emission of smoke into the atmosphere ($\bar{x}=2.84$), the town is over populated with waste littered on the street($\bar{x}=2.70$), many people are living in clustedunventilated one room apartment($\bar{x}=2.64$).This infers that human activities are the genesis of black soot in the study area, consequently, destroying agricultural produce for human consumption.

Table 2: Mean distribution of causes of black soot as perceived by the households

Variable	SA	A	D	SD	Mean (\bar{x})	SD
The town is over populated with waste littered on the street	68(24.5)	97(34.9)	74(26.6)	39(14.0)	2.70	.992
Many people are living in clustered unventilated one room apartment	67(24.1)	97(34.9)	61(21.9)	53(19.1)	2.64	1.048
People operate businesses which entails burning and emission of smoke into the atmosphere	59(21.2)	133(47.8)	69(24.8)	17(6.1)	2.84	.826
Youths are engaged in illegal drilling of crude oil	97(34.9)	99(35.6)	52(18.7)	30(10.8)	2.95	.984
Crude oil are illegally cooked to produce kerosene which are highly flammable	120(43.2)	101(36.3)	48(17.3)	9(3.2)	3.19	.836
The police set ablaze illegal crude oil depot at the Niger Delta creek emitting black smoke into the atmosphere	107(38.5)	93(33.5)	57(20.5)	21(7.6)	3.03	.946
During dry season black soot is more intense in the atmosphere	134(48.2)	90(32.4)	48(17.3)	6(2.2)	3.27	.820
Farm lands are destroyed by Oil spillage	103(37.1)	101(36.3)	61(21.9)	13(4.7)	3.06	.881
Most youths go into illegal bounkery because they are homeless	45(16.2)	57(20.5)	118(42.4)	58(20.9)	2.32	.981

Source: Field survey, 2019

Level of awareness of health effect of black soot as perceived by households

Entries in Table 3 reveal that the respondents were aware of all the 11 items investigated as effects of black soot on their health. These were: inhaling black soot could aggravate asthma ($\bar{x}=3.33$), could cause ill-health and lung diseases ($\bar{x}=3.33$), black soot causes an increased risk of heart attack ($\bar{x}= 3.27$), black soot could result in birth defects/reproductive problems ($\bar{x}= 3.27$), result in irritation of the eyes, nose, and throat ($\bar{x}=3.11$), poison blood because it contains blood poisoning compounds ($\bar{x}=3.08$), cause gasping, coughing, and breathing problems ($\bar{x}=3.08$), inhaling black soot could cause cancer ($\bar{x}=3.04$), shorten life span ($\bar{x}=3.04$) and worsening of existing heart problems and asthma ($\bar{x}=3.04$).

The most highly perceived level of awareness by the households were inhaling black soot could aggravate asthma and could cause ill-health and lung diseases with ($\bar{x} = 3.33$), respectively. This implies that the respondents are literate (Table 1).

Soot is an environmental pollution which is carcinogen to man, and can cause diseases such as respiratory illnesses, and cardiovascular infections (Niranjan and Thakur, 2017). In support, Raphaelo (2009) mentioned that black soot could be irritating to human respiratory systems and can worsen pre-existing medical situations such as asthma, lung cancer and human infertility. Muralikrishna and Manickam (2017) mentioned that photochemical smog affects man and causes irritation of the eyes, nose, throat, and chest.

Table 3: Level of awareness of health effects of black soot as perceived by households

Items	SA	A	D	SD	Mean (\bar{x})	SD
Inhaling black soot could cause cancer	95(34.2)	116(41.7)	51(18.3)	16(5.8)	3.04	.870
Black soot could poison blood because it contains blood poisoning compounds	97(34.9)	119(42.8)	49(17.6)	13(4.7)	3.08	.842
Inhaling black soot could aggravate asthma	141(50.7)	95(34.2)	34(12.2)	8(2.9)	3.33	.800
Black soot could cause ill-health and lung diseases	126(45.3)	108(38.8)	36(12.9)	8(2.9)	3.33	.800
Black soot could shorten life span	117(42.1)	82(29.5)	53(19.1)	26(9.4)	3.04	.870
Soot could cause gasping, coughing, and breathing problems	100(36.0)	122(43.9)	47(16.9)	9(3.2)	3.08	.842
Black soot could result in birth defects/reproductive problems	53(19.1)	94(33.8)	93(33.5)	38(13.7)	3.27	.793
Black soot causes an increased risk of heart attack	94(33.8)	115(41.4)	63(22.7)	6(2.2)	3.27	.793
Black soot could result in irritation of the eyes, nose, and throat	104(37.4)	122(43.9)	46(16.5)	6(2.2)	3.11	.882
Black soot can also cause worsening of existing heart problems and asthma	103(37.1)	126(45.3)	44(15.8)	5(1.8)	3.04	.870

Source: Field survey, 2019

Effects of black soot on agricultural produce

Data in Table 4 show that 9 out of the 10 items investigated were perceived by the households as effects of black soot on agricultural produce. These include: vegetables are visibly masked and hardened with black tar ($\bar{x}=3.33$), agricultural produce are masked with black tar ($\bar{x}=3.27$), Mature harvested fruits look dirty, black and unattractive to buy in the market ($\bar{x}=3.18$), Most compound trees (mango, lemon, native orange, sour suck, grape, African pear) have low yields ($\bar{x}=3.17$), black masked vegetables are not easily washed off with water ($\bar{x}=3.13$), Vegetables when cooked have hard texture rather than tender texture ($\bar{x}=3.08$), oranges, tangerines when harvested lack juice in them ($\bar{x}=3.03$), most coconuts dry and fall off the trees, rotten without water inside ($\bar{x}=2.84$). The most highly perceived effect of black soot on agricultural produce is that vegetables are visibly masked and hardened with black tar. Woodford (2018) mentioned that air pollution has serious effects on agricultural produce because of chemical residues it forms in plants when react with water. He further mentioned that

atmospheric carbon dioxide has resulted to global warming and climate change which has negative impact on the world agriculture and reducing crop yields.

The less perceived effects by respondents on agricultural produce were: mature fruits rotten and fall from trees and Most agricultural produce (Guava, paw-paw) mature with black decay spots on the skin ($\bar{x}=2.32$), respectively.

This infers that vegetables being visibly masked and hardened with black tar is considered as the major effect of black soot on agricultural produce. The burning of fossil as source of fuel causes chemical reactions which produces Ozone and peroxyacetyl nitrate (PAN) that cause damage to plants. Ozone negatively influences plant growth and its development to low yield in agricultural production. According to Brust (2013), black carbon enters leaves through stomata, and becomes toxic to the plant. There are potential risks associated with eating contaminated agricultural produce especially vegetables grown on contaminated soil which could lead to serious health issue (Hu *et al.* 2017).

Table 4: Effects of black soot on agricultural produce as perceived by the respondents

Items	Mean (\bar{x})	SD
Agricultural produce are masked with black tar	3.27	.793
Mature fruits rotten and fall from trees	2.32	.981
Vegetables are visibly masked and hardened with black tar	3.33	.800
Oranges, Tangerines when harvested lack juice in them	3.03	.946
Black masked vegetables are not easily washed off with water	3.13	.803
Vegetables when cooked have hard texture rather than tender texture	3.08	.842
Mature harvested fruits look dirty, black and unattractive to buy in the market	3.18	.756
Most agricultural produce (Guava, paw-paw) mature with black decay spots on the skin	2.32	.981
Most coconuts dry and fall off the trees, rotten without water inside	2.84	.826
Most compound trees (mango, lemon, native orange, sour suck, grape, African bear) have low yields	3.17	.775

Source:Field survey, 2019

Ways of tackling the effect of black soot by the households

Entries in Table 5 reveal that 4 out of the 8 items were considered as ways of tackling the effect of black soot by the respondents. Always washing hands before eating any food ($\bar{x} = 3.25$) was perceived as highest strategy in tackling the effect of soot by households.

Taking bath with soap and water to wash off black soot on skin ($\bar{x} = 2.92$), cleaning off black soot in the nostrils by use of towel every night before going to bed ($\bar{x} = 2.80$), and hardly buying of food and eating outside the home unwashed ($\bar{x} = 2.60$) were also perceived as ways in tackling the effects of black soot by households.

The less perceived ways of tackling the effect of black soot by households were: purchase of food stuff without soot from neighbouring towns markets ($\bar{x} = 2.48$), fruits bought in the market are washed with soap and sponge to remove masked black soot on it ($\bar{x} = 2.49$), plates in my kitchen are wrapped in cellophane bags or kitchen napkins after washing to avoid soot ($\bar{x} = 2.02$), doors and windows of my house are never opened to air my house ($\bar{x} = 1.83$). This implies that the respondents have knowledge of hygiene and disease prevention by washing their hands before eating any food. It might be that through washing of hands before any meal, the effect of the black soot to their health could be reduced to a considerable rate.

Table 5: Mean distribution on ways in tackling the effect of black soot

Variable	SA	A	D	SD	Mean (\bar{x})	SD
Always get my hands washed before eaten any food	143(51.4)	73(26.3)	51(18.3)	11(4.0)	3.25	.892
I clean off black soot always by use of towel to clean my nostrils every night before going to bed	77(27.7)	96(34.5)	78(28.1)	27(9.7)	2.80	.954
I hardly buy food and eat outside my home unwashed	58(20.9)	103(37.1)	65(23.4)	52(18.7)	2.60	1.017
I purchase food stuff without soot from neighbouring town markets	33(11.9)	100(36.0)	113(40.6)	32(11.5)	2.48	.848
Doors and windows of my house are never opened to air my house	9(3.2)	37(13.3)	129(46.4)	103(37.1)	1.83	.778
Plates in my kitchen are wrapped in cellophane bags or kitchen napkins after washing to avoid soot	13(4.7)	70(25.2)	105(37.8)	90(32.4)	2.02	.875

Fruits bought in the market are washed with soap and sponge to remove masked black soot on it	39(14.0)	106(38.1)	86(30.9)	47(16.9)	2.49	.934
Every night I take my bath with soap and water to wash off black soot on my skin	98(35.3)	92(33.1)	57(20.5)	31(11.2)	2.92	1.001

Source: Field survey, 2019

Conclusion

Soot is revealed to have effect on health and agricultural produce among households in Port Harcourt metropolis. From the findings, human activities such as illegal drilling of crude oil generates soot which is hazardous to the environment, affects agricultural produce that vegetables are visibly masked and hardened with black tar. Inhaling of soot could aggravate asthma, cause ill-health, lung diseases and health of habitats. Always washing hands before eating any food was most highly ranked as strategy in tackling effects of soot by households. The study recommends that government should through the Ministry of Health and Environment organize seminars, workshop to educate the households on hazardous effect of soot on agricultural produce, environment and health of the households in Port Harcourt metropolis. There is need for policymakers to develop centers for easy access to information on soot and its hazardous effect on agricultural produce and the environment.

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