Original Research Article

Assessing the Level of Awareness of Health Hazards Associated With Operations of Medium-Scale DPK Vendors Using Motorized Pumps With ASTs in Ilorin Metropolis, Kwara State, Nigeria.

Abstract-The continuous trend in the increase of diseases and death associated mostly with hazards from the use and transportation of kerosene; coupled with tens of millions of Nigerians depending on it - as a substitute for stoves, cooking and an erratic electric power supply for lamp illumination, this could be as a result of low awareness of these risks amongst kerosene suppliers and retailers. Kerosene being a highly inflammable substance is a major factor in various fire burn injuries, child poisoning incidences reported across the country. Thus, numerous studies have been conducted on petrol stations and refineries; with little focusing on kerosene vendorsand the operations of these vendors. ***Aim and Objectives***: This study aimed at assessing the awareness of medium-scale DPK vendors using motorized pumps with aboveground storage tanks (ASTs) in Ilorin metropolis on the health hazards associated with their trade and as such estimate the percentage increase in the establishment of medium-scale DPK vendors within Ilorin metropolis, determine the level of awareness of these vendors on the health risks associated with their trade and identify the basic safety precautions that are being practiced by these DPK vendors. ***Methodology***: The study adopted a purposive sampling technique. Data was collected with the aid of a structured questionnaire, observational checklist and Handheld Germin (GPSmap® 78) GPS.***Results***: The study indicate that there was over 2000% increase in the establishment of DPK vendors within Ilorin metropolis from two (2) in 2002 to seventy-six (76) in 2017 with majority (48) found in Ilorin west LGA. A higher percentage of the DPK vendors 59(77.6%) lack the awareness on the health hazards associated with their operations; with a large proportion of the DPK vendors not engaging in basic safety practices. Only 6(7.9%) have fire extinguishers, 13(17.1%) with sand buckets, and 65(88.5%) of the DPK vendors not using the personal protective equipment (PPEs). The geospatial assessment of the DPK vendors also revealed that only two(2) fire stations are found within Ilorin metropolis with 71% of the DPK vendors lacking the knowledge of their locations and 0(100%) ignorant of the fire station emergency numbers in case of fire mishaps. The test of hypothesis to determine the association between the basic safety precaution practices and awareness of health hazards associated with DPK vendors operations revealed that the p values for each of the sub-variables of basic safety measures were less than 0.05 at Chi values of 7.361, 8.948, and 8.136 at degree of freedoms of 1, 1, and 3 respectively for availability of fire extinguisher; bucket with sand and fire blanket; and PPEs respectively.***Conclusion***: In conclusion, the study revealed there is an uncontrolled proliferation of DPK vendors, low awareness level on the health hazards associated with their operations, lack of compliance to basic safety practices and high level of non-compliance to the use of PPEs;***Recommendations***: therefore, the need for massive awareness campaign on the various health hazards associated with DPK vendors operations, basic precaution practices, the use of safety wears, fire stations emergency numbers and the precautions to avoid fire outbreaks and other disasters associated with their trade is sacrosanct.

Index Terms- ASTs, Awareness, Basic safety practices, Burns, DPK, Fire, Fire stations, GIS, Health hazards, Ilorin metropolis, PPEs, Kerosene.

I. INTRODUCTION

Dual Purpose Kerosene (DPK) has been an important household fuel since the mid-19th century. In developed countries the use of DPK has greatly decreased as a result of availability of electricity. Meanwhile, in developing countries, kerosene use for cooking and lighting remains widespread[1]. DPK is a by-product derived from series of

fractionating processes of petrol from its initial crude form crude oil. Characteristically, kerosene is a colorless to yellowish, oily liquid with a strong odor. It is a mixture of petroleum hydrocarbons and is used in heating oil, lamps, stoves, flares, degreasers, pesticides and paint thinners, and as jet fuel [2]. It is a highly hazardous product and Nigeria with a population of over 180 million is one of the largest producers of crude oil where kerosene is derived [3]. Because kerosene is a combustible liquid, risk of fire hazards is usually associated. Kerosene may form an ignitable vapor/air mixture in closed tanks or containers, with flow or agitation generating electrostatic charges. Since kerosene vapor is heavier than air,it can travel a long distance to cause a fire or explosion far from the source [4].

Healthwise, kerosene can irritate the nose, throat and lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath. Prolonged or repeated exposure can cause burns and itching of the skin with rash, redness and blisters. High exposure can affect the nervous system causing both severe and mild headache, dizziness, nausea and vomiting, weakness, restlessness, disorientation and drowsiness [2]. Convulsions and coma may follow very high exposure to DPK. Chronic (long-term) health effects can occur at some time after exposure to Kerosene and can last for several months or years at times [3].Long term exposure of people to kerosene has been known to cause various health hazards such as toxicity through inhalation of kerosene vapours, respiratory irritations, dermatitis and irritation to the eyes, among others[5].

Fuel based lighting made up of kerosene continues to find essential use in West Africa. Although Nigeria is the sixth largest producer of crude oil among members of the Organization of Oil Producing Exporting Countries (OPEC), petroleum products, especially kerosene, are not always available. Surprisingly, kerosene is more readily available through sub-dealers and retailers than at licensed pump stations [6] despite the product being subsidized. According to Merem *et al.* (2018)[7], factor such as corruption is responsible for the product not been readily available at the licensed pump stations as these stations sells to middle men thus increasing the demand-supply chain thus leading to scarcity of the product. Such retailers/vendors who sell DPK through installed tanks can be found at almost every nook and crannies of Ilorin metropolis and their activities seem non-regulated. Installation of kerosene tanks at close proximity to residential areas and at close proximity to one another is a potential environmental health hazard. The indiscriminate siting of kerosene tanks, overpopulation of vendors in the business and unrestricted operations and activities of the DPK vendors may cause accumulation of kerosene toxic wastes, release of vapour, fire explosions and various environmental hazards.

As at present, there is dearth of information the activities of kerosene vendors; and where present, results are sparse and literature are scarcely available [1]. With the continuous environmental degradation and health hazards occurring as a result of various activities of man, this study is justified with the rationale to assess the level of awareness of health hazards associated withoperations of the numerous medium-scale DPK vendors who make use of motorized pumps within the highly populated Ilorin metropolis.

- Research Questions

    i. What is the total number of medium-scale DPK vendors operating within Ilorin metropolis?
    ii. What is the level of awareness of the vendors on the health hazards associated with their trade?
    iii. What basic safety precautions are being practiced by the DPK vendors?

- Aim of Study

The primary aim of the study is to assess the level of awareness of health hazards associated withoperations of the numerous medium-scale DPK vendors using motorized pumps with ASTs in Ilorin metropolis.

- Objectives of the study

    i. Estimate the number of medium-scale DPK vendors using motorized pumps with ASTs in Ilorin metropolis.
    ii. Identify the locations of these medium-scale DPK vendors operating within Ilorin metropolis using GIS tool.
    iii. Determine the level of awareness of these vendors on the health risks associated with their trade.
    iv. Identify the basic safety precautions that are being practiced by these DPK vendors and recommend safety measures and controls to mitigate the associated adverse effects.

II. METHODOLOGY

- Study Area`

Study was conducted in the three (3) Local Government Areas of Ilorin; namely: Ilorin East, Ilorin West, and Ilorin South. Ilorin, the state capital of Kwara State is located on latitude 8º30' and 8º50'N and longitude 4º20' and 4º35'E of the equator. Ilorin city occupies an area of about 468sqkm and it is situated in the transitional zone within the forest and the guinea savannah regions of Nigeria. It is about 300 kilometers away from Lagos and 500 kilometers away from Abuja the federal capital of Nigeria[8]. The city is situated in the transitional zone between the forest and savannah region of Nigeria. The geology of Ilorin consists of Pre-Cambrian basement complex with an elevation that varies from 273m to 333m in the West having an isolated hill (Sobi hills) of about 394m above sea level and 200m to 364m in the East. Oyegun (1983)[9] further asserted that a large part of Ilorin town is laid by sedimentary rock, which contains both primary and secondary laterites and alluvial deposits. The major river in Ilorin is Asa, which flows North-South direction dividing the plain into two, Western and Eastern part. The Eastern part covers those areas where the GRA is located while the core indigenes areas of Ilorin falls under the Western part.

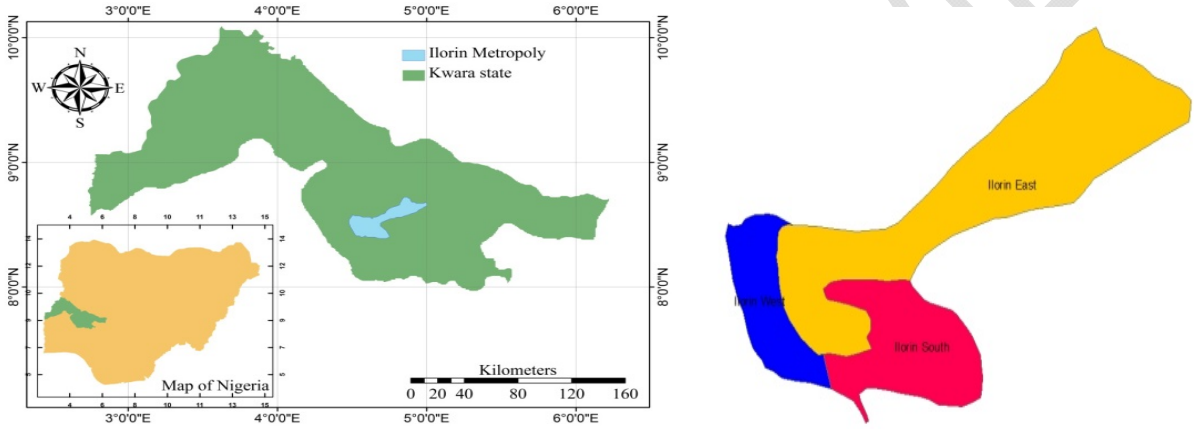

Figure 1: Map showing Kwara state with indication of the study area

- Study design:

The study design used is descriptive cross sectional studies to evaluate the health hazards associated with operations of medium-scale DPK vendors using motorised pump with aboveground storage tanks in Ilorin metropolis for the purpose of mitigating associated adverse effects.

- Sampling

The sampling frame consisted of all medium-scale DPK vendors using motorised pump with aboveground storage tanks within the three Local Government Areas of Ilorin metropolis. These medium-scale DPK vendors using motorised pumps were classified using the their storage facility methods which was based on either an Aboveground Storage Tank (AST) or Underground Storage Tank (UST) using purposive sampling method, all the DPK vendors which met the inclusion criteria was studied.

- Inclusion criteria

Respondents to be included in this study were; salespersons and owners of the medium-scale DPK vendors using motorized pumps with aboveground storage tanks.

- Exclusion criteria

All DPK sales point located within petrol stations due to the fact that their storage facility method is underground storage tanks.

- Data Collection

Three methods of data collection were used in collecting data from our respondents:

i. Face to face Interviews with the DPK vendors salespersons and owners on the awareness of the health hazards associated with the vending of kerosene.
ii. Observational checklist was used to collect data on the availability of safety equipment and the use of personal protective equipment related to the occupational health and safety of DPK vendors operations.
iii. Global Positioning System (GPS) and Measuring tape

- Data Analysis

Prior to data entry, and during the data collection period, the completed data was captured in Excel. The observational data was categorized for analysis. All numerical data was analyzed using descriptive statistics. The spatial coordinates gotten with the aid of GPS was displayed on the map with the aid of Arc View GIS software. Result was presented using tables, frequencies, charts and maps.

- Ethical Considerations

Permission to conduct this research was obtained from the Director, Ministry of Environment Kwara State, before visiting the DPK vendors. The purpose and nature of the study were explained to each respondent after which consent was sought and obtained. Each of the respondents was assured of confidentiality of the information he/she may divulge.

III. RESULTS

Table 1.1: Total number of DPK vendors operating in the various LGAs in Ilorin

Variable	Characteristics	Frequency	Percent (%)
Local Government	Ilorin east	10	13.2
	Ilorin south	18	23.7
	Ilorin west	48	63.2
	Total	76	100.0

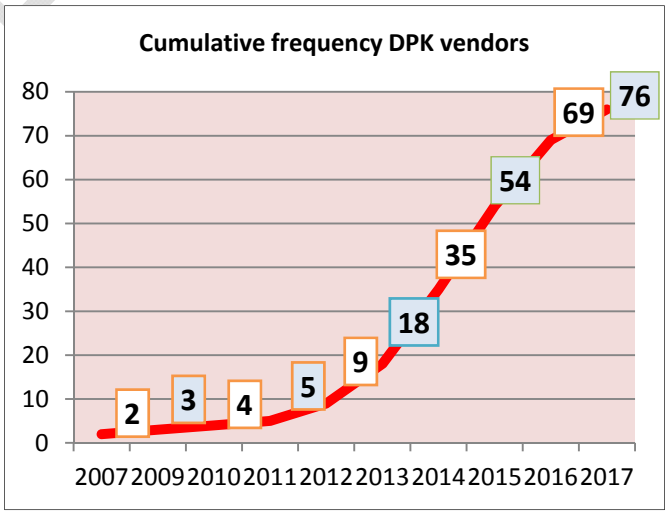

Figure 2: Ogive graphical representation of year of establishment and frequency of the various DPK vendors operating within Ilorin metropolis.

Table 1.1 shows the distribution of the DPK vendors across the three local governments in Ilorin metropolis, the results of the data from the field survey revealed that there are 76 DPK vendors operating within Ilorin metropolis. 10(13.2%) are located in Ilorin east, 18(23.7%) are located in Ilorin south and 48(63.2%) are located in Ilorin west. The high percentage of the DPK vendors being found in Ilorin west local government can be attributed to the social

economical status of the population of the people that dominated the area. According to 2006 census, Ilorin west has the largest population of residents in comparison with the other two local governments that makes up Ilorin metropolis with about 395,735 people. Most of the residents in this area are local farmers, traders, weavers of fabrics popularly known as "aso oke".Figure 2 shows the cumulative frequency graphically represented by an Ogive. From this, it was discovered that 2(2.6%) of the DPK vendors were established in 2007, 1(1.3%) was established each in the year 2009, 2010 and 2011 respectively, 4(5.3%) were established in the year 2012, 9(11.8%) were established in the year 2013, 17(22.4%) in the year 2014, 19(25.0%) in the year 2015, 15(19.7%) were established in the year 2016 and 7(9.2%) were established in the year 2017. It is of great importance to note that from year 2012 to 2017, the establishment of DPK vendors increased sporadically as it coincides with the scarcity of the product in the filling stations nationwide and the high cost of kerosene in the country. According to Oduwole *et al.* (2003)[6], kerosene is more readily available through sub-dealers and retailers than at licensed pump stations. This point is further emphasized by Merem *et al.* (2017)[10] who revealed that during this period, the nation devoted more than $5billion annually for the imports and subsidy of paraffin coupled with massive corruption in the petroleum industry which made kerosene unavailable in the fuel stations.

Table 1.2: Demographic characteristics of the population studied.

Variable	Characteristics	Frequency	Percent (%)
Local Government	Ilorin east	10	13.2
	Ilorin south	18	23.6
	Ilorin west	48	63.2
	Total	76	100.0
Age	10-20years	12	15.8
Mean=	21-40years	58	76.3
	41-60years	6	7.9
Gender	Male	20	26.3
	Female	56	73.7
Tribe	Yoruba	76	100.0
Religion	Islam	62	81.6
	Christianity	13	17.1
	Traditional	0	0.0
	Others	1	1.3
Educational status	No formal education	3	3.9
	Primary	21	27.6
	Secondary	27	35.5
	Tertiary	25	32.9
Position	Owner	46	60.5
	Salespersons	30	39.5
Marital status	Single	27	35.5
	Married	49	64.5
Year of establishment	2007	2	2.6
	2009	1	1.3
	2010	1	1.3
	2011	1	1.3
	2012	4	5.3
	2013	9	11.8
	2014	17	22.4
	2015	19	25.0
	2016	15	19.7
	2017	7	9.2

Table 1.3: The spatial coordinates of the medium-scale DPK vendors operating withinIlorin metropolis

SN	Vendor Name	LGA	Latitude	Longitude

1	Okeose	IL-E	08"22.918'	004"39.210'
2	PJJ	IL-E	08"29.049'	004"32.887'
3	Opeloyemi ventures	IL-E	08"29.569'	004"32.575'
4	Medus global ventures	IL-E	08"29.787'	004"33.846'
5	Jp	IL-E	08"29.788'	004"33.661'
6	Abanic oil, gas	IL-E	08"29.861'	004"33.812'
7	Mub	IL-E	08"29.897'	004"34.300'
8	Abdulsalamaminat	IL-E	08"30.059'	004"33.575'
9	Yawoba	IL-E	08"30.552'	004"31.965'
10	Iderakero	IL-E	08"30.749'	004"35.144'
11	UPP	IL-S	08"25.934'	004"29.767'
12	Mrs adeotiomolewa	IL-S	08"27.045'	004"35.511'
13	EFF	IL-S	08"27.496'	004"34.536'
14	Oluwadabirakerosine shop	IL-S	08"27.506'	004"35.728'
15	Olaso kerosene & lubricant	IL-S	08"27.806'	004"35.440'
16	BAC	IL-S	08"27.809'	004"36.189'
17	ACB	IL-S	08"27.812'	004"35.824'
18	Orotaiwo	IL-S	08"28.863'	004"32.723'
19	Cocacola	IL-S	08"28.872	004"32.498'
20	Oranta	IL-S	08"28.913'	004"33.241'
21	Jagokerozine and lubricant	IL-S	08"28.932'	004"36.199'
22	Nideb oil	IL-S	08"28'114'	004"35.092'
23	Cab	IL-S	08"29.243'	004"33.414'
24	Temola kerosene	IL-S	08"29.272'	004"34.115'
25	FPP	IL-S	08"29.416'	004"33.217'
26	CBA	IL-S	08"29.495'	004"32.716'
27	Onaara	IL-S	08"29.828'	004"33.363'
28	Abc	IL-S	08"30.637'	004"35.218'
29	Bello rasaq	IL-W	08"26.596'	004"35.209'
30	Munayo kerosene	IL-W	08"27.525'	004"30.560'
31	Toroaye	IL-W	08"27.543'	004"31.387'
32	Ayobami mini-depot	IL-W	08"27.618'	004"31.270'
33	Otaodo	IL-W	08"27.666'	004"30.481'
34	Gaaodo	IL-W	08"27.694'	004"30.477'
35	Tunde	IL-W	08"28.020'	004"30.980'
36	Shoa kerosene vendor	IL-W	08"29.154'	004"31.505'
37	Tuntun	IL-W	08"29.159'	004"32.190'
38	Ona-ara venture	IL-W	08"29.165'	004"32.860'
39	Success kerozine vendor	IL-W	08"29.258'	004"31.295'
40	Areta	IL-W	08"29.344'	004"31.184'
41	Albayan kerosene vendor	IL-W	08"29.346'	004"31.187'
42	Kureta	IL-W	08"29.359'	004"32.966'
43	Ajere	IL-W	08"29.447'	004"31.315'
44	ADT	IL-W	08"29.448'	004"31.308'
45	Sulymanabdulgafarsaado	IL-W	08"29.450'	004"31.309'
46	Areda	IL-W	08"29.467'	004"31.325'
47	Awele kerosene venture	IL-W	08"29.550'	004"32.314'
48	Anuoluwakerosine depot	IL-W	08"29.636'	004"31.427'
49	Progress kerozine vendor	IL-W	08"29.724'	004"29.987'
50	Itamo	IL-W	08"29.730'	004"30.886'
51	Aluko	IL-W	08"29.738'	004"32.038'
52	Abdulqodirrahmat	IL-W	08"29.763'	004"32.339'
53	Media global ventures	IL-W	08"29.764'	004"32.766'
54	Alhajamemunat	IL-W	08"29.806'	004"32.651'
55	Asbunallahukerosene	IL-W	08"29.839'	004"31.834'
56	Faolidkerozine depot 2	IL-W	08"29.847'	004"31.664'
57	BCC	IL-W	08"29.899'	004"33.503'
58	Adisabakare	IL-W	08"29'144'	004"32.207'
59	Juta	IL-W	08"30.065'	004"33.031'
60	Magic-fx	IL-W	08"30.065'	004"33.158'
61	Ola aminnakerosine	IL-W	08"30.099'	004"33.159'
62	Faolidkerozine depot 1	IL-W	08"30.131'	004"32.993'
63	Aisha	IL-W	08"30.132'	004"33.527'
64	Faolidkerozine depot 3	IL-W	08"30.166'	004"32.194'
65	Karuma	IL-W	08"30.196'	004"33.441'
66	Arolahumkerpzine depot	IL-W	08"30.198'	004"32.933'
67	Dangba	IL-W	08"30.260'	004"32.273'
68	GM kerozine	IL-W	08"30.277'	004"32.083'
69	Ola aminnakerosine	IL-W	08"30.295'	004"33.751'
70	Ramata kerosene vendor	IL-W	08"30.353'	004"30.408'
71	Lore	IL-W	08"30.423'	004"31.816'
72	Abatasale	IL-W	08"30.517'	004"31.482'
73	Jelo	IL-W	08"30.570'	004"31.153'
74	Leleoke	IL-W	08"30.586'	004"32.419
75	Gbadoa	IL-W	08"30.754'	004"32.682'
76	Yusrof	IL-W	08"30.843'	004"32.283'
77	Fire service headquarters	IL-S	08"28.909'	004"34.498'
78	Unity fire station	IL-S	08"28.929'	004"33.260'

Table 1.2 presents the descriptive statistics based on local governments, age, sex, gender, tribe, religion, educational status, position, marital status and year of establishment. It revealed that 10(13.2%) of the vendors are located in the eastern part of Ilorin metropolis; while a greater proportion 48(63.2%) were located in the western part of Ilorin. The age distribution shows that majority 58(76.3%) of the respondents were in the age group 21-40 years, 12(15.8%) were in the age group 10-20 years and 6(7.9%) were in the age group 41-60 years. There was more of the female gender 56(73.7%) than the male gender 20(26.3%). All of the respondents were of Yoruba tribe. Majority

62(81.6%) were Muslim, 13(17.1%) were Christians. 27(35.5%) had secondary education, 25(32.9%) had tertiary education, 21(27.6%) had primary education while 3(3.9%) had non-formal education. 46(60.5%) of the respondents were owners of these DPK ventures while 30(39.5%) of the respondents were salespersons. 27(35.5%) of the respondents were single while 49(64.5%) were married.The spatial coordinates of the medium-scale DPK vendors operating within Ilorin metropolis are shown in table 1.3. The latitudinal range is between 08"22.918' and 08"30.843'. The longitudinal range is between 004"29.767' and 004"32.993'. These coordinates were analysed using the spatial statistic tool to determine the pattern of distribution of the medium-scale DPK vendors across Ilorin metropolis.

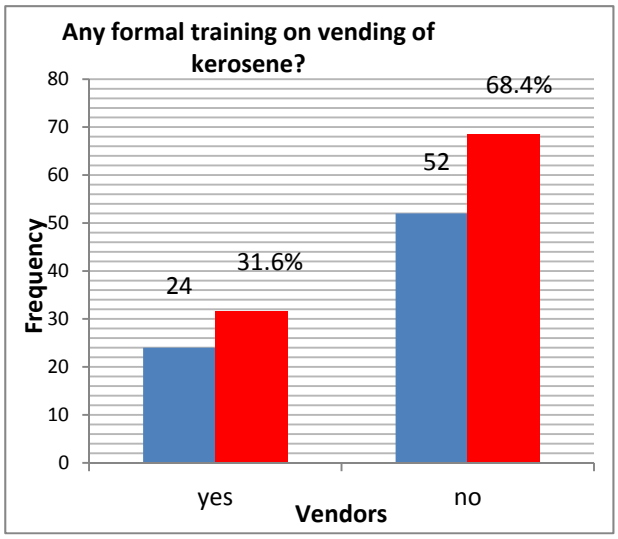

Figure 3: Bar chart showing the frequency distribution of vendors that got formal training on vending of kerosene..

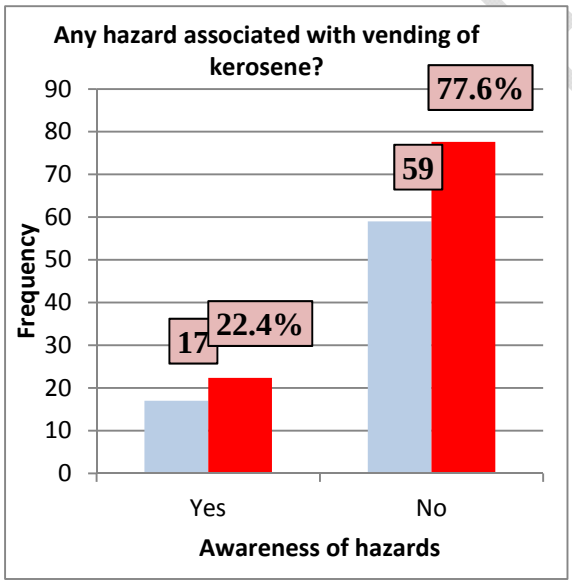

Figure 4: Bar chart showing responses (frequency and percentage) on the awareness of any hazard associated withvending of kerosene.

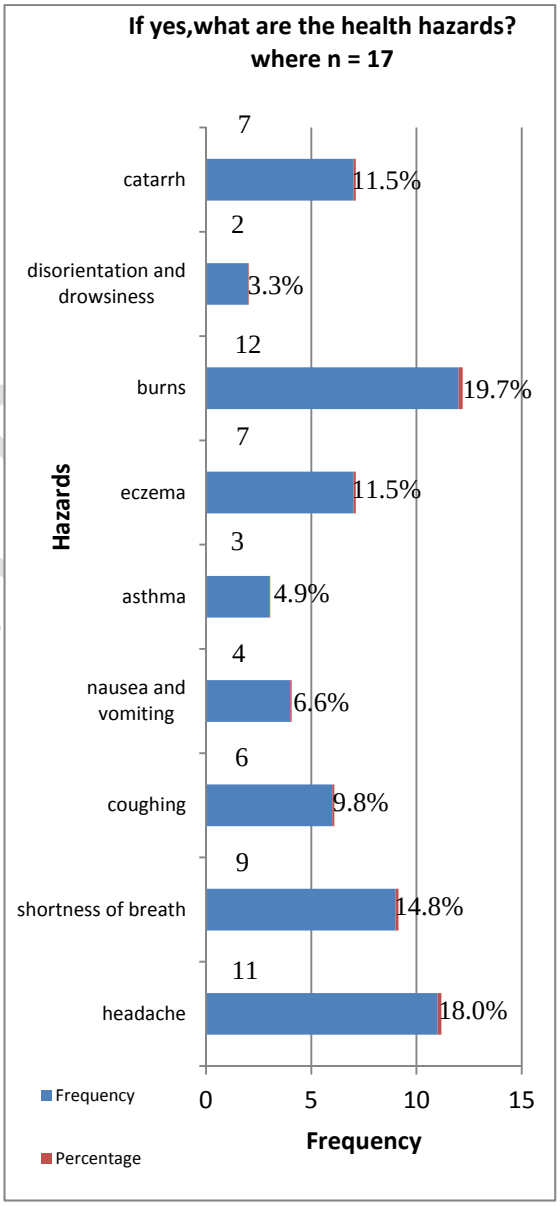

Figure 5:Bar chart showing the various hazards that respondents are aware are associated with vending of kerosene.

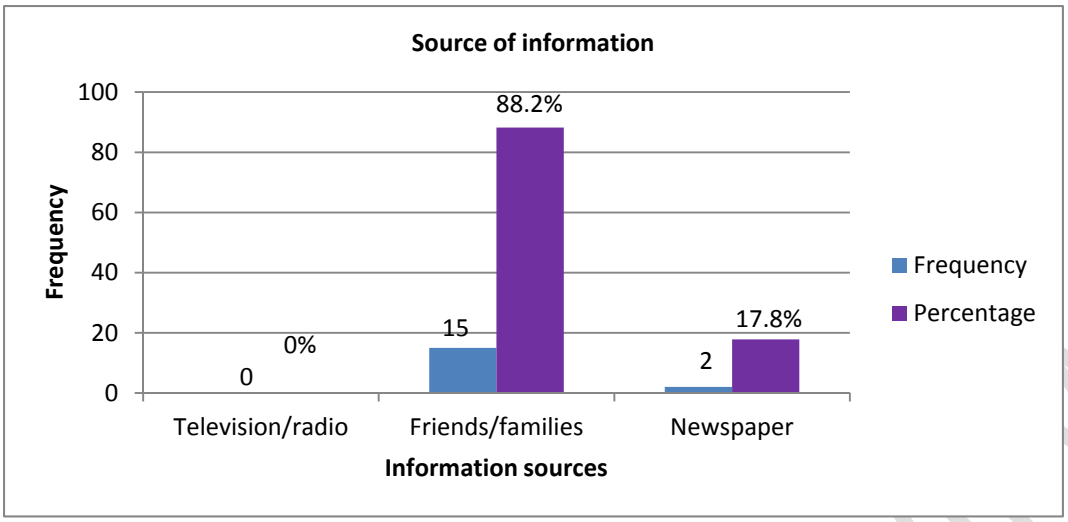

Figure 6: Bar chart showing the frequency distribution of source of information.

Figures 3 to 6 reveal the level of awareness of the vendors on the health hazards associated with DPK trade. Although majority of the respondents 52(68.4%) had no formal training on vending of DPK, an appreciable proportion 24(31.6%) had formal training on the vending of DPK. Only about 17(22.4%) were aware that there are hazards associated with vending of kerosene which is considerably low compare to the geometric increase in the number of people venturing into the business coupled with the fact that location of these DPK vendors are found mostly in the western part of Ilorin metropolis where the core indigenes reside. Majority 59(77.6%) had zero awareness and believe that there are no hazards whatsoever that is associated with vending of kerosene. About 15(88.2%) of those that are aware got their information from friends and family while 2(17.8%) read it from newspaper which further reiterates the clarion call made by Musa *et al.* (2002)[11] and buttressed by Merem *et al.* (2018)[7] that there is need for a public enlightenment on safe fire lighting and cautious use of kerosene in Ilorin metropolis. Out of 17 that are aware of the health hazards associated with DPK trade, 11(18.0%) reported the health hazard to be headache, 9(14.8%) said it is shortness of breath, 6(9.8%) said it is coughing, 6.6% said it is nausea and vomiting, 3(4.9%) said it is asthma, 7(11.5%) said it is eczema, 12(19.7%) reported it is burns, 2(3.3%) reported disorientation and drowsiness and 7(11.5%) reported it is catarrh. This is in line with the information obtained from the US Department of Health and Human Services that kerosene can irritate the nose, throat and lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath. Studies conducted by Ayakeme *et al.* (2013)[3] which was further corroborated by information from NJH (2016)[2], revealed that high exposure to kerosene can affect the nervous system causing headache, dizziness, nausea and vomiting, weakness, restlessness, disorientation and drowsiness, convulsion and coma may follow very high exposure to kerosene. Fadebiyi *et al.* (2009)[5] also reported that kerosene is a culprit in various incidences of burn injuries which is very high in developing countries- Long term exposure of people to kerosene has been known to cause various health hazards such as toxicity through inhalation of kerosene vapour, respiratory irritations, dermatitis and irritation to the eyes, to mention a few [5].

Table 1.4: The likely environmental health hazards associated with the operations of these medium-scale DPK vendors

Variable	Characteristics	Frequency	Percentage (%)
any case of spillage/leakage of kerosene	yes	5	6.6
	no	71	93.4
any case of fire explosion incidence/accidence	yes	0	0.0
	no	76	100.0
proximity to residential building	< 5m	52	68.4
	5-10m	16	21.1
	>10m	8	10.5
proximity to major road	< 5m	61	80.3
	5-10m	12	15.8
	>10m	3	3.9
proximity to a water source	< 5m	11	14.5
	5-10m	12	15.8
	>10m	53	69.7

Results from table 1.4 reveals likely environmental health hazards associated with the operations of these medium-scale DPK vendors, about 5(6.6%) of the DPK vendors had case of spillage/leakage of kerosene from their tanks and the pipes that connect the tanks with the dispensing pumps- although it looks insignificant but one of the principles of environmental health sciences, the precautionary principle stipulates that caution should be exercised in matters that could be deleterious to health even if no incidents/accidents has been reported. 52(68.4%) of the DPK vendors have their tanks situated at place less than 5m to residential buildings, 16(21.1%) have their tanks situated at distance between 5-10m to residential buildings while 8(10.5%) have their tanks situated at distances greater than 10m to residential buildings. 61(80.3%) of the DPK vendors have their tanks situated at place less than 5m to major road, 12(15.8%) have their tanks situatedat distance between 5-10m to major road while 3(3.9%) have their tanks situated at distances greater than 10m to major road. 11(14.5%) of the DPK vendors have their tanks situated at place less than 5m to water sources, 12(15.8%) have their tanks situated at distances between 5-10m to water sources while majority 53(69.7%) have their tanks situated at distances greater than 10m to water sources. A similar study which was conducted by Samuel (2011) on distribution of filling stations in Kaduna North revealed that 69.5% of the filling stations did not conform with the 15m setback thus can pose a serious environmental health hazards. Oloko-oba *et al.* (2016)[12] in a study conducted in Ilorin metropolis on the assessment of filling stations in Ilorin using geospatial techniques also revealed that 28.4% of the filling stations violated the distance from the edge of the road to the nearest pump which should be not be less than 15 m as being stipulated by the DPR guidelines for the approval of construction and operations of a filling stations. Similarly, Mshelia *et al.* (2015)[13] revealed that the guidelines for sitting petrol stations have not been adhered by most of the petrol stations thereby posing serious threat on residence in close range to them even though some of these petrol stations were situated much earlier than the residential houses close to them. This study is corroborated in a study by Abdullahi (2012)[14] in Agege Local Government in Lagos State. Although, there is no written requirement for sitting of DPK sales point or ventures in the DPR guidelines thus this has created a loophole that has lead to the indiscriminate sitting of DPK sales points all over Ilorin metropolis- which could result in numerous environmental health and health hazards to the DPK vendors and to the populace surrounding them. During the field study, it was discovered that majority of this DPK vendors uses a generator to power their motorized pump used in dispensing the product and this generator is placed close to the aboveground storage tank (ASTs) thus increasing the risk of fire explosion and further pollution of the air which constitute a major environmental health and health hazards respectively.

Table 1.5: The basic safety precautions being practiced by the DPK vendors

Variable	Characteristics	Frequency	Percentage (%)
availability of fire extinguisher	yes	6	7.9
	no	70	92.1
knowledge on the usage of fire extinguisher	yes	8	10.5
	no	68	89.5
availability of bucket with sand	yes	13	17.1
	no	63	82.9
availability of fire blankets	yes	10	13.2
	no	66	86.8
presence of personal protective equipment	overall garment/apron	9	11.8
	face mask	1	1.3
	nose mask	1	1.3
	hand gloves	0	0.0
	no PPE	65	85.5
reasons for not using PPE	availability	11	14.5
	convenience	15	19.7
	ignorance	47	61.8
	cost	3	3.9
	others	0	0.0

Table 1.5 shows the results on the evaluation of the basic safety precautions being practiced by the DPK vendors. Majority 70(92.1%) of the vendors do not have fire extinguisher with only very few 6(7.9%) that had a fire extinguisher. On the assessment of their knowledge on the use of fire extinguisher, it was discovered that only 8(10.5%) had knowledge on the usage of fire extinguisher, majority 68(89.5%) do not which is in contrast with the study conducted by Afolabi *et al.* (2011)[15] where about 55.5% of the filling stations in Ife central LGA in Osun State had knowledge on the usage of fire extinguisher. On further evaluation of other safety equipment, it was discovered

that only about 17.1% had bucket with sand and only 13.2% had fire blanket. The presence of Personal protective equipment (PPE) was also assessed. A very few 9(11.8%) had overall garment/apron, 1(1.3%) had face mask, 1(1.3%) had nose mask and none had hand gloves. 65(85.5%) had no PPE. It was evident from the earlier result revealed in figure 4 where 59(77.6%) were not even aware of the hazards associated with the operations of medium scale DPK vendors thus it is important that there should be a rigorous enlightenment campaign on basic safety practices in order to prevent accidents and illness that arise from vending of kerosene. Many reasons were cited for not using personal protective equipment, 11(14.5%) gave their reason as availability, 15(19.7%) claimed it was not convenient, 47(61.8%) was discovered to be ignorant, 3(3.9%) claimed it was because of the cost of purchasing the equipment. It is pertinent that the Ministry of Environment through the Environmental Health Officers (EHOs) and Ministry of Health should enlighten the populace of Ilorin metropolis on the need to take safety precautions seriously as it was discovered during the field survey that some of these DPK vendors engages in the sales of Petroleum Motor Spirit (PMS) as black marketers. It was also observed that the some of the DPK vendors store the petrol in the same jerrycans and aboveground storage tank (AST) used in storing kerosene which can invariably lead to kerosene contamination. Kerosene contamination has been a chief culprit in the various instances of fire outbreaks in Nigeria (134 cases in February 2001, WHO Nigeria, 2001)[16]. The epidemiological study conducted by Musa *et al*. (2002)[11] concerning a recent kerosene tragedy reported in Ilorin in which 12(18.5%) deaths out of 65 cases of burns investigated was recorded while 12(23%) of the remaining 53 cases receiving treatment were at risk of death due to severe burns they sustained in which adulteration of the kerosene was a major factor identified as the cause of the mishap. Thus, appropriate precautions by kerosene suppliers and users, and health education can help prevent similar disasters in the future.

IV. TEST OF HYPOTHESIS

- Null Hypothesis (H_0) I:

There is no significant association between safety precaution practices and awareness of health hazards associated with DPK vendors operations.

- Alternate Hypothesis (H_1) I:

There is significant association between safety precaution practices and awareness of health hazards associated with DPK vendors operations.

Table 1.6: Chi square test of association between safety precaution practices and awareness of health hazards associated with DPK vendors' operations

Basic safety practices and awareness of health hazards associated with DPK vendors operations			**Value**	**df**	**P value**
Variables	**High**	**Low**			
availability of fire extinguisher					
Yes	4(23.5%)	2(3.4%)	7.361	1	0.007
No	13(76.5%)	57(96.6%)			
availability of bucket with sand and fire bucket					
Yes	7(41.2%)	6(10.2%)	8.948	1	0.003
No	10(58.8%)	53(89.8%)			
presence of personal protective equipment					
overall garment/apron	3(17.6%)	6(10.2%)	8.136	3	0.043
face mask	1(5.9%)	0(0.0%)			
nose mask	1(5.9%)	0(0.0%)			
no PPE	12(70.6%)	53(89.8%)			

The test of hypothesis to determine the association between the basic safety precaution practices and awareness of health hazards associated with DPK vendors operations revealed that the p values for each of the sub-variables of basic safety measures were less than 0.05 at Chi values of 7.361, 8.948, and 8.136 at degree of freedoms of 1, 1, and 3 respectively for availability of fire extinguisher; bucket with sand and fire blanket; and PPE respectively.

Therefore, since the p values are less than 0.05, it is therefore concluded that there is an association between the awareness on the health and environmental hazards of DPK vendor and the putting in place of basic safety measures by these vendors.

As a result of this, the null hypothesis which states that there is no significant association between basic safety precaution practices and awareness on health and environmental hazards among DPK vendors is rejected and the alternative hypothesis which states that there is significant association between basic safety precaution practices and awareness on health and environmental hazards among DPK vendors is failed to be rejected.

V. CONCLUSION

Results from the study shows a sporadic increase in the proliferation of DPK vendors in Ilorin metropolis (a percentage increase of over 1500% within a decade and the indiscriminate citing of these DPK vendors close to residential building (68.4%) and (80.3%) major roads which causes environmental degradation and environmental health hazards.

It is of great concern as results from this study also revealed that 77.6% of the DPK vendors lack the awareness of the health hazards associated with vending of DPK, 92.1% had no fire extinguisher and 85.5% do not use PPEs which increases the vulnerability of the vendors and population surrounding them to fire mishaps, kerosene poisoning, asthma, dermatitis and even death.

Lastly, it is worthy of notice that only 2 fire stations serves the entire Ilorin metropolis , with 71% of DPK vendors not knowing the location and none(0%) of them has the fire stations emergency number in case of any fire mishaps.

The following recommendations are hereby suggested;

- The Environmental Health Officers in collaboration with Town Planning ministry should enhance their enforcement activities to ensure that proper set-backs are maintained so as to prevent indiscriminate citing of DPK stations near residential buildings and major roads.
- Promotion of public education on the dangers of DPK, basic safety practices, use of PPEs, emergency toll lines through posters, the media and publicity campaigns by all stakeholders saddled with the affairs of environmental health, environment and health.
- There should be establishment of an agency which will be saddled with emergency/disaster preparedness, mitigation and relief with a toll free emergency line like LASEMA in Lagos state.
- The Government through the State assembly should enact laws to curb the uncontrolled proliferation of medium-scale DPK vendors in Ilorin metropolis and storage of toxic and flammable substances.

Appendix

Research questionnaire

School of Allied Health and Environmental Science, Department of Environmental Health Sciences,
Kwara State University Malete.
Research topic: Health Hazards Associated with the Operations of Medium-Scale Dual Purpose Kerosene (Aboveground Storage Tank) Vendors in Ilorin Metropolis

(A) DPK VENDOR SPATIAL INFORMATION

1. Name of DPK Vendor: …….....
2. Address: ..... LGA.....
3. Status : Functional ( ) Non- Functional ( )

4. Latitude ( ) Longitude ( ) Elevation ( )
5. Year of Establishment: .....

(B) SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE (OPERATOR)

6. Age: 10- 20yrs ( ) 21- 40yrs ( ) 41- 60yrs ( )

7. Gender: M ( ) F ( )

8. Tribe: Yoruba ( ) Hausa ( ) Igbo ( ) Others…….

9. Religion: Islam ( ) Christianity ( ) Traditional ( ) Others…….

10. Educational status: No formal education ( ) Primary ( ) Secondary ( ) Tertiary ( )

11. Position: Owner ( ) Salesperson ( )

12. Marital status: single ( ), married ( ), widow ( ), divorced ( ), separated ( )

13. Any formal Training on Vending of Kerosene: Yes ( ) No ( )

14. Hours of Sales (Exposure): …….

(C) INFORMATION ON THE DPK STORAGE TANK AND THE DISPENSER/ENVIRONMENTAL HEALTH HAZARD

15. Capacity of the Tank: <5000 litres ( ) within 5000-10, 000 litres ( ) > 10,000 litres ( )

16. Did you get a permit for operations before establishing your kerosene outlet? :Yes ( ) No ( )

17. How long has the tank been installed: 0-20 yrs ( ) 21 - 40 yrs ( ) > 40 yrs ( )

18. Nature of Tank: Rusted ( ) Averagely Okay ( ) Decent ( )

19. Any case of repair on the Tank/ Dispenser: Yes ( ) No ( )

20. If Yes, How Often: Frequently ( ) Occasionally ( )

21. Any Case of Spillage/Leakage of Kerosene: Yes ( ) No ( )

22. If “Yes”, (Describe): …….

23. Any Case of Fire explosion Incidence/Accidence: Yes ( ) No ( )

24. If “Yes” (Degree of Severity): Not Severe ( ) Severe ( ) Very Severe ( )

25. How do you Refill your Tank: Independent ( ) Major Marketers ( ) Jerry cans ( )

26. How often do you Refill your Tank: Daily ( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( )

27. Proximity to Residential Building: <5m ( ) 5- 10m ( ) > 10m ( )

28. Proximity to Major Road: <5m ( ) 5- 10m ( ) > 10m ( )

29. Proximity to a Water Source: < 5m ( ) 5- 10m ( ) >10m ( )

(D) OBSERVATIONAL CHECKLISTS ON AVAILABILITY OF SAFETY EQUIPMENTS /BASIC SAFETY PRECAUTION PRACTICE

30. Availability of Fire Extinguisher: Yes ( ) No ( )

31. Numbers of Fire Extinguisher: ……..

32. Knowledge on the Usage of Fire Extinguisher: Yes ( ) No ( )

33. Date of Last maintenance of the Fire Extinguisher: ……..

34. Availability of Bucket with Sand: Yes ( ) No ( )

35. Availability of Fire blanket: Yes ( ) No ( )

36. Presence of Personal Protective Equipment (PPE):

a). Overall garment/Apron ( )

b). Face Mask ( )

c). Nose Mask or Respirator ( )

d). Hand Gloves (Nitrile Made) ( )

37. Reasons for not using Personal Protective Equipment (PPE):

a). Availability ( )

b). Convenience ( )

c). Ignorance ( )

d). Cost ( )

e). Others (Specify): ……

(E) INFORMATION ON AWARENESS OF HAZARDS (SAFETY & HEALTH) ASSOCIATED WITH VENDING OF KEROSENE

38. Do you think there are hazards associated with vending of kerosene: Yes ( ) No ( )

39. What is/are your source of information: Radio ( ), Television ( ), Newspaper ( ), Friends/Family ( )

40. If "Yes", what are these hazards?

a) Headache ( )
b) Shortness of breath ( )
c) Coughing ( )
d) Nausea & Vomiting ( )
e) Asthma ( )
f) Dermatitis (Eczema) ( )
g) Burns ( )
h) Disorientation & Drowsiness ( )
i) Catarrh ( )
j) Others (specify) …….

(E) OTHER RELATED INFORMATIONS

41. Do you have a Fire Station close to your area: Yes ( ) No ( )

42. If "Yes" (Address): …….

43. Do you have the phone number of any Fire Station within Ilorin Metropolis: Yes ( ) No ( )

44. If "Yes" (Phone Number): …….

45. Any Regulatory Institution/body regulating your activities/establishment: Yes ( ) No ( )

46. If "Yes"**,** Name of Regulatory Institution/body: ……..

47. What are their activities (Describe): ……..

References

1. Lam, N.L., Smith, K.R., Gauthier, A. and Bates, M.N. (2012). Kerosene: a Review of Household Uses and Their Hazards in Low- and Middle-Income Countries. *J Toxicol Environ Health B Crit Rev*. 15(6): 396–432.
2. New Jersey Department of Health (NJH, 2016). Hazardous Substance Fact Sheet. Available atnj.gov/health/eoh/rtkweb/documents/fs/1091.pdf. Accessed on 11/08/2018.
3. Ayakeme, T., Ebiere, E.J., Azibalua, A.A. (2013). Evaluation of health and environmental harzards of poorly refined kerosene from household users in Bayelsa state, Nigeria. *Acad. J. Environ. Sci.* 1(7): 147-151.
4. Olugbenga, S.A. (2005). Adulterated Kerosene Burn Disaster: the Nigeria Experience.*Ann Burns Fire Disasters*. Mar 31; 18(1): 40–44.
5. Fadeyibi, I.O., Omosebi, D.T., Jewo, P.I. and Ademiluyi, S.A. (2009). Mass Burns Disaster in Abule-egba, Lagos, Nigeria from a Petroleum Pipeline Explosion Fire. *Ann Burns Fire Disasters*. Jun 30; 22(2): 97–103.
6. Oduwole E.O., Sanni A.O., Odusanya O., Fadeyibi, I.O. (2003). Contaminated kerosene burns disaster in Lagos, Nigeria. *Ann. Medit. Burns Club*. 2003;16:208–216.
7. Merem, E. C., Twumasi, Y., Wesley, J., Isokpehi, P., Fageir, S., Crisler, M., Romorno, C., Hines, A., Ochai, G. S., Leggett, S.and Nwagboso, E. (2018). Assessing the Effects of Fuel Based Lighting: The Case of Kerosene Use and Disasters in Nigeria, *Public Health Research*, Vol. 8 No. 1, pp. 6-23.
8. Kwara state Government (2017). The state of harmony: Geography. Retrieved from: https://kwarastate.gov.ng/geography/. Accessed November 11, 2018.
9. Oyegun, R.O. (1983), Water Resources in Kwara State Nigeria, Matanmi and Sons, Ilorin.
10. Merem, E. C. (2017). Assessing the Effects of Fuel Based Lighting: the Case of Kerosene Disasters in Nigeria. In Proceedings of the 25th Annual AEHS Conference. San Diego, CA
11. Musa, O.I., Akande, I.M. and Saka, M.J. (2002).Epidemiological Investigation of Kerosene Burn Tragedy in Ilorin, Kwara State, Nigeria. *Sahel Med. Journal*. 5(4) 2002: 186-189.
12. Oloko-Oba, O. M., Ogunyemi, S. A., Alaga,A. T., Badru,R. A., Ogbole, J. O.,Popoola O. S. and Samson A. S. (2016). Spatial Distribution of Primary Schools in Ilorin West Local Government Area, Kwara State, Nigeria. *Journal of Scientific Research & Reports. 9(6): 1-10.*
13. Mshelia, A.M, John, A, Emmanuel, D.D. (2015). Environmental Effects of Petrol Stations at Close Proximities to Residential Buildings in Maiduguri and Jere, Borno State, Nigeria. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS).20(4):1-8.*
14. Abdullahi K. (2012) Spatial Distribution of Filling Stations in Agege Local Government Lagos State. Unpublished Research Essay Submitted to the Department of Geography, Bayero University Kano (BUK).
15. Afolabi, O. T., Olajide, F. O., Omotayo, S. K. (2011). Assessment of Safety Practices in Filling Stations in Ile-Ife, South Western Nigeria. *Journal of Community Medicine and Primary Health Care. 23 Pg1-2.*
16. WHO Nigeria (2001) Monthly News Bulletin of WHO Lagos Nigeria. Vol 15(2), March 2001.