RESIDENTS' PERCEPTION ON ROAD TRANSPORT INDUCED EMISSIONS IN ILORIN, NIGERIA

BY

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ABSTRACT

This study assessed the perception of residents on the awareness, causes, effects and control of toxic road transport emission in Ilorin, Nigeria. Multi-stage sampling techniques were used. 2 by 2 km^2 grid cells were overlaid on the road network map of Ilorin on a scale of 1:100,000 to form cells. Out of the 42 cells produced, 14 cells containing road intersections were randomly selected. A total of 500 copies of questionnaire were administered to respondents in the study area. Results showed that 75.92% of the residents were aware of transport emission. Over 74.79% of the residents identified traffic congestion, popularity of fairly used vehicles, too old vehicles and road side trading activities as the causes; majority (>69.65%) identified offensive odour and eye irritations as the effects; and over 74.12% of the residents identified nose covering, temporary exist from emission concentrated sites, winding up of vehicle' screen and eyes covering as the coping strategies; of toxic road transport emission in the study area. The ANOVA generally showed no significant variation in the perception of respondents on the awareness, causes, effects and precautionary measure on toxic emission across the metropolis ($p>0.05$) except on eye irritation and breathing difficulties ($p<0.05$ as the effects road transport emission which showed significant variations across selected intersections in the study area. The study concluded that, the coping strategies are too weak due to unforceable end to the causes and effects of road traffic emission. The study recommended the need to enforce acceptable safe limit of vehicle emission and sensitize urban residents on the health implication of exposure to vehicle emission.

Key words: Awareness level, Motorization, Toxic road transport emission, Traffic congestion

INTRODUCTION

In Nigeria, earlier studies on anthropogenic sources of deteriorating air quality have been associated with industrial and oil refinery sites with little or no consideration for transport as one of the anthropogenic source emissions (Faboya, 1997; Magbagbeola, 2001). However, recent studies identified transport as one of the major sources of anthropogenic emissions. Increase in traffic emission has been found to be associated with increase in motorization level arising from increase in demands for vehicles especially in the urban centre (Abam and Unachukwu, 2009; Okelola and Okhimamhe, 2013).

Traffic emission constitutes 90-95% of the ambient Carbon monoxides (CO) levels, 80-90% hydrocarbon (CxHy) and particulate matter (PM) globally; with records of negative impacts on human health (Savile, 1993). Research conducted in the mid 1980s in USA revealed that traffic induced emission was responsible for 77%, 80-90%, 36% and 22% of Carbon monoxide (CO), nitrogen oxides (NO_{X}), Volatile organic compounds (VOC) and PM, respectively (USEPA, 1993). Also, study conducted in UK from 1986 to 1991 revealed that vehicles related pollutants accounted for 35% increase in the proportion of NO_2 (Commission of the European Communities [CEC], 1992).

The United States Environmental Protection Agency (USEPA, 1993) and other studies (e.g. Goyal, Chatge, Nema and Tamhane, 2006; Giorgio, Massimo and Enrico, 2009) have decried that traffic emissions accounts for a large proportion of urban air pollution, yielding about 51% of carbon monoxides, 34% of nitrogen monoxides and 10% of particulate matter per year. Also, it has been observed that the emitted gases are often dangerous and highly crucial in contributing to the deterioration of urban air quality (Trasand and Liu, 2008). Also, study conducted in UK from 1986 to 1991 revealed that vehicles related pollutants accounted for 35% increase in the proportion of NO_2 (CEC, 1992). Generally, carbon dioxides, nitrous oxide, particulate matter, sulphur dioxide, lead, among other vehicles related pollutants in the atmosphere are believed to be responsible for exacerbation of asthma and chronic respiratory diseases among other infections, adjudged injurious to humans (Schwela, 2000). Traffic induced emissions have been found to have more deteriorating health effects on the children and the elderly in Guildford towns in UK (Savile, 1993; Gatersleben and Uzzell, 2000).

Despite the efforts made to improve emission reduction technology of vehicles in developed countries, the rate of emission is still considered higher than the rate of improvement afforded by the emission reduction technology. Studies have shown that over 600 million people, globally, are exposed to hazardous level of traffic generated pollutants (Cacciola, Sarva and Polosa, 2002), and in developing countries, traffic accounts for 80-90% urban air pollution (Odhiambo, Kinyua, Gatebe and Awange, 2010). There seems to be lesser concerns for clean urban strategies in most developing countries because of poor policies and weak strategies for the implementation on vehicle emission rate which serve as major instigators of environmental pollution (Han, 2006). This explains why researchers on road transportation in Nigeria (e.g. Filani, 2000; Ogunsanya, 2002) described road transportation as 'makers' and 'breakers' of cities; especially when not sustainably managed.

Traffic emission has continued to increase globally (Cacciola et al., 2002). In many developing countries in West Africa, including Nigeria, road transportation has been characterized by increase in the number of automobiles to cope with the increasing mobility challenges of growing urban areas (Olawole, 2012). Given the poor border control as well as loose quality control in many developing countries, most vehicles imported from American or European coutries are either aged or those that are capable of emiting dangerous gases (Ajayi and Dosunmu, 2002; Abam and Unachukwu, 2009; Kumar and Barret, 2018). These vehicles are deficient in emission reduction technology (Assamoi and Liousse, 2010; Val, Liousse, Doumbia and Corinne, 2013; Naidjah, Ali-Khodja and Khardi, 2017).

In Nigeria, Akpan and Ndoke (2006) observed the highest average daily concentration levels of 1840 ppm (parts per Million) of Carbon dioxide (CO_2) at Sabo junction in Kaduna while the least average daily concentration of 1160 ppm was observed at Asokoro junction in Abuja. Review of literatures has associated increase in CO_2 levels with global warming and other green house effects. Also, the study by Ndoke and Jimoh (2000) in Minna detected only some traces of nitrogen dioxides and sulphur dioxides, 15 ppm of carbon monoxide which is less than 20 ppm recommended limits by Federal Environmental Protection Agency (FEPA). Additionally, Utang and Peterside (2011) in Port Harcourt, River State, Nigeria specifically detected that, CO was higher than FEPA limits, traces of SO_X at all times in all locations, Hydrocarbon (CxHy) varied in space and time while, NO_X was nearly above the local and international standards in all the location during peak period of traffic.

Similarly, in Minna, Niger state, Nigeria, the study of Okelola and Okhimamhe (2013) detected that, the lowest mean value of CO_2 was 2453.33 ppm at Maitumbi junction and the highest was 3111.67 ppm at Broadcasting Road junction; the detected average concentration of CO_2 at the peak of traffic in all the seven sampled locations was higher than 350 ppm (the internationally accepted safe limits for CO_2). This result contributes immensely to global warming and poses threat to human health. On the other hand, the results for other gases were found to be lower than the internationally acceptable safe limits and poses no threat. In Ilorin – the present study area Aboyeji, Adeoye and Olawole (2018) also revealed similar trend for CO. Although, mean CO concentrations were below the 50 ppm internationally acceptable safe limits but well above 25 ppm stipulated by American Conference of Governmental Industrial Hygienists (ACGIH) in 1991.

Earlier, Aboyeji (2015) also revealed significant contamination of the air in Ilorin by Carbonmonoxides (CO), Nitrogen monoxides (NO), Nitrogen dioxide (NO_2), Surphur dioxides (SO_2), Volatile Organic Compound (VOCs) and Ammonia (NH_3). It is however not clear if the residents of the area, especially those living around the juctions with records of abnormally high air pollutants are aware of the potential negative effects of the contaminated atmosphere on their health, or if they have strategies to minimize the negative impact of polluted air. The first step to controlling air pollution is to raise awareness about it (Giorgio et al. 2008). Awareness here, refers to knowledge or perception of the existence, frequency and vulnerability of certain cause and all factors defining it. Hence, this study was carried out to assess the level of awareness of urban residents on the existence of road transport emission in the study area. The specific objectives are to assess the perception of residents on the causes, effects and control of road transport emission in the study area.

THE STUDY AREA

Ilorin, the administrative capital of Kwara State, Nigeria is located between Latitude 8º 24′ 30″ and 8º 32′ 30″ N and Longitude 4º 28′ 0″ and 4º 40′ 0″ E. in the North Central part of Nigeria by geo-political demarcation (Figure 1). Ilorin is 500 kilometer from Abuja the Federal capital territory of Nigeria and 293 km from Lagos the commercial Capital of Nigeria. The estimated population of the city is about 814, 192 in 2017 (UN, 2017). Ilorin has grown over the years; its status as the capital of old Kwara state (involving parts of the present Kogi State) since 1967 and the present Kwara state since 27^{th} August 1991 has tremendously contributed to its growth; making it a notable center of administrative, commercial and educational activities. The indigenous people are Yoruba, Hausas, Nupe, Gobiri and Fulani but out of these, the largest ethnic group is the Yoruba and as such, can conveniently be called a Yoruba town. The central location of Ilorin makes it accessible to people from all parts.

Ilorin is in the savannah grassland area and experiences both the wet and dry seasons annually. The raining season starts usually towards the end of March and ends around October (Oyegun, 1983). The dry season is naturally very hot, except during the harmattan period, when it is cool and dry. Harmattan sets in by late November and ends by early January. Ilorin has functional air, rail and road transport. Road transport in Ilorin encompasses both intra and intercity roads development.

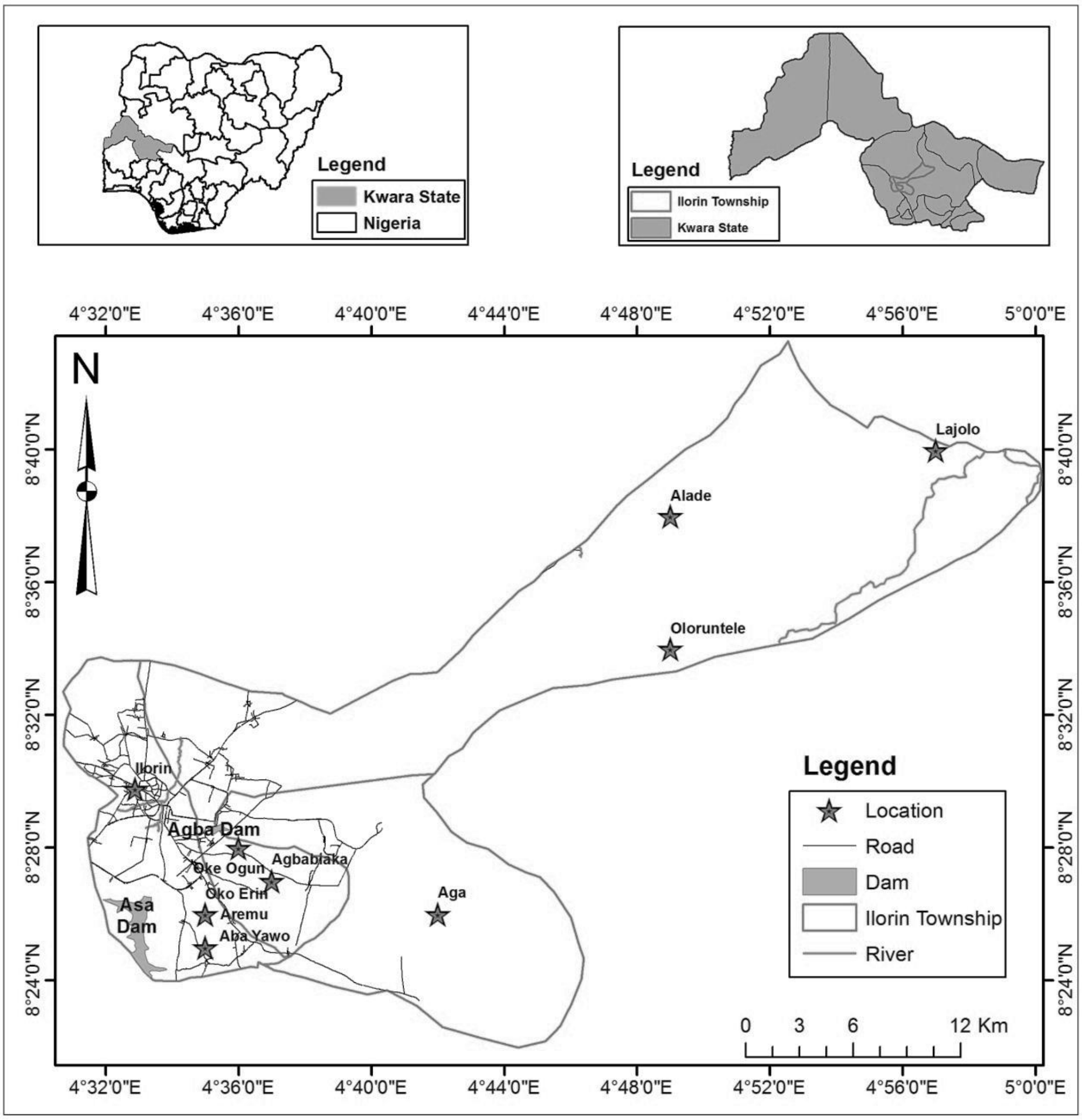

Figure 1: The Study Area
Source: Digitized Topographic Map of Nigeria, obtained from the Office of the Surveyor General of the Federation

The intercity roads includes the Ilorin-Jebba road to the North East, the Ilorin-Ajase Ipo road to the south, the Ilorin-Kaima road to the west and the Ilorin Shao to the north and the Ilorin-Ogbomosho road to the southwest. As at today, Ilorin has one over head bridge constructed across the Post Office junction (one of the busiest traffic congested junction) area in Ilorin. Several road junctions are found along the major and minor roads in Ilorin with only four of them equipped with modern/computerized traffic management technique (Traffic signals). Many others are however being manned by traffic wardens police and recently organized para military group called Kwara Road Traffic Management Authority (KWATMA) with the task of controlling vehicular traffic in Ilorin. The over dependence of the officers on human efforts for traffic control is susceptible to failure due to fatigue or sometimes due to harsh weather in form of scourging sun or heavy rainfall (Aderamo, and Atomode, 2012).

Ilorin enjoys reliable intra city transport services largely dominated by commercial transport operators. The mode of conveying passengers and freights from one place to another in the cities are the taxies, Buses, the tricycles (the Keke Napep) and the commercial motor cycles popularly called" Express" in the area. While the Buses and keke-Napep seems to have definite routes, the Taxis and commercial motorcycle seem to serve all routes. Generally, the transport fare usually charged by Taxis is N50.00 per drop while Buses and keke- Napep usually charge N30.00. Also, the Commercial Motor cycles operators usually charges N50.00 minimum their charges however varies with increasing distance and ability of the client to pay.

The selection of Ilorin for this study was based on the continuous increase in human population and motorization level in the city; being the most populous urban centre in Kwara State, Nigeria.

MATERIALS AND METHODS

Road network map of the the study area and opinions of the resisdents on the awareness, causes, effects and mitigating measures of road transport emission served as the data for this study. Multi-stage sampling procedure was employed to select sites for questionnaire administration. The selected sites were road intersections in Ilorin. In the first place, two kilometers by two kilometers grid lines was overlaid on the road network map of Ilorin on a scale of 1:100,000 to form cells. This produced 42 cells. Out of these, 14 grid cells containing road intersections (Figure 1) were randomly selected. Secondly, questionnaires were administred to 10 respondents systematically selected from housing units/shops located on either side of all roads converging at each of the 14 randomly sampled road intersections at an interval of 100 meter uptill 500 meters away from the center of each road intersections. Based on the number of roads that converged to form each of the 14 randomly selected road intersections, the following numbers of respondents were selected from the road intersections: Post office junction (40), A-Division roundabout (30), Maraba junction (40), New Yidi/Asa Dam junction (30), Offa garage roundabout (30), Offa garage/Pipeline junction (30), Oja oba roundabout (30), Adeta roundabout (50), Garin-Alimi roundabout (40), Mandate juction (30), Mini-Campus junction (30), Okoolowo junction (40), Tipper garage junction (40) and Tanke junction (40). A total of 500 repondents were selected for questionnaire administration in the study area.

The confinement of the study to areas around road junction was based on the aggravated level of congestion at road intersections (Aderamo and Atomode, 2012) and positive correlation between traffic congestion and emission (Akapan and Ndoke, 1999; Abam and Unachukwu, 2009; Utang and Peterside, 2011). The data were analyzed using both descriptive and inferential statistics. Inferential statistics especially one -way analysis of variance (One way ANOVA) was used to assess the degree of spatial variations in responses across various junctions and test the validity of the stated hypotheses. The stated hypotheses were tested at 0.05 significant level.

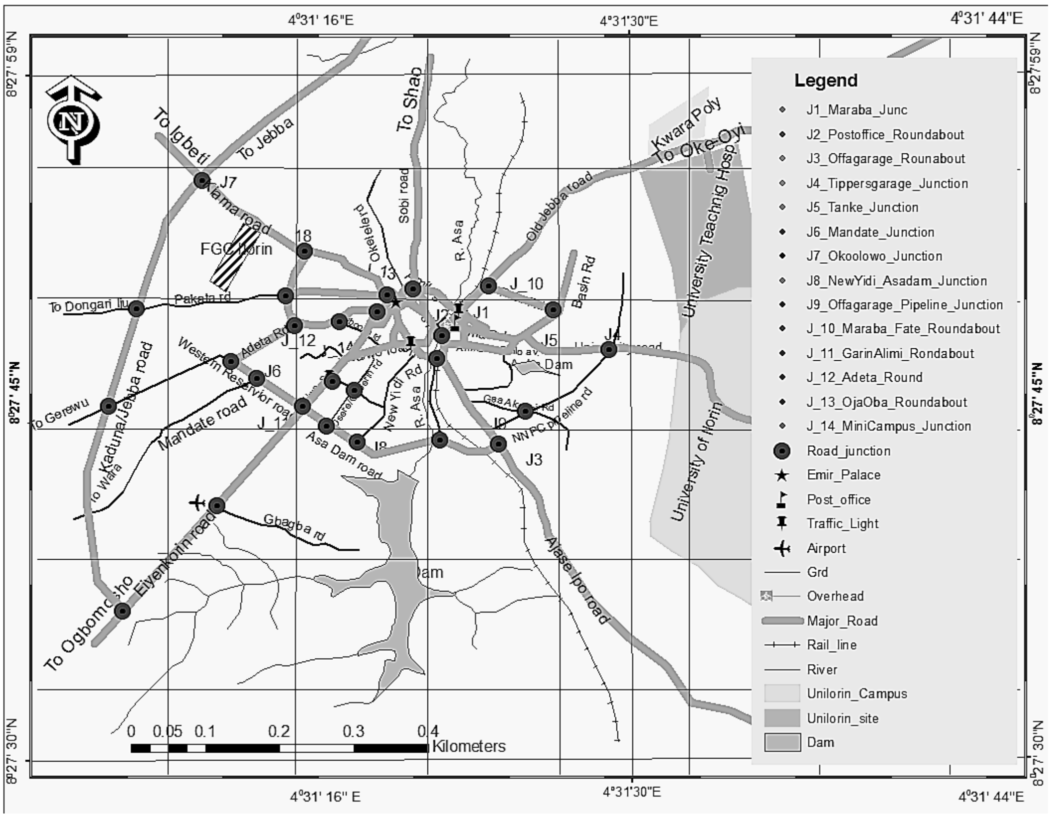

Figure 2: Locations of sampled juctions in the Study Area

Source: Digitized Topographic Map of Nigeria, obtained from the Office of the Surveyor General of the Federation

RESULTS AND DISCUSSION

Perception of Respondents on Awareness Level of the Existence of Toxic Road Transport Emission

The study revealed that, the majority (75.92%) of the respondents were aware of the existence of vehicle emission in the study area, while (24.07%) of the respondents were not aware. The high level of awareness among the sample may be attributed to increasing level of motorization in the Metropolis. The study also revealed that, the highest level of awareness was experienced around New Yidi junction, where 93.3% of the respondents were aware. The second was around Okoolowo junction where 82.5% of respondent were aware and the third was around Pipeline junction where 80% of the respondent were aware of the existence of traffic emission (Figure 3). This may probably be as a result of a relatively higher level of vehicular traffic and traffic congestion in those areas.

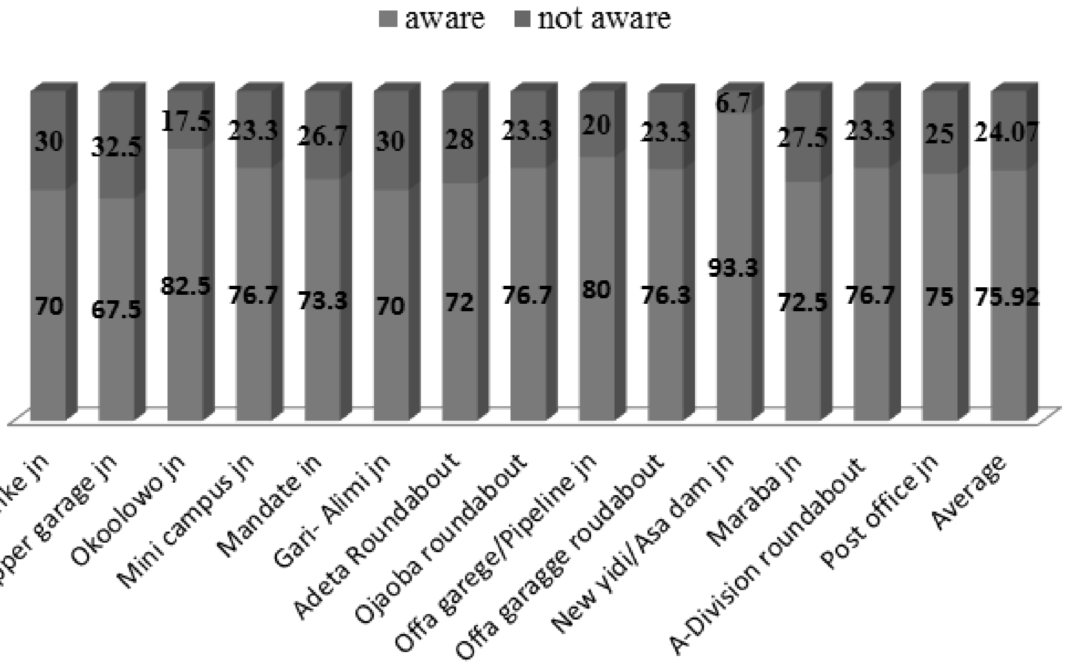

Figure 3: Awareness of the existence of toxic road transport emission among residents sampled at various junctions in Ilorin, Kwara State, Nigeria

The result of the ANOVA test presented in Table 1 shows that the p values on the perception of respondents on awareness of toxic road transport emission in the study area. The result equally shows that, there is no significant variation in the perception of residents on the awareness of toxic road transport emission from respondents sampled around various major road intersections in the study area with p (.708) > 0.05. This means that the awareness among respondents in all the sampled locations is similar. This could be as a result of similarities in the conditions of sample sites as they are all major junctions in Ilorin (the study area).

Table 1: Awareness of Vehicles Emission in the City

Variable	**Sum of Squares**	**Df**	**Mean Square**	**F-value**	**Sig.**
Between Groups	1.837	13	0.141	0.755	0.708
Within Groups	90.905	486	0.187		
Total	92.742	499			

Source: Author's computation

Perception of Respondents on the Causes of Toxic Road Transport Emission

The respondents' perception on the causes of toxic road transport emission is presented in Figure 4. Analysis revealed that, the major causes of road transport emission in their order of importance included; traffic congestion (93.01%), fairly used vehicle (86.23%), too old vehicles (78.33%) and road side trading activities (74.79%). Earlier studies have associated increased in traffic congestion to increased rate traffic emission (Aderamo and Atomode, 2012; Utang and Petersisdes, 2012). According to Kumar and Barret (2018), vehicles age in

Sub-sahara Africa are very high averaging 20 years for mini buses and 30 years for cars. Older vehicles lack emission reduction technology and therefore play monumental role in increasing toxic road transport emission (Ajayi and Dosunmu, 2002; Assamoi and Liousse, 2010). Also, the contribution of road side trading activities to emission is based on its ability to impeed smooth flow of vehicular traffic thereby aggravating concentrated level of emission.

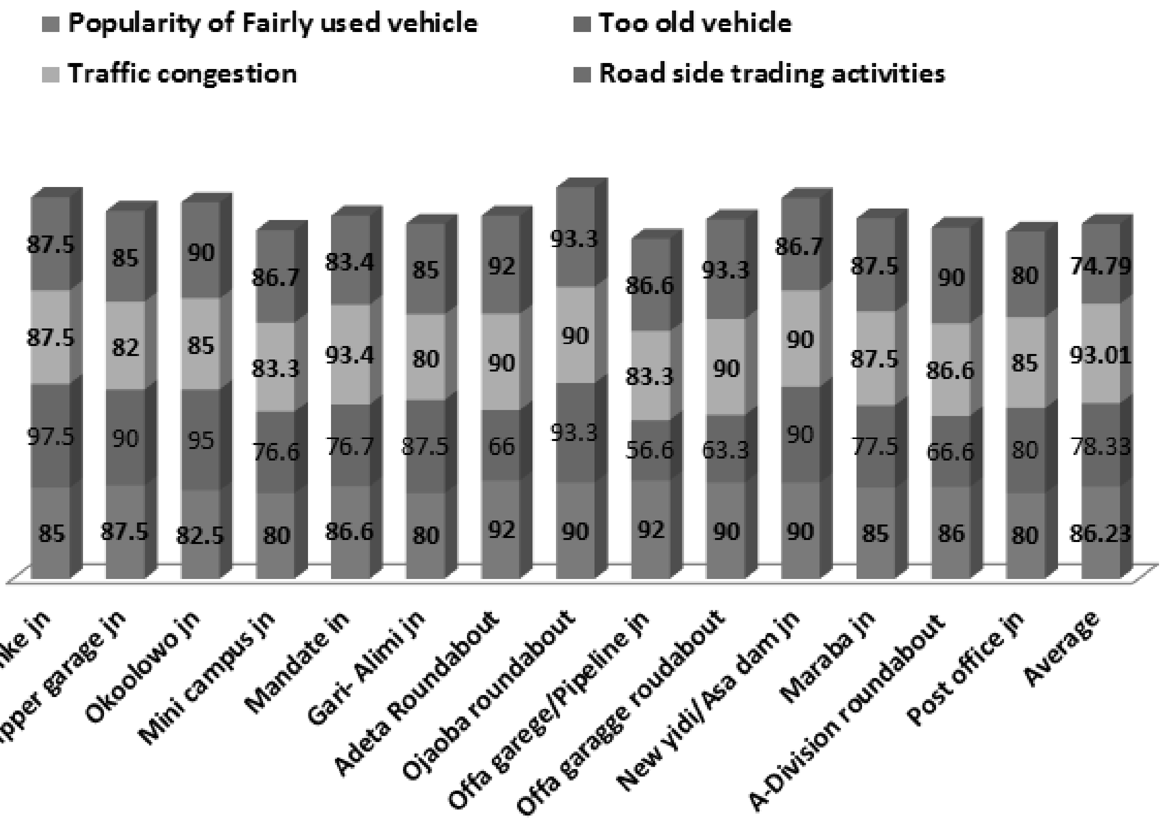

Figure 4: Perception of respondents on the causes of toxic road transport emission

The result of the ANOVA test presented in Table 2 shows that the p values on the perception of respondents on causes of toxic road transport emissions among respondents sampled at various road junction in the study area. The result equally shows that, there is no significant variation in traffic congestion with p (0.960) > 0.05, popularity of fairly used vehicles with p (0.736) > 0.05, too old vehicles with p (0.997) > 0.05 and road side trading activities with p (0.999) >0.05 as identified causes of toxic road transport emission in the study area. It implies that the perception of respondents were similar; possibly due to similarities in the conditions of vehicular traffic at around selected road intersections in the the study area.

Table 2: Result of ANOVA Test on the Causes of Road Transport Emission

Variable		Sum of Squares	Df	Mean Square	F	Sig.
Too old vehicle	Between Groups	5.590	13	0.430	0.242	0.997
	Within Groups	865.178	486	1.780		
	Total	870.768	499			
Traffic congestion	Between Groups	9.462	13	0.728	0.426	0.960
	Within Groups	829.488	486	1.707		
	Total	838.950	499			
Road side trading activities	Between Groups	4.125	13	0.317	0.196	0.999
	Within Groups	786.697	486	1.619		
	Total	790.822	499			
Popularity of fairly used vehicle	Between Groups	15.803	13	1.216	0.728	0.736
	Within Groups	811.993	486	1.671		
	Total	827.798	499			

Source: Author’s computation

Perception of Respondents on the Effects of Toxic Road Transport Emission

The analysis of the perception of respondents on the effects of toxic road transport emission is presented in Figure 5. Analysis revealed that, 76.1% and 73.7% of respondents recognized offensive odour and eye irritation agreed, respectively as the effects of toxic road transport emission in the study area. A relatively low proportion of the respondents identified breathing problem (7.64%) and triggering of cough (7.61%) as the effects of toxic road transport emission. The finding reveals that awareness level on the health implication of toxic road transport emission in Sub-sahara Africa is generally low. This contradicts the findings in Guildford towns, in the UK where negative health implication (i.e. cardiac infection) were largely associated with traffic emission (Gatersleben and Uzzell, 2000).

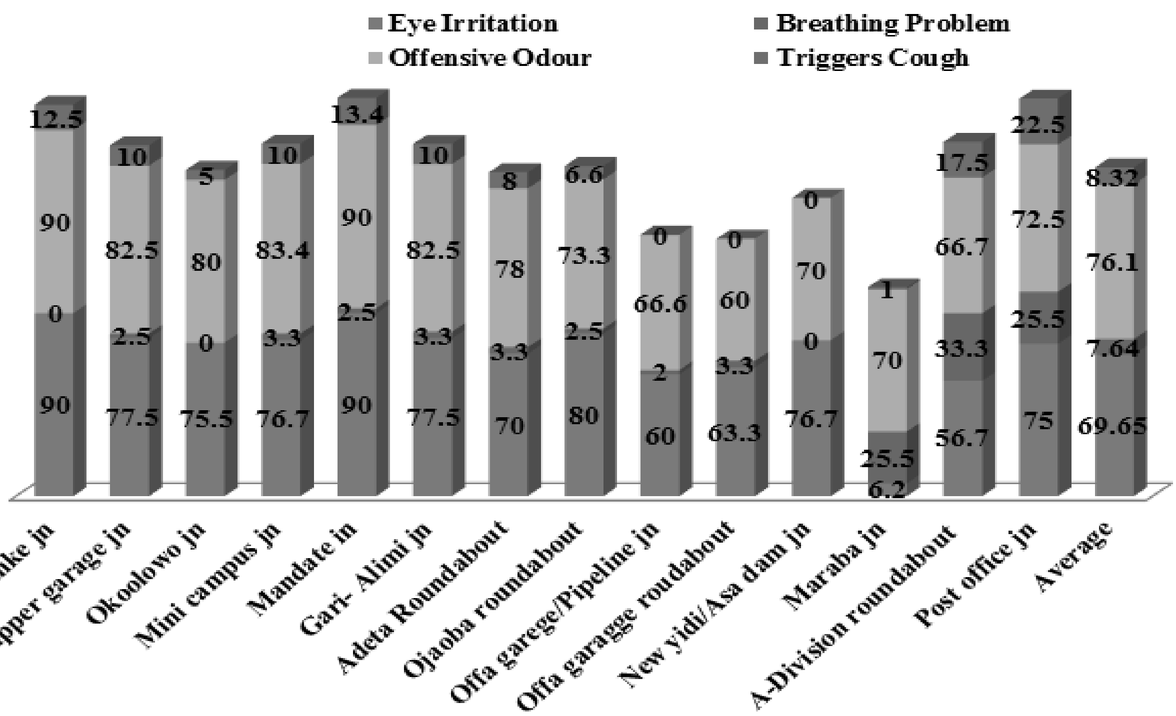

Figure 5: Perception of residents on the effects of toxic road transport emission

The result of the ANOVA test presented in Table 3 shows that the p values on the perception of respondents on the effects of toxic road transport emissions among respondents sampled at various road intersection in the study area. The result equally shows that, there is no significant variation in offensive odour with p (0.052) > 0.05, triggered cough; with p (0.158) > 0.05 among respondents in selected road intersection in the study area, while significant variation were found in eye irritation with p (0.32) < 0.05 and breathing problem with p (0.000) < 0.05 among respondents in selected road intersection in the study area. Therefore, with reference to offensive odour and triggered cough with p (0.158) > 0.05, it depicts similarities in the perception of respondents on triggered cough as effect of toxic road transport emission across selected junctions in the study area. On the other hand with reference to eye irritation and breathing problem with p (0.000) < 0.05, it depicts that the perception of respondents on breathing problem as an effect of toxic road transport emission across selected junctions in the study area was not similar.

Table 3: Result of ANOVA test on the effects of road transport emission

Variable		Sum of Squares	Df	Mean Square	F	Sig.
Eye Irritation	Between Groups	65.601	13	5.046	1.850	0.034
	Within Groups	1325.447	486	2.727		
	Total	1391.048	499			
Breathing difficulty	Between Groups	48.263	13	3.713	3.490	0.000
	Within Groups	516.937	486	1.064		
	Total	565.200	499			
Triggers cough	Between Groups	28.321	13	2.179	1.393	0.158
	Within Groups	760.037	486	1.564		
	Total	788.358	499			
Offensive odour	Between Groups	52.557	13	4.043	1.728	0.052
	Within Groups	1136.905	486	2.339		
	Total	1189.462	499			

Source: Author's computation

Perception of Respondents on the Coping Strategies to Toxic Road Transport Emission

The analysis of the coping strategies to toxic road transport emission in the study area is presented in Figure 6. Specifically, the coping strategies to toxic road transport emission by the respondents in their order of preference were nose covering (87.4%), temporary exit from emission concentrated area (86.3%), winding up of the vehicles'screen (76.3%) and eyes covering (74.1%). This represents the holistic view of respondents, irrespective of whether they are in a vehicle or at their various homes or shops located by the road sides.

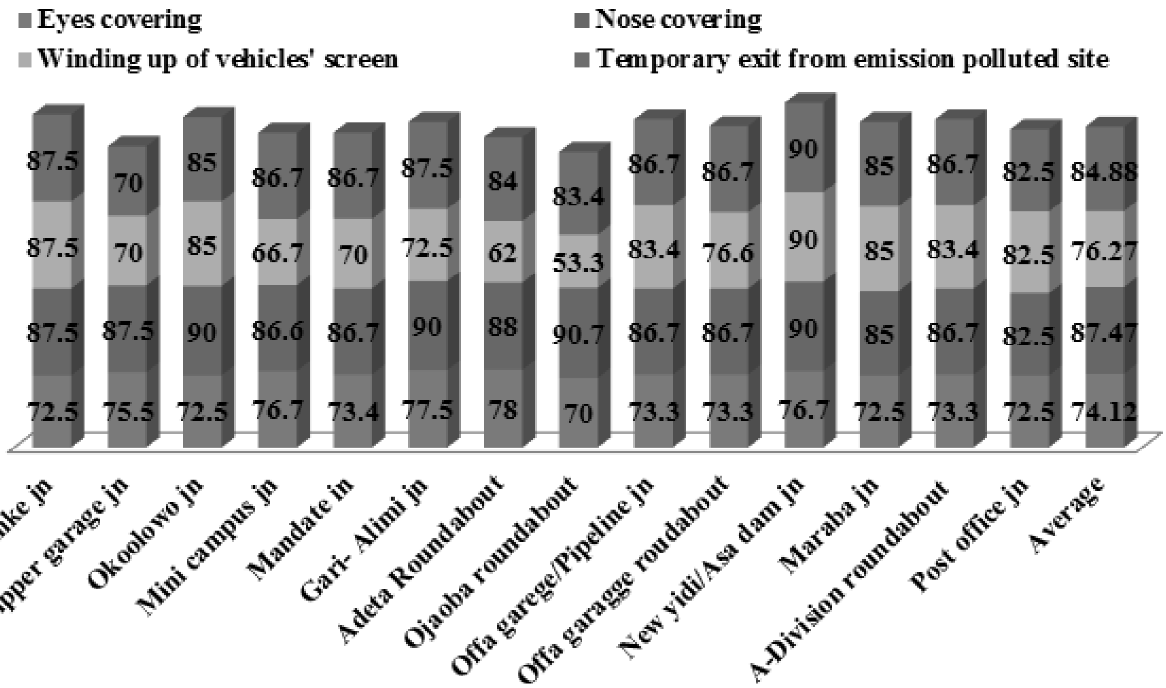

Figure 6: Perception on control of emission on control of toxic emission

The result of the ANOVA test presented in Table 4 shows that the p values on the perception of respondents on the coping strategies of toxic road transport emissions among respondents sampled at various road junction in the study area. The result equally shows that, there is no significant variations in nose covering with p (1.000) > 0.05, temporary exist from emission cconcentrated sites with p (1.000) > 0.05, winding up of vehicles' screen p (0.161) > 0.05 and; eyes covering with p (1.000) > 0.05 as coping strategies; of toxic road transport emission. These ANOVA result depicts that, the perception of respondents on coping strategis were similar. This may possibly be due to the similarities in the social political and economomic environment of the respondents across selected road intersections in the study area.

Table 4: Result of ANOVA test on the control of road transport emission

Variable		Sum of Squares	Df	Mean Square	F	Sig.
Eyes covering	Between Groups	13	0.224	0.99	0.068	1.000
	Within Groups	486	2.259			
	Total	499				
Winding up of the vehicles'screen	Between Groups	35.043	13	2.695	1.388	0.161
	Within Groups	943.875	486			
	Total	978.918	499			
Nose covering	Between Groups	1.447	13	0.111	0.065	1.000
	Within Groups	833.345	486	1.715		
	Total	834.792	499			
Temporary exit from emission polluted site	Between Groups	1.933	13	0.149	0.089	1.000
	Within Groups	809.867	486	1.666		
	Total	811.800	499			

Source: Author's computation

CONCLUSION

This study observed the perception of residents on the level of awareness, causes, effects and precautionary measures against vehicle emissions around 14 selected major road intersections in Ilorin Metropolis. It showed that majority (75.92%) of the respondents were aware toxic road transport emissions in the city. It also showed that agreed that the causes of toxic road transport emissions in order of priority includes traffic congestion, used vehicle, too old vehicle and road side trading activities. Also, in order of priority, respondents recognized offensive odour and eye irritation as the effects of toxic road transport emission in the study area. Also, appropriate precautionary measures in order of importance according to the respondents includes covering of the nose, temporary exit from emission concentrated area, winding up of the screen of the vehicle and covering the eyes, respectively. The ANOVA generally showed no significant variation in perception of the respondents on the awareness, causes, effects and precautionary measure on toxic emission across the metropolis ($p>0.05$) except on eye irritation and breathing difficulties ($p<0.05$ as the effects road transport emission which showed significant variations across selected junctions in the study area.

Based on these findings, the study recommends the intervensions of relevant stakeholders to control the importation of fairly used vehicle. There is the need to formulate and implement acceptable safe limits of vehicle emission as an integral aspect of determining the road worthiness of the vehicle. Also, there is the need to improve the quality of urban roads and road junctions in order to improve the flow of traffic. Urban residents should be sensitized through various media on the possible health implications of exposure to vehicles emissions is recommended. Also, there is the need to plant aesthetic trees by the road sides in order to absorb excess carbon that may be injurious to human health.

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