

ATEPAN

16.1 — JOURNAL'S
NATIONAL —

14



Annals of Technology Education Practitioners Association of Nigeria

(Formerly Journal of Nigerian Association of Teachers of Technology, JONATT)

Vol. 3 No. 2 (JUNE, 2020)

ISSN: 2645-2839

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ASSESSMENT OF THE IMPACT OF MOTOR VEHICLE EMISSION ON THE ENVIRONMENTAL HEALTH OF PEOPLE LIVING IN SULEJA METROPOLIS

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Abstract: This study assessed the impact of motor vehicle emission on the environmental health of people living in Suleja metropolis. Three research questions were raised and three hypotheses were formulated to guide the study. The research questions assessed the status of motor vehicle emission and health-related problems in the study area. The study employed a descriptive survey design. A thirty (30) item questionnaire was used to collect data from (150) respondents located in Suleja metropolis. All the one hundred and fifty respondents were used for the study. Findings revealed among others, that motor vehicle emissions are the major causes of health problems affecting the population. Based on the findings of the study, recommendations were made which among others include: developing effective control of automobile emissions quality management programmes; improvement of motor traffic flow and control which requires good city road network; provision of reliable mass transport system which will reduce the number of vehicles on Suleja metropolis road and therefore reduce emissions; and strengthening of the vehicle inspections and maintenance department.

Keywords: Motor Vehicle, Emission, Climate Change, Transportation, Environmental Pollution

Introduction

The effect of Climate change as a result of environmental pollution from gases contributing to global warming is a thing of global concern which must be continually addressed. Bai, Richard, Urge-Vorsatz, Delgado and Schultz (2018) asserted that, climate change affects more than half of the world's population in urban areas and cities where 75% of all carbon dioxide emitting from energy use in cities and satellite towns such like Suleja are increasingly feeling the effects of extreme hot weather, and floodplains. Chu and Pan (2017) observed that Climate change is a crucial issue that concerns about the survival and development of human beings. As asserted by Bai, et al., (2018), more than 1,000 people died and 45 million people lost homes, livelihoods and services when severe floods hit Southeast Asian cities, including Dhaka in Bangladesh and Mumbai in India. The case is the same in Nigeria with those living in the riverside areas in some parts of Nigeria including Niger state.

According to Ritchie and Roser (2019), Carbon Dioxide is not the only greenhouse gas which contributes to climate change—Nitrous Oxide and Methane are also greenhouse gases. It comes to a consensus gradually that Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O) and Hydrogen Fluoride (HFCs) eventually led to global climate change that we produced during all production and life activities. Carbon Dioxide is the most important factors in greenhouse gases. From a global perspective, highway transportation is one of the three main carbon sources of greenhouse gas emissions. It has been classified into various categories that include air pollution, water pollution, soil pollution, noise pollution and electromagnetic radiation pollution among others. All these are dangerous to public health. Air pollution can be caused by the release of small particles or noxious gases being released into the atmosphere, whether by natural or artificial sources. These gases include Carbon Monoxide (CO), Sulphur Dioxide (SO₂), Nitrogen Oxide (NO), and chemical vapours, as well as others. These gases can also lead to a chain-reaction event that includes acid rain, smog, and the greenhouse effect. If left unchecked, the chemical aspect of air pollution could become the largest contributor to premature death in the world, higher than the rate of cancer, HIV/AIDS, automobile accidents, or any other cause of unnatural or premature death.

It is often assumed that the greatest single cause of air pollution is the big factories, especially in the big cities. However, the greatest single contributor to the pollution problem facing not only the United States but also the entire world is automobile emissions which come mainly from cars and other types of automobiles, as well as off-road vehicles (Karlsson, 2005). In 2006, transportation mostly from automobiles caused over half of the Carbon Monoxide, a third of The Nitrogen Oxides, and almost a quarter of the hydrocarbons in our atmosphere (Lage & Mathew, 2008). With the number of vehicles on the road and the number of vehicle miles travelled escalating rapidly, we are on the fast road to uncontrollable air pollution. These substances have been shown to produce harmful effects on the blood, bone marrow, spleen, and lymph nodes. The tars and other organic compounds released in the smoke from automobiles also pollute the atmosphere and, when they land on the ground, pollute the soil and can potentially enter the groundwater and drinking supply. Furthermore, motor vehicle emission has a direct effect on the ozone layer, it harms natural environments, which has caused widespread damage to crops and vegetation. There is a clear link between Green House Gas (GHG) emissions, transport modes and urban morphology. Urban centres are centres of attraction because they provide opportunities for engagement in productive activities and associated remuneration. Given the phenomenon of globalization, large cities are expected to attract investment and to remain competitive only as long as they are healthy, secure, well planned and efficient. This efficiency is crucial especially in the movement of people, goods and services. However, the several challenges of rapid urban growth include inadequate infrastructure, road congestion and environmental degradation (increasing emission levels from transport and related activities). The problem of this study is therefore to assess the impact of motor vehicle emission on the people living in Suleja metropolis as regards to guide on environmental protection. Environmental pollution is the contamination of the earth's environment that has interference with the environment which is hazardous to human health.

Research questions

1. What is the status of motor vehicles emission in Suleja metropolis?
2. What are the health problems resulting from motor vehicle emission?
3. What are the strategies for effective management of emission from the motor vehicles?

Hypotheses

- H_{01} : There is no significant difference between the mean responses of motor vehicle owners and residential occupants on the statuses of motor vehicles emission in Suleja metropolis.
- H_{02} : There is no significant difference between the mean responses of motor vehicle owners and residential occupants on health problems resulting from motor vehicle emission.
- H_{03} : There is no significant difference between the mean responses of motor vehicle owners and residential occupants on the strategies for effective management of emission from the motor vehicle.

Methodology

The research design adopted was a survey method with the use of a structured questionnaire to collect the required information from the respondents. The study was carried out in Suleja metropolis in Niger state, Nigeria. An accessible population of 50 motor vehicle owners and 100 residential occupants of Suleja metropolis were used for the study. The total population of one hundred and fifty (150) respondents was used for the study. The questionnaire used to gather information was developed based on four-point Likert's type rating scale by the researchers. The questionnaire was administered to the respondents by the researchers personally. The data analysis techniques employed in this study were descriptive and inferential statistics. The descriptive statistics included mean and standard deviation while the inferential statistic involved the use of t-test. Mean score above 2.50 was considered agreed and mean scores below 2.50 was considered disagreed. The t-calculated value above the t-critical ± 1.96 was accepted and calculated value below the t-critical ± 1.96 was rejected.

Results

Table 1: Mean Response of Residential Occupants and Motor Vehicle Owners on the Status of Motor Vehicle Emission in Suleja Metropolis ($N_1=50$; $N_2=100$)

S/N	Item	\bar{X}_1	\bar{X}_2	\bar{X}_t	Remarks
1	Motor vehicle traffic has increased tremendously	3.42	2.39	2.91	Agreed
2	Increased urbanization and industrialization are accelerating the use of motor vehicles	3.76	3.82	3.79	Agreed
3	Enhanced concentrations of emission in Suleja has greatly exacerbated	3.30	2.39	2.85	Agreed
4	A fleet of diesel-powered trucks influences air quality	2.56	2.26	2.59	Agreed
5	Smog is becoming a serious issue in Suleja	2.52	2.62	2.57	Agreed
6	The level of motorization has increased vastly	2.62	2.21	2.42	Disagreed
7	Serious air quality deterioration	2.70	2.79	2.75	Agreed
8	People are exposed to motor vehicle emissions	2.62	2.69	2.66	Agreed
9	Motor vehicles emissions are the major source of health problems affecting the populations	2.70	3.83	3.27	Agreed
10	Motor vehicles emission causes air pollution	2.29	3.12	2.02	Agreed

Key: \bar{X}_1 = Mean score of residential occupants, \bar{X}_2 = Mean score of motor vehicle owners, \bar{X}_t = Average mean score of residential occupants and motor vehicle owners, N_1 = Number of the residential occupant, N_2 = Number of motor vehicle owners.

The result presented in Table 1 shows that the respondents in two groups (residential occupants and motor vehicle owners) agreed with all the items with the mean score above 2.50 except item 6 with the mean score below 2.50.

Table 2: Mean Response of Residential Occupants and Motor Vehicle Owners on the Health Problems Resulting from Motor Vehicle Emission in Suleja Metropolis ($N_1=50$; $N_2=100$)

S/N	Item	\bar{X}_1	\bar{X}_2	\bar{X}_t	Remarks
1	It causes cancer in humans	3.64	3.73	3.69	Agreed
2	It has a direct effect on the ozone layer	3.34	3.32	3.33	Agreed
3	It has toxic impacts on natural environments	3.93	3.91	3.92	Agreed
4	Air pollution can restrict processes enabling vegetation and crops to grow	3.26	3.32	3.29	Agreed
5	It can cause dizziness, convulsion, headaches and in high concentrations lead to death	3.92	3.95	3.94	Agreed
6	It causes widespread damage to crops and forests	3.92	3.90	3.91	Agreed
7	Contributes to the formation of acid rain and global warming	2.30	2.82	2.01	Disagreed
8	Damages lung tissues	2.58	2.53	3.01	Agreed
9	Aggravates respiratory disease	3.76	3.82	3.79	Agreed
10	it may shorten the lifespan of exposed people	3.82	3.89	3.86	Agreed

Key: \bar{X}_1 = Mean score of residential occupants, \bar{X}_2 = Mean score of motor vehicle owners, \bar{X}_t = Average mean score of residential occupants and motor vehicle owners, N_1 = Number of the residential occupant, N_2 = Number of motor vehicle owners.

The result presented in Table 2 shows that the respondents in two groups (residential occupants and motor vehicle owners) agreed with all the items with the mean score above 2.50 except item 7 with the mean score below 2.50.

Table 3: Mean Response of Residential Occupants and Motor Vehicle Owners on the Strategies for Effective Management of Emission from the Motor Vehicle in Suleja Metropolis (N₁=50; N₂=100)

S/N	Item	\bar{X}_1	\bar{X}_2	\bar{X}_t	Remarks
1.	Efficient vehicle technology development	3.30	3.46	3.38	Agreed
2.	Ensuring that your vehicle is regularly maintained	2.80	2.83	2.82	Agreed
3.	Shift travel to less carbon-intensive modes (eg. cycling)	2.94	3.36	3.15	Agreed
4.	Effective traffic calming	2.32	2.69	1.11	Disagreed
5.	Enforce government policies importation of used cars	3.76	3.82	3.79	Agreed
6.	Adequate traffic controls should be implemented	3.28	2.56	3.42	Agreed
7.	Raising awareness on air pollution as it relates to health effects and its principal sources	3.56	2.53	3.06	Disagreed
8.	Concerted efforts by stakeholders towards improved air quality	3.00	2.76	2.88	Agreed
9.	Strengthening local capacity for air quality management	3.36	2.23	2.80	Agreed
10.	Establishment of a participative and multi-sector process in the management of air quality	3.92	3.90	3.19	Agreed

Key: \bar{X}_1 = Mean score of residential occupants, \bar{X}_2 = Mean score of motor vehicle owners, \bar{X}_t = Average mean score of residential occupants and motor vehicle owners; N₁ = Number of the residential occupant; N₂ = Number of motor vehicle owners.

The result presented in Table 3 shows that the respondents in two groups (residential occupants and motor vehicle owners) agreed with all the items with the mean score above 2.50 except item 24 and 27 with the mean score below 2.50.

Table 4: t-test Analysis on the Status of Motor Vehicle Emission in Suleja Metropolis

Respondents	N	Mean	SD	Df	t-cal	t-tab
Residential Occupants	50	2.85	1.35	148	0.005*	± 1.96
Motor Vehicle Owners	100	2.81	0.90			

Key: * = Not significant; N = Number of residential occupants and motor vehicle owners; df = Degree of freedom; t-cal = calculated value; t-tab = table value.

The analysis in Table 4 showed that the t-cal value was below the t-tab value. Therefore, the null hypothesis was accepted for all the items. Hence there is no significant difference in the opinion of the respondents concerning the status of motor vehicle emission in Suleja metropolis.

Table 5: t-test Analysis on the Health Problems Resulting from Motor Vehicle Emission in Suleja Metropolis

Respondents	N	Mean	SD	Df	t-cal	t-tab
Residential Occupants	50	3.39	0.53	148	-0.05*	± 1.96
Motor Vehicle Owners	100	3.52	0.61			

Key: * = Not significant; N = Number of residential occupants and motor vehicle owners; df = Degree of freedom; t-cal = calculated value; t-tab = table value.

The analysis in Table 5 showed that the t-cal value was below the t-tab value. Therefore, the null hypothesis was accepted for all the six items. Hence there is no significant difference in the opinions of the respondents on health problems resulting from motor vehicle emission in Suleja metropolis.

Table 6: t-test Analysis on the Strategies for Effective Management of Emission from the Motor Vehicle

Respondents	N	Mean	SD	Df	t-cal	t-tab
Residential Occupants	50	3.22	0.78	148	0.08*	± 1.96
Motor Vehicle Owners	100	3.01	0.93			

Key: * = Not significant; N = Number of residential occupants and motor vehicle owners; df = Degree of freedom, t-cal = calculated value, t-tab = table value.

The analysis in Table 6 showed that the t-cal value was below the t-tab value. Therefore, the null hypothesis was accepted for all the items. Hence there is no significant difference in the opinions of the respondents on the strategies for effective management of emission from the motor vehicle.

Findings

1. The residential occupants in Suleja metropolis are being exposed to vehicle emission on daily basis which is a major source of air pollutants that affects the populace.
2. Several health problems in Suleja metropolis such as dizziness, convulsion, headaches, respiratory disorder among others results from motor vehicle emission.
3. There are several strategies for effective management of emission from the motor vehicle in Suleja Metropolis. Some of these strategies include government developing effective control of automobile emissions quality management programmes among others.
4. There is no significant difference between the mean responses of motor vehicle owners and residential occupants on the status of motor vehicles emission in Suleja metropolis.
5. There is no significant difference between the mean responses of motor vehicle owners and residential occupants on the health problems resulting from motor vehicle emission in Suleja metropolis.
6. There is no significant difference between the mean responses of motor vehicle owners and residential occupants of Suleja metropolis on the strategies for effective management of emission from the motor vehicle.

Discussion of findings

The findings on status of motor vehicles emission in Suleja metropolis indicates that motor vehicle emission in Suleja metropolis has increased tremendously because of an increase in urbanization and industrialization which are accelerating the use of motor vehicles. Motor vehicle emission in Suleja metropolis has strongly influenced the air quality of which residents are exposed to, and motor vehicles emission are the major source of air pollutants. The longevity of existing physical infrastructure in cities, therefore, affects transportation choices (Cao, 2009). The efficient functioning of the physical elements of a city to a large extent affects the productivity (the economic prosperity) of the city. According to Alain, Benoit, and Belinda (2011), transport is thus a key driver of the economies of cities and is highly dependent (98 %) on fossil oil.

The findings on health problems resulting from motor vehicle emission indicates that motor vehicle emission in Suleja metropolis is one of the major causes of health problems which includes dizziness, confusion, headaches, cancer, respiratory disease, and shorten the lifespan of exposed people.

The findings on the strategies for effective management of emission from the motor vehicle indicates that government should develop effective control of automobile emissions quality management programmes; improvement of motor traffic flow and control which requires good city road network; provision of reliable mass transport system which will reduce the number of vehicles and motorcycles on Suleja metropolis road and therefore reduce emissions; and strengthening of the vehicle inspections and maintenance department.

Conclusion

The study concluded that Suleja metropolis are being exposed to motor vehicle emission as a result of increased urbanization and industrialization which accelerated the use of motor vehicles, several health problems in Suleja metropolis resulted from concentration of motor vehicle emission which pollutes the air and result to respiratory disorder and related diseases. The design of the city and the design of its transportation network determine whether residents are automobile-dependent or have choices for multiple forms of transportation such as public transport modes- rail and bus rapid transit schemes for examples.

Recommendations

1. There should be reliable and efficient mass transport system to reduce the number of motor vehicles on our roads and therefore reduce the emissions of CO₂, N₂O and SO₂ gases.
2. All motor vehicles moving on the road must pass a vehicle inspection and maintenance test to reduce smog affecting air quality causing health challenges such as cancer, lung tissues, respiratory disorder, road dizziness, and headaches resulting from motor vehicle emission.
3. There is a need for immediate and effective traffic control programmes and good city road network to reduce the idling period for vehicles on highways and streets.
4. Government should put in place effective management policies and programmes to reduce the effects of CO₂, N₂O and SO₂ automobile emissions.
5. Government policies regarding the importation of used cars should be instituted to avoid importing vehicles with high emission rate.
6. Vehicles, especially commercial type, should be regularly serviced to reduce high emission rate that results to air pollution which affects residents of Suleja metropolis.

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