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Air Pollutants Occurrence Determinant Assessments and Climate Change Health Effect on Humans along Coastal Road-Senegambia Axis in Gambia

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Abstract

Air pollutant is a major health risk humans faced world-wide and climate change menace globally. Air pollutants cause air pollutions, harmful substances release into the atmosphere in form of particulate or gaseous substance leads to the contamination of air and the environment as well as ecosystem. Globally, only one tenth people are free from air pollution, nine out of ten people inhaled polluted air in which majority of people are not aware of the significant health issue and environmental impacts of poor air quality. Regarding to the whole world, air pollution is one of the largest threats faced by people, mostly adverse air quality. Air pollution has killed numerous people due to the severity of their concentrations that affects sensitive respiratory organs like the heart, lungs, chest etc. Collection of air pollutant data was done for a period of six months, using electronic air meter (model 460DG) from January to July, 2023. Fifteen different air qualities occurred; six among them are the air the pollutants detected in the study area. Carbon monoxide (CO) was found with the highest concentration levels, recorded as 232.56 ± 14.13 μg/m^3 in class five category with purple colour, in excess atmospheric air (O_2) results to carbon (IV) oxide as the main cause of climate change and global warming and also part of Greenhouse Gases (GHGs), particulate matter (PM_{10}) recorded 115.36 ± 27.06 μg/m^3, ammonia (NH_3) had 67.25 ± 44.87 μg/m^3, particulate matter ($PM_{2.5}$) recorded mean value of 65.69 ± 28.13 μg/m^3, ozone (O_3) had an average mean value of 64.04 ± 6.55 μg/m^3 and humidity recorded 61.83 ± 7.41 μg/m^3, apart from (CO), in the detected air pollutants, other five pollutants are categorized into class two (2) by virtue of their moderate yellow coloration and index value of concern levels of peoples' health in

the environment. Air pollution challenges can be control and solved using different air pollution, encouraging more vegetation by planting trees like *Coleus blumeri*, *Ficusvariegata and Phascolus vulgaris*. Species of Pinus, Quercus, Pyrus, Juniperus and Vitis depollute the air by metabolizing nitrogen oxides. A lot required trees should be planted especially around those areas which are prone as high-risk areas of air pollution. Air pollutants occurrence in the study location exists in this form of ascending order of significance as CO > PM_{10} > NH_3 > O_3 > $PM_{2.5}$ > Humidity. Other occurred pollutants were satisfactory to human, due to their class of category. They fall in class one (1) category, green colour indicating good and concern level and index values.

Subject Areas

Environmental Sciences

Keywords

Pollution Standard Index Threshold, Climate Change, Health Implications Air Pollutant Devices, Plant Species for Air Pollutant Reduction

1. Introduction

Air pollutant simply means the release of harmful gaseous and particulates substances in the atmosphere that causes contamination of air as well as the environment and ecosystem. Globally, only one tenth people are free from air pollution, nine out of ten people breathe polluted air in which majority of people are not aware of the health risk and the impacts of poor air quality in the environment. Air pollution occurred when harmful gaseous and particulate chemical substances are discharged into the air. This air pollutant includes Particulate Matter, nitrogen oxides and Sulphur (IV) oxide. Greater numbers of air pollutants are given off through anthropogenic activities such as burning fossil fuels, vehicle exhaust smokes and emissions from agriculture and industries. Air pollution has a lot of effects on our health; thereby reducing quality of lives standard and reducing life span. However, it's the world's largest single environmental health risk. It worsens respiratory challenges and increases the risk of asthma attacks that result to more health issues. The more people expose to air pollutants, the more vulnerable to its severity, resulting to cancer, heart attacks, paralysis and strokes etc. As such, one of the main death reoccurring respiratory challenges globally is cause by air-borne pandemic, resulting to air pollution. Those at risks is the affected people in society who are most likely to exposed to the chance of being attacked, most especially children and elderly people, in which children expose to it have stunted lungs. Study had showed that developing body connected to air pollution exposure results to diabetes. Air pollution affects the environment, majority of air pollution sources are from greenhouse

gas (GHG) emissions. Greenhouse gases (GHGs) causes the temperature of the earth snared in the stratosphere, leading hotter temperature that results to climate change. Air pollution also, impacts soil and water quality as well as impacting the ecosystem and wildlife. Air pollution can be avoided by busy roads high traffic congestion areas, and walking away from congested traffic routs. With regards to recent report in the Lancet planetary health, shows some indications that doesn't favor people as a result of the largest threats they pose. About 9 million deaths are approximately recorded annually with a surprising 16% death globally according to [1]. Death rates caused by pollution has increased drastically due to ambient air pollution and toxic chemicals release and exposure into the atmosphere, due to a direct outcome of industrialization and urbanization due to development and technological advancement in the present generation, results to environmental air pollution but steps have been taken in reducing and controlling death link to pollution, as a result of air pollutant devices. Despite this steadily accumulating environmental issues and crisis, policy action to combat this challenge remains not fit. Majority of policymakers don't regard air Pollution as a pressing contemporary environmental concern, leading to dull and unclear response and limited progress in the environment. This un-faire attitude towards Pollution, despite its claiming millions of lives annually, remains a significant barrier to change to the environment and world at large. As per [2], the lead author of the report, a lack of attention to this environmental crisis due to gaseous and particulate pollutants contributes significantly to this stagnation of human health. According to him, most deadly and deteriorating pandemic is spread in the air which is part of air pollution epidemiologically. He believes that more public outcry is necessary to draw attention to this "enormous issue". Any unsatisfactory change in form of solid, liquid and gaseous properties, adversely affects life is called pollution. Pollution may be due to artificial or natural activities in the ecosystems. Natural pollution phenomena contaminate the air by wildfires, floods, volcanic eruptions, tsunamis or earthquakes and natural processes (methane from marshy lands). Man-made pollutants (artificial) activities such as burning fossil fuels, vehicle exhaust fumes and emissions from agriculture and industry threaten the integrity of nature. In recent years, respiratory health problems are increasing every day. Furthermore, global air pollutant affects human health pose respiratory challenges. Motor vehicle emissions are the major leading cause air pollution, [3], Countries like China, United State of America; Russia etc., are the major industrialized and urbanized countries globally, leading in air pollution emission. Nigeria is not out-looked in this category of excessive air pollution in West African country due to uncontrollable gas flaring and other related emissions till date, despite control standard set by Environmental Protection Agency [4], people still neglect and ignore despite the environmental pollution caused by all these technologies. Farm mechanization in Agricultural and developmental advancement, air pollution comes from land cultivation practices for farming, road construction and lumbering leading to bush burning;

spraying of chemicals such as pesticides and herbicides on crops for farming practices accounts for millions of hazardous wastes metric tons generated every year. Study had shown that United State of America alone generates about 240 - 250 million metric tons of air pollution, which constitute below 5% of the population of the world, but produces approximately 20% - 25% of the world's carbon (iv) oxide (CO_2) and generates approximately 30% worlds' waste. Since carbon dioxide is the dominating gaseous substances, which leads to climate change and global warming. Recently, due to excessive production of carbon monoxide in the atmosphere in form of oxygen released from vehicles which gives carbon (IV) oxide, (carbon dioxide) in excess, as a dominating gaseous substance leading to climate change and global warming as a result of increase in atmospheric temperature and hotness of the weather as well as ozone layer depletion because of other greenhouse gases. China has overtaken United States of America as the world largest producer of CO_2, still far behind, based on per capital pollution reduction (PCPR) according to [5]. Related respiratory problems caused by numerous air pollution sources, are spreading frequently in environmental pollution, which affects the health of humans and public worldwide, as reported by [6], millions of death was recorded through inhalation of hazardous chemicals. According to [7], studies also showed the outcomes of gaseous substances and particulate matter, are highly related and correlated with birth rate and migration rate, [8]. In Gambia, air pollutant occurrence determinants assessment has caused drastically alteration in its climate change, health effects on humansalong the study location due to the ongoing road construction in airport junction along Senegambia geographical location, that prompt for this research. The targeted study area in the country; significantly show changes in atmosphericpollutants levels of occurrence, in terms of color, class/category, concern levels and value index of pollution [9].

1.1. Categories of Air Color and Air Quality

Air Color	Levels	Categories/Classes	Value of Index
Green	good	1	0 - 50
Yellow	moderate	2	51 - 100
Orange	not healthy for some group	3	101 - 150
Red	unhealthy	4	151 - 200
Purple	very Unhealthy	5	201 - 300
Maroon	hazardous	6	301 above

1.2. The Main Health Effects of Air Pollution in Humans Are:

1) Air qualities that are not favorable can eliminate many organisms and humans.
2) Almost all respiratory diseases are caused by air pollution.
3) Study had shown that about 1.2 million prematuredeathsin China is caused

by air pollution in 2010 due to high smog level.

4) The high smog levels faced by Chinese for some period of time can destroy human bodies and generate different diseases.

5) World Health Organization (WHO) have estimated in 2007 that air pollution cause five hundred peoples death annually in United State of America.

6) In 2017, study also showed by Lancet Commission on Pollution and Health found that global pollution, especially toxic air killed nine million people annually, which is three times that of the number of deaths caused by HIV & AIDS, combination of tuberculosis and malaria and 15 times higher than deaths caused by wars and other forms of human violence.

7) Human health is severely altered by particulate matters in the atmosphere. The particulates can cause a running nose as well as nasal itching.

8) Air pollution is also associated with lung damage and limited breath malfunctioning.

9) Air pollution can also have an inflammatory effect on the heart—it increase blood pressure and combine pre-existing conditions of the heart.

10) Death risk significantly increases with long term exposure to polluted air.

1.3. Air Polluted Devices

These are devices used to control and prevent air pollution; they are categorized into two types, namely:

1) Particulate control device (PCD)

2) Gaseous control devices (GCD)

Under the particulate control device, we have,

a) Electrostatic precipitators (EP): this is a particulate control device that is utilized under the influence of electrostatics and sieve, to remove carbon (dirt) existing t smoke stack [10].

b) Cyclone separator (CS): cyclone separator is a particulate control device also, that is as a separation device with the help of centrifugal force to remove and separate particulate matter from diffused polluted gaseous substances [11]. Gravitational settling chamber (GSC): this also removes larger particle that is more than fifty micrometres (50 μm) diameter in size stream of polluted gas. This particle obeys Stoke's law as a result of having higher density that enables them to settle at the bottom the chamber from where they are wisely removed.

c) Fabric filter (FF): this is when bulk of gas polluted is ultimately allowed to move across a channel fitted with sieve, which clean particles of matter. Here, dust particles are trapped down with the help of cloth fixed inside the fabric, that serve for its filtering purpose, particulate polluted gas is also allowed to pass through clean gas and remove the dust particles, [12].

Under gaseous control device, we have the following outlined below as:

a) Scrubbers: scrubbers are gaseouscontrol device meant to removes damaging gases from industries before allowed to expel into the ecosystem. They remove oxides of Sulphur presence in the atmosphere. There are two types of scrubber,

are; wet scrubber and dry scrubber. Scrubber helps also in preventing acid rain formation [13].

b) Incineration: this is involves the conversion of evaporating and vaporizing compound of organic form into oxides of carbon and water vapor via burning. It uses specialized piece equipment called afterburner, built for important complete burning situations at a very high temperature.

c) Carbon Capture: it means an act of seizing by force, the dominant greenhouse gases, (CO_2) kept below the soil and sea is blocked from going into the atmosphere by the soil and sea. Carbon (IV) oxide (CO_2) can be captured theoretically, also stored beneath the ground, pumping into the geological units (strata); this method is used to restrict greenhouse gas emission that leads to climate change.

1.4. The Purpose of the Work Is To:

1) Clean air and energy access brings about healthier population and universal health coverage.

2) Reducing the adverse responses of air pollution categories released into the atmosphere makes humans, animals and plant healthy.

3) Controlling air pollution, make our air clean, purify water, produce food and reduces chemical in the environment.

4) Air pollution control also improves air quality, protect public health and ensure compliance with rules and regulations.

5) It helps in identifying the pollution sources, investigate change in climate and support research development.

2. Method of Study

This study employed a quantitative research design that uses Air Quality meter detector and electronic thermometer. Fifteen different air quality parameters were detected were Air Quality Index (AQI), Carbon (IV) oxide (CO), Nitrogen (II) oxide (NO), Nitrogen (IV) oxide, Ozone (O_3), Sulphur (IV) oxide (SO_2), Ammonia (NH_3), Particulate matters (PM_{10}, $PM_{2.5}$), Temperature, Pressure, Weather, Dewpoint, Wind Speed and Humidity. Both equipment is used to measure different values (readings) of air pollutant variables and their different colors indications in order to categorized and classify the types of pollutant that occurs in the given study environment.

2.1. Description of the Study Area

The study was carried out along coastal road Senegambia axis, in West Coast Region of The Gambia. West Coast Region (WCR), originally known as Western Division (WD), it is knownas one of the administrative divisions of the Gambia. It has its headquarter in Brikama. Subsequently, it was rearranged and reorganized as the Brikama Local Government Area (BLGA) with the same land area covered unchanged. Presently, the population of West Coast Region in the Gam-

bia for both male and female has a total population of 807,462 people, with a population density of 457.75 square kilometer. West Coast Region of the Gambia has latitude 13˚20'21"N and longitude 16˚41'15"W. It is called the Western Coast Region because of its location around the coast, and its altitude is about 8.00 meter above the sea levels.

2.2. Data Collection

Data of air pollutants were collected from the month of January to July 2023. Data was collected from 10.00 am to 12.00 noon in every two weeks interval in each month, for a period of six months throughout the sampling era, which accounted to twelve times (12) visit to the field. Air pollutants occurrence determinant assessment parameters were detected with different concentration levels was observed and obtained in the study area for analyses of data.

2.3. Sample Size

A total of five hundred and forty (540) samples were obtained during the sampling period, it consist of fifteen (15) different air pollutants measurements assessment, that is detected and recorded by electronic air meter detector model 460 draft gauge, with digital thermometer that was used also during data collection, for a period of six months. In each month, fifteen air pollutants were triplicated during data collection (that is, data were collected three times with an interval of five minutes (5 mins), before taken the average readings) which gave a total of forty-five (45) parameters, recall that sample collection was done twice a month, which accounted for a total of ninety (90) parameter samples of air pollutants occurrence determinant assessment, for the duration of six months, which gave the sample size as stated above.

2.4. Sample Preparation

Air pollutants occurrence determinant assessment parameters were detected with different concentration levels obtained from the electronic air meter detector model 460 DG, with the help of and internet and GPS for location, all on with battery charged full, to give accurate readings. Reading is taken immediately air meter is switched on at the location available air pollutants parameters as well as temperature indications with the thermometer AP, TPP version 5.2.3 screen, as well as atmospheric pressure, weather, wind speed, dew point and humidity. Temperature readings were taken between 23˚C - 39˚C. Although, readings were very high in the dry season compared to that of the rainy season, the reason was seasonal alteration and climate change.

2.5. Air Pollutant Determination/Analysis

Air pollutant occurrence measurements were detected, using electronic air meter and thermometer. Most detected air pollutant parameters were analyzed and subjected to pollution standard index (PSI) threshold; as a control or

guide to ascertain its human health concentration effects regarding to our respiratory system, as well as the atmospheric ozone layer. Although they are categorized into classes depending on the color that displayed on the air meter screen, so color also serve as an indicator in determining air pollutants in the location.

2.6. Statistical Analyses

A test of central tendency and dispersion is used in this study, characterize and categorized each pollutant status; [14]. Data were collected in the morning around 10.00 am - 11.30 am. Samples of air pollutant indicator concentrations, were performed thrice separately (triplicates) in each data and mean values were taken; this is done repeatedly throughout the six months sampling periods. Different air pollutant occurred and detected in different classes depending on their level of concern and where they found themselves, comparisons were also carried out in terms of color detection for the period of six months in order to know their level effects on humans and impacts on climate change in the environment.

3. Results and Discussion

Table 1 summarizes data analyses of air pollutant occurrence determinants assessment and its climate change health effects in West Coast Region in Gambia. Air quality index (AQI) occurred and detected as the first air pollutant based on the air quality meter used in the study area but was blow the required by pollution standard index (PSI). Air quality index ranged from 1 - 6 μg/m^3, air quality index average mean value was recorded as 3.75 ± 0.46 μg/m^3 indicates well (good) with green color, it is within the value of index, this agree with [15].

3.1. Carbon Monoxide (CO)

Carbon monoxide (CO) is given off into the atmosphereas cars accelerate; vehicle enginesburn fossil fuels. It is a gas that emanates from the burning of non-renewable natural resources such as petroleum and gasoline gas, mostly in cars and other movable and machineries, that can't be seen or smelled. CO combines with atmospheric air (oxygen) to give carbon (IV) oxide (CO_2) which is the dominating greenhouse gases that has potential harmful consequence in excess to human's exposure as well as causing climate change and global warming. CO ranged from 180 - 344 mg/l, carbon monoxide mean value recorded was 232.56 ± 14.13 mg/l with a purple coloration indicating very unhealthy level of concern, this go in line with work done by [16], on oxides of carbon poisoning to human health. Hence the name silent killer gaseous air pollutant that is most crucial to health globally due to its chronic effects and high toxicologically tendency, to unhealthful and lethality, this go in agreement with work done by [17] [18], due to its high concentration. This can also make people dizzy, when combine with oxygen result to carbon (IV) oxide, excess carbon (IV) oxide in the atmosphere

Table 1. Spatial air pollutants occurrence determinants assessment along coastal road-Senegambia axis in west coast region road construction in the Gambia.

Variable indicators Units	N	Mean ± SE	SD	Range (min - max)
Air Quality Index (AQI) μg/m^3	12	3.75 ± 0.46	1.6	1 - 6
Carbon monoxide (CO) μg/m^3	12	232.56 ± 14.13	48.96	180 - 344
Nitrogen monoxide (NO) μg/m^3	12	33.37 ± 22.47	77.83	0.1 - 200
Nitrogen (IV) oxide (NO_2) μg/m^3	12	33.73 ± 22.42	77.66	0.13 - 200
Ozone (O_3) μg/m^3	12	64.04 ± 6.51	22.56	29 - 100
Sulphur (IV) oxide (SO_2) μg/m^3	12	3.73 ± 2.20	7.63	0.20 - 20
Ammonia (NH3) μg/m^3	12	67.25 ± 44.82	155.43	0.01 - 400
Particulate matter (PM_{10}) μg/m^3	12	115.36 ± 27.06	93.72	16 - 289
Particulate matter (PM2.5) μg/m^3	12	65.69 ± 28.13	97.44	2.04 - 357
Temperature (T) ˚C	12	27.26 ± 1.33	4.61	23 - 39
Pressure (P) Hg	12	24.67 ± 3.33	11.54	1 - 30
Weather (W) degree	12	26.33 ± 1.13	3.92	20 - 32
Dew Point (DP) degree	12	13.15 ± 2.67	9.27	1 - 25
Wind speed (WS) m/s	12	17.13 ± 1.46	5.05	11 - 27
Humidity (H) %	12	61.83 ± 7.41	25.65	29 - 89

All values are expressed as mean ± SE (min-max), n = 12.

result to smog, global warming and climate change because of increase in temperature. Carbon monoxide (CO) affects almost all organs in the body; the high oxygen demandedin cardiovascular system causes them to predominate the acute delayed in the futures [19] [20].

3.2. Oxides of Nitrogen (NO & NO_2)

Oxides of nitrogen (NO & NO_2) and nitrogenous compounds are of benefit to environmental scientists because of its essential nutrients, they are beneficial to living organisms at the same time become pollutant with some harmful effects in excess amount. Nitrogen monoxide (NO) ranged from 0.01 - 200 mg/l and nitrogen (IV) oxide (NO_2) range from 0.13 - 200 mg/l. The average mean values recorded for both oxides of nitrogen are 33.37 ± 22.47 mg/l and 33.73 ± 22.42 mg/l respectively. They are within the permissible limit of pollution standard index (PSI), with their level of concern; they are good in the environment. High levels of nitrogen (IV) oxide exposure can affect human respiratory tract.

3.3. Ozone (O_3)

Ozone (O_3), this is form as a result of excess oxygen in the atmosphere, that

combine with greenhouse gases to form acid rain particles which harm plants and animal. Ozone at the foundation bases can increase existing breathing diseases that lead to throat irritation, asthma, chest pain and headache. Ozone ranged from 29 - 100 mg/l, and the average mean value was found to be 64.04 ± 6.51 mg/l, which fall under moderate level of health concern, for the period of this study. This ground ozone is not emitted directly but by other compounds like NO_X and volatile organic compounds (VOC) in the presence of sunlight. Increased exposure to ozone in the environment affect important vegetation including forests, wildlife parks etc. leading to climate change because the forest that has been tampered with, [21].

3.4. Sulphur (IV) Oxide (SO_2)

Sulphur (IV) oxide (SO_2) is mainly produced from burning fossil fuel that contains Sulphur such as coal and oil. A corrosive gas that can't be seen, perceive at very low level, at high level like that of rotten egg odor. It can cause cardiovascular diseases such as bronchitis, irritation for throat and lungs, coughing, wheezing, asthma attack etc. Sulphur (IV) oxide ranges from 0.20 - 20 mg/l, and the average mean value recorded as 3.73 ± 2.20 mg/l. The value of Sulphur (IV) oxide was low that enable it to fall within the good index value of concern, as well as within the recommended limit of pollution standard index.

3.5. Ammonia (NH_3)

Ammonia (NH_3) is a naturally occurring gaseous substance that serves as a building block of a chemical compound for a commercial range and household products. Ammonia is an indicator building block of nitrogen in the form of ammonium nitrite and nitrate. Ammonia mean value was 67.25 ± 44.87 mg/l, moderately high and ranged 0.1 - 400 mg/l. Ammonia is found everywhere in the environment, high level concentration of ammonia can scratch (itch) the eye.

3.6. Particulate Matters

Particle pollution is also known as particulate matter (PM) which comprised of very tiny pieces of solid or liquid in the air. Particles that cause pollution include dirt, dust, soot, smoke; drops of liquid etc., some of them are bigger than the other. Particulate matters are defined by their micrometers (diameters) for regulatory air quality purposes. Those of them with diameter of less than 10 microns are called (PM_{10}) are inhaled into the lungs and causes adverse health effects. On the other hand, excellent particulate matter also known as ($PM_{2.5}$), it has a particle less than 2.5 microns in diameter; however, $PM_{2.5}$ is made up of some portion of PM_{10}. Both PM_{10} and $PM_{2.5}$ are derived from different sources of emission with different chemical configurations.

Particulate matters (PM_{10} & $PM_{2.5}$) ranged from 16 - 289 μg/m^3 and 2.40 - 357 μg/m^3 particulate matter (PM_{10}) had a mean value of 115.36 ± 27.06 μg/m^3 which fall in class three under unhealthy level of concern for some sensitive group of

people, which also indicate orange coloration on the screen of air meter used according to pollution standard index (PSI) threshold limit, [22] [23].

Particulate matter ($PM_{2.5}$) is tinnier 7.5 microns less than that of particulate matter (PM_{10}). Its average mean value is recorded as 65.69 ± 28.13 μg/m^3. $PM_{2.5}$ falls under category two with yellow coloration indicating moderately fair, this value disagreed with that of study done by [24], that had value in which it falls within the pollution standard index of 0 - 50, indicating green coloration. Compared to the permissible standard as a control measure, both particulate matters have respiratory heart challenges such as chest pain/tightness, coughing, increased heartbeats, short of breath etc., it also linked with general body irritation, lung cancer and problem of baby's parturition for example low birth weight. Particulate matters are the main target and hotspot of the study location, as regards to its high mean value concentrations according to [25].

3.7. Temperature

Temperature is measured with thermometer, it SI unit is in degree Celsius. It is used to measure the hotness and coldness of any given location. The thermometer used in this study is that of the digital electronic type. It ranged from 23˚C - 39˚C, it mean value is within the range. Its mean value recorded as 27.26˚C ± 1.33˚C, the value of temperature is classified into the class I, category which depicts good level of concern, indicating green coloration with regards to PSI standard of [26] [27], as well as having the readings that go in agreement with previous work done by [28], on temperature. The normal temperature readings favors the biota, this was as a result of presence of tress found along the axis of study area, and other plants that help to ameliorate the changes of the climate.

3.8. Pressure

Pressure has its SI unit as millimeter of mercury (mmHg), sometime pascal (pa) is used. Pressure is the perpendicular applied force to an object per unit area in which force is applied upon. It ranged from 1 - 30 mmHg, and its mean value recorded as 24.67 ± 3.33 mmHg which pose no threats to people in the study area because it reads normally.

3.9. Weather

Weather is measured in degree; it is used by meteorology to read rainfall precipitation. Weather range from 20˚ - 32˚ and recorded a mean value of 26.33˚ ± 1.13˚ is related to each other in the aspect of pollution parameter occurrence and assessment.

3.10. Dew Point

Dew point of any given body of air is the temperature at which it must have zero degree Celsius (cooled) to become saturated with water vapor. However, dew point is the temperature the air needs to get cooled at constant temperature in

achieving relative humidity (RH). The temperature in dew point depends on the air pressure and its water content. Dew point mean value recorded as 13.15˚ ± 2.67˚, ranged from 1˚ - 25˚ and its level of concern is good, the higher the rise of dew point, the greater the amount of moisture in the air.

3.11. Wind Speed

Wind speed used to determine and measure the direction and speed of a wind in any given location. Its unit is in meter per second. As a weather measurement and part of air pollutant occurrence detector, ranged from 11 - 27 m/s and the mean value recorded as 17.13 ± 1.46 m/s and it is within the range. It also falls within the class 1 category which indicates good level of concern.

3.12. Humidity

Humidity is the rate of water vapor in the air. When the vapor amount in atmosphere is high, humidity is also high. It comes from water vapor evaporating from the sea and lake. Humidity ranged from 29˚ - 89˚, and recorded mean value of 61.83˚ ± 7.41˚, humidity had a moderate high level of concern here which may result to adverse effects on human body that contributes to low energy and lethargy. It also cause hyperthermia, due to overheating it makes the body not to allow the outward flow of heat (sweat) effectively. All the fifteen air pollutants detected, seven air pollutants found at class I category, which is good for human health and indicated with green coloration, others are found in different categories of class with different health risk and challenges, carbon monoxide recorded the highest pollutant concentration levels that will make patient very unhealthy, the reason of this is because of the use of motor cars and other vehicles that combust hydrocarbons, with incorrect octane number, when release into the atmosphere, combine with the atmospheric oxygen and give carbon (IV) oxide which is the dominating gas for climate change, as shown below in the graph (Figure 1).

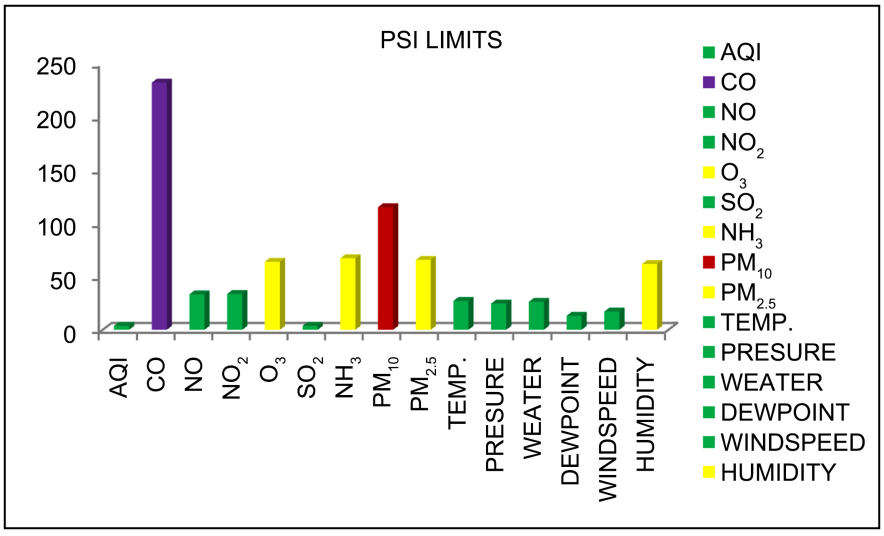

Figure 1. Spatial air pollutant occurrence and their health impacts level coloration indication.

4. Recommendation

With regards to the findings, the following recommendations were considered as:

1) The use of respiratory face mask as well as eye google should be welcomed.

2) Air quality can be improved with constant use of air pollution devices installation.

3) Air pollutant can also be minimized and control with the use of unleaded vehicles with smoke efficient.

4) Policies regarding to air polluter should be made as polluter pay policy (P^3) once the bench mark is drawn to reduce pollution rate.

5) Nylon tile road networks and overhead bridge should be constructed to reduce traffic congestion.

6) Federal road tax collector at the to-gate; should be encourage d and provided for employment and internal generating revenue (IGR), as seen in other cities in West African countries.

7) Ornamental trees and flowers should be planted along all the roads to reduce pollution rate of the air and improve the air quality in the country.

8) Air meter detector equipment should be provided at the port authority to check the vehicles entering into the country, as well as their salvage value and sequence of carbon in them.

5. Conclusions

Results obtained from this study showed that:

1) Carbon monoxide (CO) released from vehicle fossil fuel combustion (smoke) exhaust into the atmosphere result to carbon (IV) oxide formation, as the dominant gas of greenhouse gases (GHGs) that causes climate change and global warming.

2) Other particulate matters (PM_{10} & $PM_{2.5}$), level of concern forms the major respiratory issues in the study locations.

3) The trends of health impact assessment of air pollutant, people encountered is life threatened challenges on associated respiratory risk such as cardiac, emphysema, bronchitis, asthma, headache etc. are the main issues people faced and suffered from air pollution.

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Authors' Contributions

My coauthor made a significant efforts contributing to this study, in terms of

field work and other data collection processes as well as analyses and the final draft of this paper, which gave the approval of this article to be published any other expenses encountered and accounted for, she was there for me always.

Conflicts of Interest

The authors declare no conflicts of interest.

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