Evaluation Of Heavy Traffic Vehicular Exhausts Roads Side Polluted Guinea Grass (Paniaum Maximum) On Health Performance And Pathological Responses Of Guinea Pigs In Humans As The Consumer Of Its Meat.

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Abstract: The detrimental effects of pollutants caused by traffic vehicular exhausts emissions on roads side vegetation particularly guinea grass (panicum maximum), human health as well as animals have been a major concern would wide. Guinea grass is grazing plant of great economic importance for guinea pigs and has contributed up to 80% in its nutrition. There are possible indications that when these roads side guinea grass are polluted by traffic vehicle exhausts emission, it affects the health of the guinea pigs that depends on the plants for life as well as the health of the consumers of its meat. Increase in the motor vehicular traffic and its associated emissions on the roads side areas have led to a sharp increase in the prevalence of allergic diseases such as asthma and rhinitis. However, the indirect adverse effect of air pollution from traffic vehicular emission on humans via the consumption of animals that depends on polluted grass for life is unprecedented. This study was an evaluation of heavy traffic vehicular roads side polluted guinea grass by motor exhausts emissions on health performance and pathological responses of guinea pigs in human as the consumer of its meat. Twenty four (24) guinea pigs of varying age ranging from 6 to 16 weeks old were used in 8 weeks experiment which were allotted to four (4) dietary treatments (T_2, T_3, T_4 and T_5) and the control (T_1) with 6 guinea pigs per treatment and two replicates each. Heavy metals from 4 roads side polluted guinea grass and the control grass in Rivers State which include Aba Road (T_2), Ikwerre Road (T_3), NTA Road (T_4) and East West Road (T_5) were analyzed to determine the degree of contamination. Result indicated the body weight values obtained for the experiment (T_2, T_3, T_4 and T_5) were not comparable with the control value despite the fact that the control had the least initial body weight. The values obtained in the control were significantly higher than the test experiment (Table 1). All the roads side guinea grass were contaminated compared to the values obtained in the control (T_1). Guinea grass on the Aba road had the highest contamination with Nikel (6.4 mg/kg) and Manganese (4.8mg/kg) followed by Leord (4.1mg/kg) and chromium (3.1mg/kg). Similar values were obtained for other treatments.

Keywords: Guinea Pig, Heavy Metals, Humans and Polluted guinea grass.

Introduction

Guinea grass is a grazing plant of great economic importance and has contributed up to 80% in guinea pig diet and provide vitamin C, minerals and nutrients. However, there are possible indications of polluted roads side guinea grass by motor vehicle exhaust especially emission from diesel particle engine which affects guinea pig health as well as the health of the consumers of its meat [1]. Guinea pigs have considered a major source of meat and delicacy without restriction in Nigeria and other parts of Africa, Philippines, as well as South America [2]. The increasing motor vehicle traffic and its associated emissions on the roads side in the urban areas have led to a sharp increase in the prevalence of allergic disease such as asthma and rhinitis. Epidemiological and laboratory-based studies have demonstrated that pollutants emitted from motor vehicles can induce increased allergic symptoms such as reduced lung function, allergic inflammation and increase airway hyper responsiveness which may provide an underlying mechanism for the increasing prevalence of allergic diseases [3]. The indirect adverse effect of air pollution from traffic vehicular emissions on humans via the consumption of animals that depends on polluted grass for life is unprecedented. For almost the past four decades, the global vehicular fleet has increased 10-fold leading to the newer forms of air pollutants especially ozone precursors like oxides of nitrogen, volatile organic compounds and particulate matter [4]. However, over 600 million people living in the cities and towns around the world as well as the animals are directly or indirectly exposed to unhealthy and dangerous levels of motor vehicle generated air pollutants [5],[6]. Diesel vehicles emit up to 100 times more particles than those released from catalyst equipped gasoline cars of corresponding performance [7]. It is also reported that various metals are injurious to the health of

humans and wildlife when they occur in the environment at some critical high concentrations [8],[9]. Roads side emissions are particularly responsible for high levels of pollution (toxic heavy metals) on roads side guinea grass. However, to roads side vehicle emissions have been revealed in various human and other animal tissues such as hair, blood and respiratory organs [9],[10]. There is a limited research in this aspect of study with guinea pigs. Hence, the aim of this study is to investigate disease prevalence in humans via the consumption of guinea pigs that depends on roads side guinea grass polluted by heavy vehicular traffic emissions.

Materials and Method

This study was conducted at the animal house research unit, Department of Experimental pharmacology and Toxicology, University of Port Harcourt, Rivers State. Rivers State is located within longitude $6^{o}50E$ – $7^{o}05E$ and latitude $5^{o}05N$-$5^{o}06N$ in the land area of the Niger Delta with dense and thick tropical rainforest vegetation. The state is characterized with high ambient temperature of $27^{o}C$ and annual rainfall ranging from 2500mm to 3000mm. Twenty four (24) guinea pigs of varying age ranging from 6 to 16 weeks old with average initial weight of 250g to 500g were used in the experiment. The animals were acclimatized and fed on grass and concentrate mixtures for one week. After the one week adjustment period, they were allotted to four dietary treatments, and the control with 6 guinea pigs per treatment in complete Randomized Design. Each treatment was replicated two times and there were two guinea pigs in each replicate. The animals were later placed on the actual study and fed soley on the dietary treatments (polluted guinea grass). T_1 was the control (normal guinea grass) while T_2, T_3, T_4 and T_5 were the test guinea grass which includes Aba road, (T_2), Ikwerre road (T_3), NTA road (T_4) and East West road (T_5). Dietary treatments and normal guinea grass were offered ad libitum and 200ml of water was also given to the animals. Water intake was determined by weighing the remained water the following morning. The animals were weighed before the commencement of the study and continued on weekly basis up to the end of the study to determine the average final weight gain. Heavy metals from the traffic vehicular exhausts emissions on roads side polluted guinea grass around the major roads in rivers state were also determined. The animals were scarified for biochemical and haemotological analysis at the end of the study. Data collected were analyzed using analysis of variance technique (ANOVA) and significant differences between means were represented using ducan multiple range test.

Results and Discussion

Looking at table 1, the performance of guinea pigs in terms of body weight especially the test experiment (T_2, T_3, T_4 and T_3) values obtained are not comparable with the control (T_1) despite the fact that the control had the least initial body weight (250gr). Increase in body weight was at a low rate for the test experiment T_2 and T_3 had the least body weight followed by T_5 and T_4 respectively. This implies that effects of some unbeneficial factors as a result of the heavy metals contained in roads side polluted guinea grass might be responsible. This finding was in agreement with the report of [8] that various heavy metals are injurious to the health of humans and wild life when they occur in the environment at some critical high concentrations.

Table 1: *Nutrient Composition of Guinea Grass (Panicium maximum)*

Country location/cut duration/ state of growth	Dm	Cp	Cf	Ash	EE	MEF
Fresh, mature, Nigeria	25.7	7.8	33.4	12.2	1.6	45.2
Fresh, vegetative, 40cm,Tanzania	25.0	8.8	29.9	11.2	1.6	48.5
Fresh, vegetative, 80cm, Tanzania	25.0	8.8	32.8	12.9	1.5	44.0
Fresh, cut intervals of 1wks, Malaysia	22.0	20.5	24.1	11.4	0.9	43.1
Fresh, carcybloom, Tanzania	28.0	5.3	39.6	10.6	1.4	43.1
Fresh, cut of intervals of 3wk, Malaysia	23.0	14.3	27.4	12.2	0.9	45.1
Fresh cut at intervals of 4wks, Malaysia	25.0	10.2	30.9	13.0	1.3	43.1
Fresh cut at intervals of 5wks, Malaysia	24.5	10.2	30.6	13.9	0.8	44.5
Fresh cut at intervals of 6wks Malaysia	25.0	9.6	31.2	13.2	1.4	45.2
Hay, wet season, 8wks, 110cm Thailand	86.9	7.7	39.0	10.9	1.6	40.8
Hay, wet season, 10wks, 110cm Thailand	87.3	7.7	39.0	10.4	1.4	42.0
Hay, wet season 12wks, 170cm Thailand	36.5	5.5	40.1	10.4	1.4	42.6
Hey, dry season, 6wks, 65cm, Thailand	81.6	11.9	31.7	12.0	3.2	41.2
Hey, dry season, 8wks, 70cm, Thailand	90.8	8.3	37.7	13.0	2.0	41.0
Hey, dry season, 12wks, 70cm Thailand	89.2	6.6	35.5	13.2	1.8	42.9
Hey, dry season, 12wks, 95cm Thailand	91.1	7.2	36.4	12.5	2.1	41.8
Silage, Tanzania	20.0	6.3	39.2	19.1	2.1	31.7

Source: FAO, 2003 Dm = dm matter, cp = crude protein, Cf=crude fibre, EE- ether extract, NFE = nitrogen free extract.

Table 2, showed the levels of heavy metals contained in the polluted guinea grass. Result has showed that all the roads side guinea grass were contaminated compared to the value obtained in the control (T_1). Guinea grass on the road side of the Aba road (T_2) had the highest contamination of Ni(6.4mg/kg) and Mn(4.8mg/kg) followed by Pb(4.1mg/kg) and Cr(3.1mg/kg). Similar trend was obtained at East west road with highest contamination of Ni and Mn followed by Pb and Cr compared with the control value. Ikwerre road (T_3) showed higher contamination of Cr (4.2mg/kg) and Ni

followed by Pb and Mn while NTA road had highest contamination of Mn and Pb followed by Ni and Cr respectively. This finding tallied and was in agreement with the reports of [1],[11] that roads side areas polluted by heavy traffic vehicular exhausts emissions are particularly liable to such high levels of toxic heavy metals in the atmosphere and vegetation. It implies that guinea grass on polluted roads side areas are contaminated with heavy metals.

Table 2: *Performance of guinea pigs fed road side polluted guinea grass (panicum maximum)*

Parameters	Treatments				
	T_1 (control)	T_2 (Aba Road)	T_3 (Ikwerre Road)	T_4 (NTA Road)	T_5 (East West Road)
Initial weight (g)	220	520	250	232	500
Final body weight (g)	413	600	340	382	625
Total weight gain(g)	193	80^{b}	90^{c}	150^{ab}	125^{bc}
Average weekly weight gain (g)	27.57	11.42	12.85	21.42	17.85
Average daily weight gain (g)	3.94	1.631	1.835	3.06^{ab}	2.55
Total feed intake	4340^{a}	8520^{b}	5100^{c}	4460	8560^{b}
Total water intake	2107^{a}	2865^{b}	2102^{c}	2104^{c}	2836^{c}
Average weekly feed intake (g)	620	1217.1	728.5	637.1	1222.8
Average daily feed intake	88.5	173.8	104.0	91.01	174.6
Average weekly water intake	301	409.2	300.2	300.5	405.1
Average daily water intake (ml)	43	58.4	42.8	42.9	57.8

Means with different super scripts (a, b,c) are significantly different at (P<0.05)

However, table 3 showed that degree of metal accumulation for roads side polluted guinea grass by heavy metals which was evaluated using the factors of accumulation method (FA). FA is estimated as the ratio of average concentrations of a metal in the road side polluted guinea grass to that obtained in the control plant (normal or unpolluted guinea grass).

Table 3: *Showing factors of accumulation for heavy metals in polluted guinea grass*

Metal	Factors of accumulation (FA) plant
Cd	38.3
Pb	20.25
Cu	12
Zn	12.75
Ni	48.5
Cr	15.5
Mn	21.25

According to the result of the FA values in table 4, roads side guinea grass polluted by heavy traffic emissions showed higher bio accumulation of Cd(3.8mg/kg) and Pb(20.25mg/kg) respectively. This result agrees with the findings of [12] who reported that bioaccumulation of Pb (FA values) in the plants was poor compared to Cd (FA values). This indicates that guinea grass on roads side areas polluted by traffic emission do bioaccumulation of metals in varying levels.

Table 4: *The level of heavy metals in polluted Guinea grass (panicum maximum) and control (normal grass) heavy metals*

Roads side	Cd	Pb	Cu	Zn	Ni	Cr	Mn
Control (T_1)	0.03	0.2	0.1	0.1	0.1	0.2	0.2
Aba road (T_2)	1.3	4.1	1.2	1.6	6.4	3.1	4.8
Ikwerre road (T_3)	1.0	3.9	1.7	0.9	4.1	4.2	3.1
NTA road (T_4)	1.1	4.0	0.9	1.1	3.8	2.0	4.2
East west road (T_5)	1.2	4.2	1.0	1.5	5.1	2.7	4.9

Table 5 represented the haematological parameters of guinea pigs. For the PCV, values obtained in T_2, T_4 and T_5 are not comparable to the values obtained in the control (T_1) except T_3. PCV is involved in the transportation of oxygen and absorbed nutrients. Hence, increased PCV shows a better oxygen transportation to the tissues and absorption of nutrients. Aba road (T_2) had the least PCV values compared to the control (T_2). The reason might be the effects of unbeneficial factors caused by heavy metal contamination in the polluted roads side guinea grass. This finding confirmed the report of [13]. The values obtained in Ikwerre road (T_3) was unexpected and comparable to the control (T_1) value. Factors other than age, sex, breed, sampling techniques and testing methodology may have influenced the result. Haemoglobin serves the function of transporting oxygen to the tissues of the animal to aid oxidation of ingested food in order to release energy for other body functions as well as transport carbon dioxide out of the body of animals. So animals with higher haemoglobin values have better oxygen transport for oxidation of ingested food and enough energy to carryout other body functions. Haemoglobin values followed the same trend and not comparable to values obtained in the control (T_1) except T_3. Aba road had the least value. While blood cell fight infection and defend the body against invasion by foreign organisms and produce antibodies in immune response. Thus, animals with low white blood cell always have high risk of disease infection while those with high counts are capable of resistance to diseases. The control (T_1) had the highest value followed by T_3, T_4 and T_5, T_2 had the least values. The result obtained for white blood cell was in agreement with the reports of [14]. Blood platelets are implicated in blood clothing. Animals with low blood platelet concentrations will have risk of prolonged blood clot-formation which results in excessive loss of blood during injury. The result from the values was not expected as the value obtained in the control (T_1) was next to the highest.

Location / Treatments	PCV (%)	Hb(g/dl)	RBC	WBC	Platelet	M	L
Control (T_1)	39±1[a]	13 ±0.3[a]	5.4±0.4[a]	3.5±0.15	255±15	32.5±2.5[a]	67.5±2.5[a]
Aba road (T_2)	28 ±o[c]	9.3 ± o[c]	3.8 ± o[b]	2 ± o[a]	240+o[a]	30 ±o[a]	70 ± o
Ikwerre Road (T_3)	40 ± o[a]	13.3±o[a]	6±o[a]	3.3±o[a]	180±o	28±o[b]	72±o[a]
NTA road (T_4)	34 ±o[b]	11.5±2[b]	5±o[c]	3 ±o[a]	300 ± o	42±o[a]	58±o[b]
East west road (T_5)	33 ±1[b]	11+o[b]	4.65±o[c]	2.5±o.15	235±15	32.5±7.5	625±1.9[a]

Table 5: *Showing haematological parameters of guinea pigs fed on road side polluted guinea grass (Panicum maximum)*

Means with the same super scripts are not significantly different (P>0.05)

Table 6: *Showing feed and water intake of guinea pigs*

Location/Treatments	Feed Intake	Water Intake
Control (T_1)	0.41 ± 0.01[a]	143.070 ± 1.064[a]
Aba Road (T_2)	0.41 ± 0.002[a]	141.523 ± 1.920[a]
Ikwerre Road (T_3)	0.21 ± 0.015[b]	100.095 ± 0.337[b]
NTA road (T_4)	0.21 ± 0.002[b]	100.190 ± 0.481
East west road (T_5)	0.40 ± 0.002[a]	100.333±0.221[a]

Means with the same super scripts are not significantly different at (P>0.05).

Conclusion

Epidemiological studies have indicated that rapid increase in air pollution from motor vehicles may be an important risk factor for increase in the prevalence of allergic diseases that occur in the environment. Roads side guinea grass polluted by emissions from motor vehicle exhausts have the potential of causing long-term increases in the prevalence of allergic diseases in guinea pigs that depends on affected grass for life. This food-chain interaction pose threat to human health as well as expose man to high risk of allergic diseases as man source his meat from these animals.

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