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THE XENOBIOTIC EFFECT OF 2, 4-DIMETHYLAMINE SALT (720 G/L) ON ELECTROLYTES AND METABOLITES IN NEW ZEALAND RABBITS (*ORYCLOTAGUS CUNICULUS*)

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ABSTRACT

Pesticides are generally toxic and exert serious biocidal effects on target and nontarget organisms. To ascertain this fact, thirty (30) adult New Zealand Rabbits (*Oryclotagus Cuniculus*) whose weight average 2.0kg were used for the toxicity bioassay of Aminoforce containing 720 g/l 2, 4-Dimethylamine salt. The test animals where orally administered with three concentrations (2.00 ppm, 4.00 ppm and 6.00 ppm) of toxicant for 21 days. The muscle from each exposed animal were collected, crushed and homogenized with deionized water for electrolyte assessment. Also, blood samples were collected and centrifuged for 15 minutes at 3000 rpm. Results of this study confirmed a decline in blood metabolites like; total protein, albumin, bilirubin and creatinine, while urea value appreciated. Measured electrolytes in the muscle such as sodium (Na^+) appreciated while potassium (K^+) declined. But that of Magnesium and Chloride ion values in the muscle stabilized in the experimental group, thus being not significantly different ($p>0.05$) across the various concentrations of the toxicants. This result confirmed the toxicity of the toxicant on metabolic and electrolyte parameters of exposed animals. Thus 2, 4-dimethylamine salt should be handled and used cautiously in order to avoid its toxicity.

Key Words: Aminoforce, Herbicide, Metabolites, Electrolytes.

1. INTRODUCTION

Pesticides are biocides which alters metabolic process of targeted organisms (pest) in the ecosystem. They become a menace to farming activities, and non-target biota when applied without caution. "Pesticides are of different formulations which act sometimes as microbial agents or disinfectant against target pests" [1]. Due to their toxic effect on both target and nontarget organisms in the environments, they by extension present a serious risk to humans and other bio-life forms in the environment by bioaccumulating in food chains and tissues of organisms [2]. Feed and fodder used in feeding animals are also frequently contaminated with pesticides [3], which accumulates in the adipose tissues of affected animals [4]. In the last few years, research has revealed the trend and toxic effect of pesticide on human health and animals in general, especially as it regards human food poisoning in different countries of the world. Statistically, there are millions of incidences and over 20,000 fatalities, arising from indiscriminate use of pesticides [5]. The application of pesticides in commercial agriculture was first recorded around 1940s during the advent of industrialization which introduced modern mechanics and methodologies. There is increased in the application of herbicides in modern agriculture to boost food security for the ever-growing world population in various countries, but without adequate storage or disposal options. Globally, the reckless use of pesticides has resulted to the contamination and rapid decline of biodiversity [6].

Herbicides like aminoforce containing 720 g/l of 2, 4-Dimethylamine salt is a selective pre-emergent and post-emergent systemic herbicide which reduces the population of broad-leaved weeds and additional plants on farms or agricultural lands. Its application on grasses, golf courses, woods, roadways and playgrounds also

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help control the population of unwanted weeds and target organisms in such areas [7]. The use of these anthropogenic chemicals in agriculture and food preservation as well as security have caused untold environmental problems, as well as the acute and chronic adverse on human. Knowledge on the toxicity and xenobiotic effects of 2, 4-Dimethylamine is limited (Kurenbach, *et al*., 2015). As such this study is aimed at assessing the xenobiotic effect of 2, 4-dimethylamine salt (720 g/l) on electrolytes and metabolites in new zealand rabbits (*oryclotagus cuniculus*)

2. MATERIALS AND METHOD

A total of thirty (30) healthy adult New Zealand Rabbits weighing an average of 2.0 kg each were used in the bioassay. The Rabbits were obtained from a rabbit farm at Ugeli in Delta State, Nigeria and was transported individually in plastic baskets to Imgbi, Yenagoa, Bayelsa State and acclimated in a private rabbitory for the experiment. The herbicide, Aminoforce containing 720 g/l of 2, 4-Dimethylamine salt was purchased from Swali chemical market within Yenagoa metropolis of Bayelsa State, Nigeria.

A rabbitory was built having a total of twelve (12) compartments, with each compartment having a dimension of 90 x 75cm x 120cm. It was roofed with aluminum roofing sheets to provide the needed shade, and protect animals from the scorching effect of the sun. An equal dark and light conditions where maintained at all times during the experimental period. Rabbits were also acclimated for 31 days and during this period; they were provided with tap water and synthetic poultry feed daily.

2.1. Determination of Sublethal Dose

The sublethal doses needed for the main experiment was determined following a trial experiment also known as range finding test. Three concentrations (0.002 ml, 0.004 ml and 0.006 ml) from the original toxicant (Aminoforce) was prepared, which was later converted to parts per million (ppm) (2 ppm, 4 ppm, and 6 ppm) for the main experimental run following the method described by Inyang, 2008. This was also followed by a renewal bioassay throughout the period of the trial test.

2.2. Main Experiment

The main test lasted for a period of three weeks (21days). During this period, experimental animals were randomly selected and exposed to three sub-lethal concentrations (2ppm, 4ppm and 6ppm) of the toxicant obtained from the trial test. This was aimed at testing the toxic effect of chemical on exposed animals.

2.3. Sample Collection and Analysis

2.3.1. Blood

At the end of the exposure period, a clinical syringe (10ml) and needle was used to collect blood samples from the ear of rabbits through the large veins and sometimes from the central artery. Collected blood was centrifuged, and supernatant (serum) poured into a plain sample bottle for analysis to determine the effect of toxicant on a number of metabolites in exposed animals.

2.3.2. Organs

Organ like muscle was collected by dissection, crushed in a mortar and homogenized with deionized water for electrolytes assay. The mixture (s) was centrifuged before collecting the supernatant (serum) into plain sample bottles for chemical analysis of electrolyte in the muscle following the documented protocol [8].

2.4 Statistical Analysis

All data was statistically analyzed to achieve relevant information using the Statistical Package for Social Sciences (SPSS) version 20 software. The data obtained from the analysis of results are expressed as mean ± standard deviation after been subjected to one-way analysis of variance at α=0.05 to check for significance level of different experimental parameters (metabolic and electrolyte) assessed in this study. Duncan multiple range test (DMRT) was applied to distinguish discrete mean values.

3. RESULT AND DISCUSSION

Results on the the xenobiotic effect of 2, 4-dimethylamine salt (720 g/l) on electrolytes of new zealand rabbits (*oryclotagus cuniculus*) is presented in Table 1. The value of Sodium (Na^+) ions measured in the muscle of rabbits exposed to AminoForce increased to 2.70±1.41mmol/L at 2.00ppm, 4.25±1.06mmol/L at 4.00ppm and 5.05±2.47mmol/L at 6.00ppm when compared to the control value of 1.95±1.63mmol/L (Table 1). The appreciation in the value of sodium ion in the muscle was observed to be dose dependent, thus, increase in toxicant concentration leads to increases in the value of sodium ion in the muscle. This observation is in tandem with the study of another author [9]. These electrolytes are positively (cations) or negatively (anions) ionized molecules in acting as pH buffer in blood tissues and cells of distressed animals [10].

Table 1: Effects of Aminoforce on electrolytes in the muscle of New Zealand Rabbit

Conc. of AminoForce (ppm)	Na^+ (mmol/L)	K^+ (mmol/L)	Cl^- (mmol/L)	Mg^{2+} (mmol/L)
0.00	1.95±1.63	13.30±4.24	26.62±1.63	0.85±0.02
2.00	2.70±1.41	11.95±0.92	26.20±0.42	0.82±0.15
4.00	4.25±1.06	9.84±1.22	26.60±1.41	0.67±0.98
6.00	5.05±2.47	8.62±3.66	26.20±1.98	0.62±0.19

All data is expressed as mean ± standard deviation using the software programme Statistical Package for Social Sciences version 20.

In their experiment, they recorded appreciation in the value of sodium in the blood of probe rabbits intoxicated with bendiocarbamate. The observed increase in the value of sodium ion (Na^+) as compared to the control is an indication of hypernatraemia in the blood which is usually associated with dehydration. This could be attributed to the toxic effect of xenobiotic on exposed rabbits. Similarly, Inyang *et al.* [11] also reported related result after studying the effect of glyphosate on some electrolytes in *Heterobranchus bidorsalis*. Their result also recorded increase in the value of some electrolytes. Inyang and Patani, [12] also reported similar findings and confirmed an increase in the value of electrolytes in

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the muscle of exposed fishes after studying the haematological aberrations and electrolyte stabilization in *heterobranchus bidorsalis* induced by Rhonasate 360sl containing glyphosate.

The muscles need sodium, potassium, chlorides and magnesium ions to contract. When these electrolytes become lopsided, it can result in either weakness of muscle or extreme tightening. The heart, muscles and nerve cells use electrolytes to convey electrical impulse to other cells. From the result presented in Table 1 of this study, there were observed changes in the values of certain electrolytes measured in the muscle of exposed rabbits.

The increased value of sodium in the muscle as recorded in this study could also be an indication of xenobiotic poisoning caused mainly by the effect of the toxicant on rabbits and this could lead to an increased activity of diarrhea, sweating and vomiting which were common observations at the intoxication stage of probe rabbits in this study. Furthermore, the loss in weight occasioned by excessive dehydration as was observed among exposed animals in this study could be attributed to increased muscular activity and stress induced by xenobiotic which may actually lead to lethargy in exposed rabbits.

The increase in sodium concentration in the muscles of exposed rabbits as opposed to potassium reduction in muscle cells in this study is also suggestive of alteration in physiological activity, osmoregulation as well as disturbance of the functions of neuromuscular, endocrine and excretory system of animals. This report is in line with the finding of Cox, [13] who also reported that cypermethrin alters nerve impulse which travels along nerves of vertebrates and other animals due to alteration in the normal level of electrolytes in animals. Similar results were also documented by some authors [14, 15], on electrolyte variance in tissues and organs of animals exposed to similar xenobiotics.

Potassium is a vital mineral that has numerous functions in animals. It assists control muscle tightening; enhance healthy functioning of the nerve as well as fluid balance. Potassium ordinarily is concentrated inside the cells of muscles, and other tissues of animals. The variance in concentration of potassium from within the cell as juxtaposed to plasma is essential in producing electrical impulse in the body of animals for proper muscle and brain function.

On the contrary, as presented in table 1 above, the measured value of potassium (K^+) in the muscles of rabbits treated with toxicant declined significantly from 11.95±0.92mmol/L at 2.00ppm, to 9.84±1.22mmol/L, and 8.62±3.66mmol/L at 6.00ppm as compared to the control (13.30±4.24mmol/L). This could be as a result of the influence of poisons on renal function, altering the kidney's ability to regulate the level of potassium thereby causing its levels to decline as observed in this study. This is a direct pointer to the damaging influence of poison on the kidney.

Related results were also accounted by Inyang *et al.* [11] after exposing *Heterobranchus bidorsalis* to varying concentrations of glyphosate. The decreasing effect of potassium (K^+) ion in this study, if it continues could lead to conditions such as hypokalaemia, muscular weakness, cramps, spasm and fatigue, digestive disorder, heart palpitation and breathing difficulties in exposed rabbits. These in most cases induce osmotic imbalance that can lead to abnormal haemo-concentration and circulatory collapse.

The variance in the value of potassium ion in probe animals as compared to the control in this study also possibly defines the toxic effect of toxicant on electrolyte activities in exposed rabbits, thus interfering with potassium (K^+) ion homeostasis. Related to this study is the report by Mahjoubi-Samet *et al.*, [16]. After exposing rats to the effect of dimethoate, they also recorded variance in the levels of various electrolytes such as high calcium level (Hypercalcaemia) and low phosphorus level (hypophosphatemia) as compared to the control. According to the authors, exposure to dimethoate altered bone mineral composition such as calcium and phosphorus levels in probe animals. Also, the recorded decline in the value of potassium could lead to ionic imbalance and this may trigger or activate muscle weakness or excessive contraction as well as poor heart, nerves and muscle electrical impulse coordination to other cells in exposed animals.

Whereas, as shown in Table 1 above, the values of Chloride (Cl^-) and Magnesium (Mg^{2+}) ions did not indicate major alteration as compared to the control. Values of Chloride (Cl^-) recorded 26.20±1.98mmol/L at highest concentration of 6.00ppm as compared to the control of 26.62±1.63mmol/L while that of magnesium recorded 0.67±0.19mmol/L at highest concentration of 6.00ppm of toxicant as compared to the control of 0.85±0.02mmol/L. This possibly indicate that the xenobiotic (Aminoforce containing 720 g/l of 2, 4-dimethylamine salt) may be less toxic to the activities of chloride (Cl^-) and magnesium (Mg^{2+}) ions in the muscle or it may be due to the low concentration of toxicant used in this study.

The stabilization of some values of electrolytes based on Ogamba *et al.,* [10] assertions could be a pressure stimulated reply caused by the effect of animals exposed to toxicant which could activate definite physiological and metabolic means that may result to a quick uptake of electrolytes from water and food substance or decrease of ion-efflux as it where.

Table 2: Effects of Aminoforce on metabolites in the blood of New Zealand Rabbits

Conc. of Aminoforce (ppm)	T.P (nmol/l)	ALB (g/l)	T.BIL (g/l)	UREA (nmol/l)	CREAT (mmol/l)
0.00	65.26±3.30	32.66±0.58	23.61±4.11	6.56±1.32	149.12±87.70
2.00	63.46±2.87	31.84±2.56	14.30±3.79	4.53±5.38	95.27±2.51
4.00	67.38±5.58	29.08±3.27	13.59±1 0.04	7.27±0.12	77.27±0.12
6.00	57.17±11.32	32.23±2.06	11.63±2.47	6.74±0.43	67.71±29.96

All data is expressed as mean ± standard deviation using the software programme Statistical Package for Social Sciences version 20.

From the result of this result presented in Table 2, the value of total protein in the blood of probe rabbits conclusively declined from 63.46±2.87 nmol/l at 2.00ppn, to 57.17±11.32 nmol/l at 6.00ppm as compared to 65.26±3.30 nmol/l of the control. But there was slight

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increase in the value of total protein to 67.38±5.58 nmol/l at 4.00ppm as compared to the control (65.26±3.30 nmol/l). This slight increase in the value of total protein at concentration 4.00ppm could be due to pressure stimulated by poison and probe animal reaction to maintain physiological equilibrium. According to Chatterjea and Shinde [17], "the decrease in the levels of total protein and albumin in the serum, are the major diagnostic symptoms of liver diseases". Related results were also accounted in other research [10, 11, 14-16], as a result of oral administration of different doses of dimethoate. They also recorded decline in the levels of various metabolic parameters. The decrease in serum protein could be credited to modifications in protein and free amino acid metabolism and their mixture in the liver.

Metabolites are small intermediate end products of metabolic activity that is aided by enzymes in animal cells [18-20]. They serve as cellular fuels to generate cellular energy and also stimulate, and conduct cell signaling and play inhibitory roles on enzymes. They also have various functions including structure, catalytic activities, usually as cofactors to enzymes, defense and interactions with other organisms such as pigments, odorants and pheromones [20]. Metabolite summary has been recognized as a multi-parallel plan for virtual calculation of a blending of compounds or compound groups utilizing different techniques [16].

Regardless of its beginning since late 1960s, it was barely in 1980s that its usage was recognized to analyze metabolic disarray in animals, particularly for quick testing of inborn errors such as diabetes in humans and cardiovascular risk factor evaluation [17]. Thus, profiling blood samples of metabolic parameters can be adopted to inspect definite biochemical reaction [14]. Examples of metabolites measured in this experiment include total protein, albumin, bilirubin, urea and creatinine. The mean levels of metabolites (total protein, albumin, total bilirubin, urea and creatinine) in the blood of control rabbits and in rabbits treated each day with AminoForce (2, 4-dimethylamine salt) for 21 days are presented in table 2 below.

According to Inyang [17], proteins are energy molecules responsible for providing needed energy for animals to carry out their physiological functions. Full protein experiment is a straightforward, schedule blood check. It examines regular or irregular levels of protein in the body. Having too much or too low protein can cause unanticipated loss of weight, tiredness, or inflammatory diseases. The full protein level can aid detect liver and kidney illnesses, together with other situations. Though, very high or low serum protein points do not constantly indicate a persistent or disease conditions. Rather, there are some every day factors that can affect an animal protein levels and they include: stress due to increased muscular action, diet, level of hydration as well as complications from pesticide or toxicant inducement. Consequently, high serum total protein levels can signify these conditions of health such as swelling caused due to infection or injury, cancer due to malignant growth of cells in exposed animals, dehydration, chronic kidney disease as well as liver or hepatotoxicity.

Moreover, the protein stage repression might be as a result of loss of protein either by reduction in protein mixture or improved proteolytic actions or deprivation as reported by Inyang [17]. Furthermore, the observed decline in serum proteins might also be credited partially to the harmful impact of toxicant on liver cells, as established by the improvement in actions of liver AST and ALT. It is therefore, imperative that the low level of total protein measured in the serum of animals treated with Aminoforce is a show of the toxic effect of the pesticide on nutritional activity, absorption, liver function, as well as renal function which may lead to nephritic syndrome or glomerulonephritis, and cardiac functions of treated animals.

Albumin is one of the most abundant blood proteins in the body of animals. It is produced in the liver and plays several roles in animals as well as responsible for maintaining arterial pressure, by keeping water in the blood vessels [17]. It transports several substances ranging from various hormones to drugs. Therefore, changes in albumin level in the blood, either decrease or increase can be used to diagnose various health problems that involve the kidney or liver and it may be caused as a result of malnutrition, inflammatory disorders, infections, as well as dehydration [18].

Increased level of albumin in the blood is seen in most cases when the blood is too concentrated, as in the case with dehydration leading to excess water loss occasioned by the effect of a drug, clinical condition or toxic chemical effect. Reduced level of albumin could also be due to reduced liver function or increased albumin losses and are often associated with inflammation of liver or malnutrition as well as kidney diseases.

As presented in Table 2 of this study, the value of Albumin in the blood slightly declined from 31.84±2.56 g/l at 2.00ppm to 29.08±3.27 g/l at 4.00ppm as compared to the control of 32.66±0.58 g/l. But at the highest toxicant concentration of 6.00ppm, the value of albumin appreciated slightly to 32.23±2.06 g/l as compared to the values of previous concentrations. Its values in the blood recorded lowest at 4.00ppm (29.08±3.27 g/l) of toxicant concentration, followed by 2.00ppm (31.84±2.56 g/l) as compared to the control (32.66±0.58 g/l).

This variance in the value of serum albumin in probe animals as compared to the control perhaps is indicative of the toxic effect of AminoForce which could result in associated risk of liver inflammation, nephrotoxicity or malnutrition. The reduced levels of albumin in AminoForce treated animals may also indicate or present the condition of abnormal control of arterial pressure and osmoregulation in the blood vessels, which further indicate reduced body mass and weight reduction in animals treated with toxicant in this study.

This finding is related to that of Inyang and colleagues [19]. They also recorded a decline in the serum albumin when male rabbits and *Parpohiocephalus obscurus* where exposed to the activity of dimethoate and diazinon as well as Lamda cyhalothrin pesticides respectively and concluded that the decline may be possibly due to renal failure and inability for probe animals to osmoregulate, thereby causing albumin to be excreted with urine.

The level of urea in the blood was also measured in this study with result presented in table 2 above. From the result recorded, urea level in the blood slightly varies with the control in an irregular pattern. At the initial exposure of probe animals to 2.00 ppm of toxicant concentration, its average value declined to 4.53±5.38

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nmol/l as compared to the control of 6.56±1.32 nmol/l. This shows the response of probe animals to stress induced by their sudden exposure to xenobiotic in this study.

The observed decrease in urea level could also be indicative of liver disease if the trend continues. But as the concentration of toxicant was increased to 4.00ppm, urea value appreciated to 7.27±0.12 nmol/l as compared to the control (6.56±1.32 nmol/l) and later stabilized to 6.74±0.43 nmol/l at 6.00ppm, but still slightly higher as compared to the control of 6.56±1.32 nmol/l. Though, the observed variance in the value of urea recorded at the highest concentration of toxicant was not important when measured with the control, this could perhaps be due to the low concentration of toxicant used in this study.

Urea level recorded highest in animals treated with 4.00ppm of toxicant, reaching a value of 7.27±0.12 nmol/l as compared to the control of 6.56±1.32 nmol/l. The slight elevation of urea level as measured in this study could be a major sign of glomerular filtration damage as reported by Chatterjea and Shinde, [11]. The result of this research is related to that of Elias, [12] who also exposed male rabbits to the activities of Dimethoate and Diazinon respectively, and recorded similar increase in the level of serum urea in treated animals as compared to the control animals. But this observation is slightly dissimilar to the findings of previous authors like Nyblom and colleagues, [13]. In their publication, they reported a decline in the value of urea and concluded that a decreased urea level is indicative of liver disease.

Bilirubin is an orange-yellow material formed during the usual breakdown of red blood cells. Bilirubin passes via the liver and is finally excreted, thus controlling the level of bilirubin in the body. More than average stages of bilirubin might signify diverse forms of liver issues. Sporadically, higher bilirubin levels might signify an improved pace of obliteration of red blood cells [14]. In the present study, the administration of Aminoforce containing 2, 4-dimethylamine salt caused gradual and regular dose dependent decrease in bilirubin level throughout the experiment. Values of bilirubin declined to 14.30±3.79 g/l at 2.00 ppm, 13.59±10.04 g/l at 4.00 ppm and 11.63±2.47 g/l at 6.00 ppm as compared to 23.61±4.11 g/l of the control. The depreciation was also dose dependent, that is, its values declined as the concentration of toxicant increases as previously reported [15].

Consequently, a lower than normal level of bilirubin in the blood is not really much of a clinical concern as it only shows how far the liver is able to clear bilirubin to prevent condition of jaundice. Rather, higher than normal level could mean that liver damage or diseases is possible. Therefore, the result of this study presented in table 4 above may indicate that the experimental toxicant pesticide is slightly toxic to the cells of the liver in clearing bilirubin. Sastry *et al*. [16], also examined that contact of fish for a long period to most poison like insect killer obstruct protein metabolism, reduction of full protein in the plasma and serum of fish.

The decline in the value of total bilirubin in this study does not conform to the report by Saafi *et al.* [17]. They reported increase in metabolic parameters of dimethoate-intoxicated rats. But generally, changes in serum bilirubin which is acknowledged as sign of liver function might offer more proof on hepatotoxicity stimulated by toxicant as reported by Khan *et al*. [18]. But consequently, the variance of the value of bilirubin in Aminoforce treated rabbits as compared to the control is an indication of hepatotoxicity on exposed animals.

Creatinine is a material the body generates in the course of regular metabolism and eradicates it nearly wholly via the kidneys process of filtration [19]. Thus, dimension of creatinine is a precise evaluation of how well the kidney processes of filtration are functioning. Something that changes the capacity of the kidneys to sieve creatinine well (such as lack of moisture) can lead to alterations in creatinine and urea levels in the blood [19]. Creatinine is also a dispel product of muscle turnover and is indicative of muscle mass, which is calculated as a simple blood test [20].

As presented in table 2 of this study, the value of Creatinine regularly declined from 95.27±2.51 mmol/n at 2.00 ppm to 77.27±0.12 mmol/l at 4.00 ppm and 67.71±29.96 mmol/l at 6.00 ppm as compared to the control value of 149.12±87.70 mmol/l. The observed decrease was dose reliant as the concentration of poison increases. This trend is a clear indication of the toxic effect of toxicant to metabolic parameters such as creatinine in probe animals. The significant decline in creatinine as seen in this study does not conform to the report by previous authors like Capcarova *et al*. [9] in bendiocarbamate-intoxicated rabbits. They reported increase in the values of creatinine measured in the blood of probe animals. Also, the observed decrease in the value of creatinine in this study might be an indication of increased kidney function as well as reduced muscle activity which could result in gastrointestinal bleeding, liver disease or malnutrition as well as muscle spasm and atrophication in exposed rabbits. Similar finding to this study was reported [15, 19]. They due to oral administration of diverse doses of dimethoate on rats confirmed a reducing trend of creatinine in the blood of rats exposed to dimethoate.

Generally, changes in the values of serum metabolites in Aminoforce treated rabbits, presented in table 2 of this study as compared to the control is an accepted sign of liver function which provides proof on hepatotoxicity stimulated by the toxicant. In addition, increase in serum metabolites such as urea in this study can also be credited in part to the harmful impact of xenobiotic on liver cells [20-29]. Thus, results of the current study as presented in table 1 and 2 above are indicative of hepatotoxicity and nephrotoxicity. Similar to this finding is the work of Inyang, [28] who accounted related findings in plasma total protein, albumin, glucose and organ's total urea and creatinine of *Clarias gariepinus* exposed to diazinon. Inyang *et al.* [27] further studied the "Sublethal effects of diazinon on selected metabolic parameters of *Clarias gariepinus*". In their study, fishes were exposed to changeable sublethal doses of poisons at diverse concentrations for 30 days to monitor their impacts on a few metabolic processes of the fish. Their conclusion was in line with the findings of this study that Creatinine and total protein values reduce with growing concentration of the poison.

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4. CONCLUSION

Aminoforce herbicides are usually produced to eliminate or control unwanted weeds, annual and perennial broadleaf grasses and plants. But concerns of the hazards of the herbicides towards environmental impact and its life forms such as poultry animals like rabbits which serves as food for humans as well as direct impact on human health through the practice of spraying of these xenobiotics on farm lands by applicators or farmers is a major concern as seen from the result of this very study. Other investigators and researcher of pesticide toxicology over the years have also raised concerns over the influence of xenobiotics on the surroundings in general. Most especially in Nigeria, It is hard to determine and investigate direct effects of pesticides such as AminoForce containing 720 g/l of 2, 4-dimethylamine salt on the ecosystem and their direct associations with the health of human beings due to several pitfalls. To curb the rising trend of food poisoning in Nigeria due to bio-accumulation and magnification of xenobiotics in food chains, there is therefore the need for an elaborate, comprehensive and extensive research at this time to gather data about the use of herbicides containing 720 g/l of 2, 4-dimethylamine salt. This should be followed with the analysis of bio-concentration of the 2, 4-D family of herbicides in animals, especially those that serves as a direct source of nutrition to man.

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