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Calculation of metabolic waste of *Clarias gariepinus* and *Tilapia niloticus* obtained from two commercial fish ponds in Gwagwalada

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ABSTRACT: An automated blood serum chemistry analytical system designed for human usage was employed to establish the levels of urea and creatinine parameters present in sera obtained from 60 experimental groups of catfish and tilapia from a commercial pond with length ranging from 10 to 58 cm and weight ranging from 98.2 to 900.2 grams (For the first group) and 6.8-5 cm and 28.9-90.5 g (for the second group) respectively. The present study was carried out to determine the result of Urea and Creatinine values of *Clarias gariepinus* and *Tilapia niloticus* obtained from two commercial ponds in Gwagwalada. The results observed from catfish when compared to that of tilapia, showed a slight difference of both species. Highest Creatinine value recorded for *Clarias gariepinus* was 1.53 mg/dl and the lowest was 0.00 mg/dl. While the highest Urea level recorded is 10.4 mg/dl and minimum was 0.04 mg/dl. Highest Creatinine value recorded for *Tilapia niloticus* was 1.43 mg/dl while the lowest value recorded is 0.02 mg/dl. Urea highest value recorded is 11.40 mg/dl and lowest value is 0.02 mg/dl. The ratio of urea to Creatinine was very high for both species and can be concluded to be either as a result of gastrointestinal bleeding, kidney failure, high protein diet as well as pollution of pond water with substances such as ammonia, and urea which are excreted by fish. It is therefore important to regularly change water to control the effect Urea blood level.

Key words: Gastrointestinal bleeding, kidney failure, protein diet.

INTRODUCTION

Fish is important to man and is of the most readily available and valuable source of high graded relatively protein available to man. Furthermore, of all the source of protein, fish is the easiest to digest, with most of the species showing protein digestibility of between 90 and 98% (Acton and Melissa, 1999).

Clarias gariepinus of the family *claridae* is the most common Nigerian fresh water fish species and is prominent in aquaculture practice. They are easily cultured with large economic gains because of their air-breathing and hardy nature, suitable reproductive strategy, nutritional efficiency and attainment of large size in a short time (Fagbenro *et al*., 1993). The sharp tooth catfish (*Clarias gariepinus)* is one of the most important individuals' species in traditional fresh water fisheries in Africa. It is widely attributed in Africa, where it occurs in almost any freshwater habitat flood plains, large sluggish rivers, lakes and dams. The fish is omnivorous, feeding on fishes, birds, frogs, small mammals, reptiles, snails, crabs and other invertebrates. It is also capable of feeding on seeds and fruits.

Tilapia is the common name for nearly a hundred species of cichlid fish from the tilapiine cichlid tribe (Rahman et al., 2002). Tilapia are mainly freshwater fish inhabiting shallow streams, ponds, rivers and lakes and less commonly found living in brackish water. Historically, they have been of major importance in artisan fishing in Africa and the Middle East, and they are of increasing importance in aquaculture and aquaponics. Tilapia can become problematic invasive species in new warm-water

habitats such as Australia, whether deliberately or accidentally introduced, but generally not in temperate climates due to their inability to survive in cold water. Tilapia ingest a wide variety of natural food organisms, including plankton, some aquatic macrophytes, planktonic and benthic aquatic invertebrates, larval fish, detritus and decomposing organic matter (Lim and Webster, 2006).

Urea (Blood urea nitrogen) test measures the amount of nitrogen in the blood that comes from the waste product urea. Urea is made when protein is broken down in the body. A blood urea nitrogen (BUN) test measures the amount of nitrogen in your blood that comes from the waste product urea. A BUN test is done to see how well the kidneys are working, if the kidneys are not able to remove urea from the blood normally, the BUN level raises.

Creatinine is a breakdown of creatinine phosphate in muscle, and is usually produced at a fairly constant rate by the body (depending on muscle mass). Serum creatinine (a blood measurement) is an important indicator of renal health because it is an easily measured byproduct of muscle metabolism that is excreted unchanged by the kidneys. Creatinine itself is produced via a biological system involving creatinine, phosphocreatine (also known as creatinine phosphate), and adenosine triphosphate (ATP, the body's immediate energy supply).

Creatinine is a waste product of muscle turnover. Creatinine also increases as kidney function decreases. Few influences outside the kidney affect creatinine concentration, so it is a better marker of kidney function than BUN. Urea and creatinine are nitrogenous end products of metabolism, taken together the BUN and creatinine levels provide a very accurate estimation of how well the kidneys are working. Both tests are related and are associated with the complete metabolic profile, CMP. Either test can be run on a blood sample or urine sample. Abnormal levels indicate a kidney or liver-related disease or condition.

Any elevation in levels of blood urea nitrogen and/or serum creatinine does not necessarily indicate structural renal disease. Conversely, blood urea nitrogen or serum creatinine values, which appear to be within the range of normal, do not by themselves rule out significant reduction in glomerular filtration rate. Any interpretation of the blood levels of these two substances must be done with the awareness that a variety of extra renal factors can affect them. The blood urea nitrogen to serum creatinine ratio can be a valuable tool in the determination or renal functional and structural integrity (Aitken et al., 2003). An increased ratio of BUN to creatinine may be due to conditions that cause a decrease in the flow of blood to the kidneys, such as congestive heart failure or dehydration. It may also be seen with high protein blood levels or from gastrointestinal bleeding (Adekunle, 2010). Abnormal levels indicate a kidney or liver related disease or condition. The study therefore aims to determine the metabolic waste of *Clarias gariepinus* and *Tilapia niloticus from* two commercial fish ponds in Gwagwalada.

MATERIALS AND METHODS

Study area

This study was carried out in the University of Abuja main campus premises, located along Km 23 Airport road. Its climate is marked by a dry season starting from November and running to March and a wet season from April to October. Its temperature ranges from 20°C to 36°C with rainfall between 1400 mm and 1600 mm.

Experimental fish

Thirty specie of *Clarias gariepinus* with varying sexes and lengths ranging from 10.0 to 58.0 cm and weights 98.2 to 900.2 g, and thirty specie of *Tilapia* with varying sexes and lengths of 6.82 to 15.0 cm with weights of 28.9 to 90.5 g.They were collected from two commercial ponds (Jeremiah Useini farm and Agricultural Development Project (ADP) farm) in Gwagwalada (Abuja). They were examined individually for diseases (Cipriano, 2001).

Method of sample collection

Fish were caught using a small hand net. After the preliminary investigation were taken, they were placed belly upwards and blood samples were taken from the caudal circulation with the aid of a heparinized 2 cm^3 disposable plastic syringes and a 21 gauge disposable hypodermic needle. The use of plastic syringe is a necessary precaution with fish blood because contact with glass results in decreased coagulation time. The puncture site was 3-4 cm from the genital opening and it was wiped dry with tissue paper to avoid mucus contamination. The needle was inserted perpendicularly to the vertebral column of the fish and gently aspirated during penetration. It was then pushed gently down until blood started to enter as the needle punctured a caudal blood vessel. Blood was taken under gentle aspiration until about 1cm^3 has been obtained, then the needle was withdrawn and the blood gently transferred into lithium heparin anticoagulant tube and allowed to clot at room temperature for 30-40 min.

Centrifugation of blood sample

The blood in the anticoagulant tubes were collected and then centrifuged at 4000R for 10 min followed by serum separation and was stored in a refrigerator until analysis.

Determination of urea

Urea was determined via Nesselerization method, described in Pratt, (1996) and Aitken *et al.* (2003). Three test-tubes labeled Blank (B), Standard (S), and Sample (T) were used according to the Centromic Gmbit kit manual

Table 1. Urea and creatinine concentrations for female *Clarias gariepinus.*

Weight (g)	Length (cm)	Urea (mg/dl)	Creatinine (mg/dl)
710.7	51.7	4.49	0.29
627.5	45.3	10.0	1.42
615.2	44.7	1.10	0.00
601.5	48.3	7.03	1.40
587.1	40.4	0.99	0.70
502.7	55.6	4.80	0.19
500.3	52.4	4.70	0.18
420.3	30.0	4.00	1.31
400.1	32.3	2.26	0.48
378.4	24.6	1.90	1.41
295.7	16.5	1.03	0.26
157.5	12.4	2.70	0.12
154.5	11.0	0.04	0.19
142.5	12.2	1.34	1.04

Table 2. Mean and variance of all the Parameters for female *C. gariepinus.*

Groups	Count	Sum	Average	Variance
S/N	14	105	7.5	17.5
Weight (g)	14	6094	435.28	36194.35
Length (cm)	14	477.4	34.10	268.47
Urea (mg/dl)	14	46.38	3.312	7.54
Creatinine (mg/dl)	14	8.99	0.642	0.306

Table 3. Urea and creatinine concentrations of male *Clarias gariepinus.*

Weight (g)	Length (cm)	Urea (mg/dl)	Creatinine (mg/dl)
900.2	58.0	0.96	1.49
807.8	50.3	10.1	1.53
775.0	53.0	5.05	1.35
720.3	53.0	4.59	0.39
650.8	53.6	2.08	1.33
513.0	33.0	4.21	0.45
434.0	34.4	0.91	0.73
415.2	25.1	2.05	0.95
406.3	27.5	3.76	0.20
378.5	29.7	1.98	1.41
302.2	17.3	1.04	0.35
285.0	18.2	0.20	0.30
254.4	15.2	2.23	0.14
180.6	11.4	0.46	1.30
100.8	10.0	0.84	0.30
98.2	10.1	1.21	1.03

(Urea-indicator fluid, German), 1 mL of working reagent was transferred to B, S, and T. Exactly 10 uL of distilled water was added in each tube and incubated for 10 min at room temperature. The absorbance values of the sample and standard were read against the reagent blank. Plasma urea was expressed in mg dL-1 and measured at a wavelength of 340 nm.

Determination of creatinine

Creatinine was determined by Jaffe spectrophotometric method described in Pratt, (1996) and Aitken, *et al.,* (2003). The working reagent, samples and standard were prepared at room temperature. Two test-tubes labeled S for standard and T for sample, and 1 ml of the working reagent was into both followed by the introduction of 100 uL of standard into S and 100 uL sample into T. The content of each tube was gently mixed, distilled water was used to zero the automatic chemical analyzer and the absorbance values of the standard and sample were recorded at 500 nm after 30 and 90 seconds. All the reagents are used as directed by the manufacturer's manual using Sodium (1+1) fluid (Centromic Gmbit, German). Distilled water was used for blank test; serum creatinine was expressed in mg dL-1 and measured at a wavelength of 340 nm.

Statistical analysis

The obtained data were subjected to statistical analysis using one-way analysis of variance (ANOVA) to test for level of significance between urea and Creatinine of the three fish species. The descriptive statistics mean and standard deviation were also analyzed. All analyses were performed using the SPSS (Statistical Package for Social Sciences) software program.

RESULTS

Table 1 shows that maximum weight recorded is 710.7 g, while the minimum weight recorded is 142.5g. The maximum length recorded is 55.6 cm, and the minimum is 10.0 cm. The maximum level of urea recorded is 10.0 mg/dl while the minimum level recorded is 0.04 mg/dl. The highest level of creatinine recorded is 1.42 mg/dl while the minimum level recorded is 0.00 mg/dl. From the (Table 2), the mean weight is 435.28; mean length is 34.1, mean Urea is 3.312 and mean Creatinine is 0.642 (Figures 1 and 2). Appendix (Table 1) shows that there is a significant difference between the Length and Weight, Urea, Creatinine for female Clarias *gariepinus.* Therefore, we reject H_O of no significant difference.

From the Table 3, maximum weight recorded is 900.2 g, while the minimum weight recorded is 98.2 g. The maximum length recorded is 58.ocm, and the minimum is

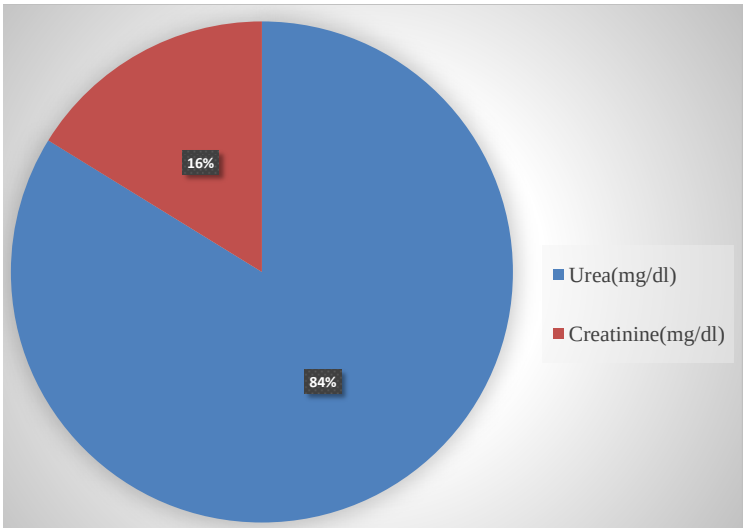

Figure 1. A chart showing the concentrations in mg/dl of Urea and Creatinine for Female *Clarias gariepinus.*

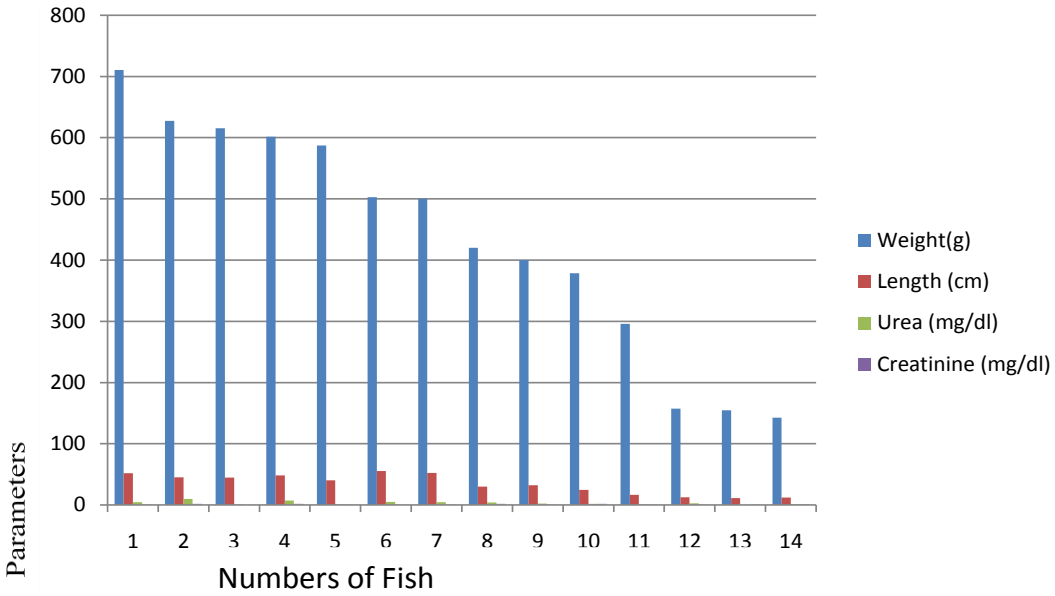

Figure 2. A chart showing Urea and Creatinine concentrations of female *Clarias gariepinus.*

10.0 cm. The maximum level of urea recorded is 10.4mg/dl while the minimum level recorded is 0.20 mg/dl. The highest level of creatinine recorded is 1.53 mg/dl while the minimum level recorded is 0.14 mg/dl (Figures 3 and 4). From the (Table 4), the mean weight is 57.47, mean length is 11.21, mean of urea is 5.56 and mean of creatinine is 0.81. Appendix (Table 2) shows that there is a significant difference between the Weight and Length, Urea and Creatinine of Clarias *gariepinus* (Male). Therefore, we reject H_O of no significant difference.

From the (Table 5), maximum weight recorded is 86.9 g, while the minimum weight recorded is 28.9 g. The maximum length recorded is 15.0 cm, and the minimum is 6.82 cm. The maximum level of urea recorded is 10.51mg/dl while the minimum level recorded is 0.21 mg/dl. The highest level of creatinine recorded is 1.43 mg/dl while the minimum level recorded is 0.02 mg/dl (Figures 5 and 6**)**. From (Table 6), the mean weight is 57.47, mean length is 11.21, mean of urea is 5.56 and mean of creatinine is 0.81. Appendix (Table 3) shows that here is a significant difference between the Weight and Length, Urea and Creatinine, of *Tilapia niloticus* (Male).

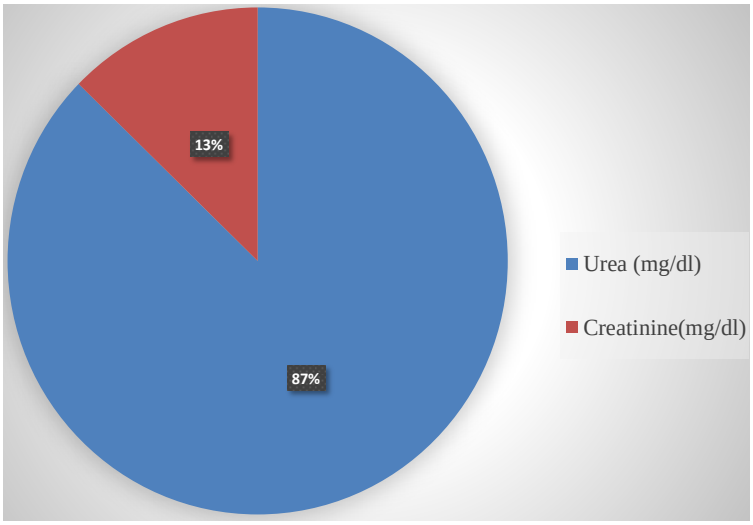

Figure 3. A chart showing the concentration in mg/dl of urea and creatinine for male *Clarias gariepinu.*

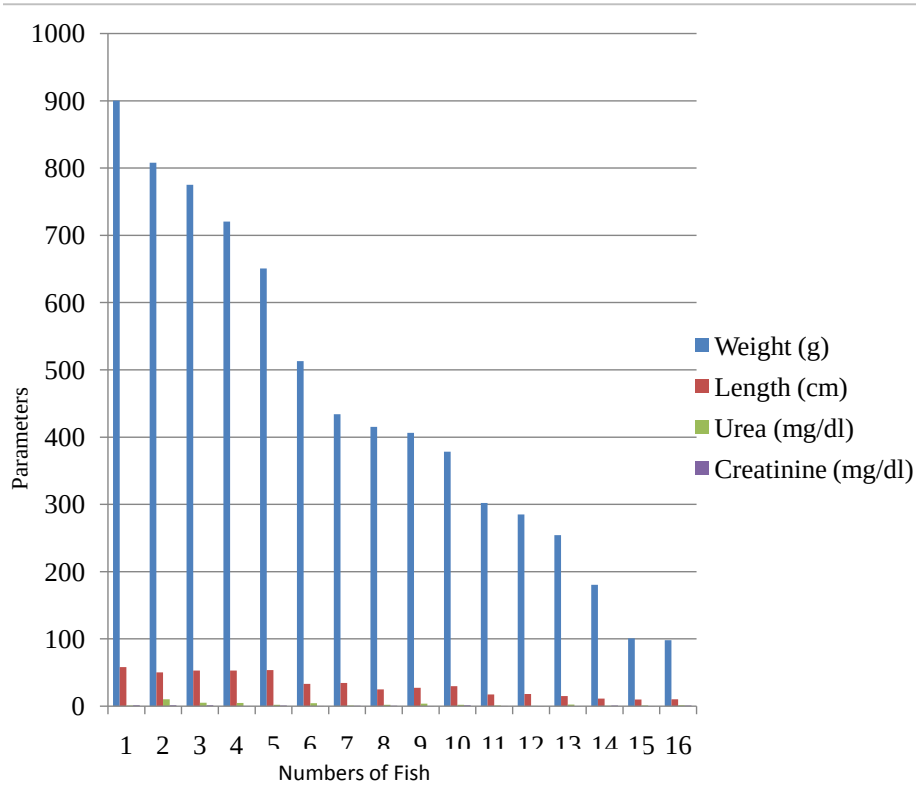

Figure 4. Shows the physical parameters, Urea and Creatinine concentrations for male *Clarias gariepinus.*

Therefore, we reject H_0 of no significant difference.

From (Table 7), maximum weight recorded is 90.5 g, while the minimum weight recorded is 37.8 g. The maximum length recorded is 15.0 cm, and the minimum is 9.00 cm. The maximum level of urea recorded is 11.40 mg/dl while the minimum level recorded is 0.25 mg/dl. From the (Table 8), the mean weight is 55.75, mean length is 11.25, mean of urea is 6.04 and mean of creatinine is

Table 4. calculation for mean and variance of male *C. gariepinus*

Groups	Count	Sum	Average	Variance
Weight (g)	14	804.7	57.47	295.38
Length (cm)	14	157	11.21	4.06
Urea (mg/dl)	14	77.95	5.56	12.46
Creatinine (mg/dl)	14	11.35	0.81	0.26

Table 5. Urea and Creatinine Concentrations of Male *Tilapia niloticus*

Weight (g)	Length (cm)	Urea (mg/dl)	Creatinine (mg/dl)
86.9	15.0	8.54	0.65
84.2	14.8	7.51	1.33
76.4	13.2	9.03	1.25
70.3	11.6	10.51	0.95
61.0	12.0	8.05	1.37
60.2	10.5	0.47	0.02
57.3	10.6	4.31	0.23
54.3	11.3	4.32	1.21
52.3	11.3	3.65	0.40
48.5	10.2	7.51	1.10
44.2	9.8	0.21	0.10
43.7	8.9	9.03	1.01
34.5	8.20	0.22	0.30
30.9	9.60	4.59	1.43
28.9	6.82	0.33	1.01

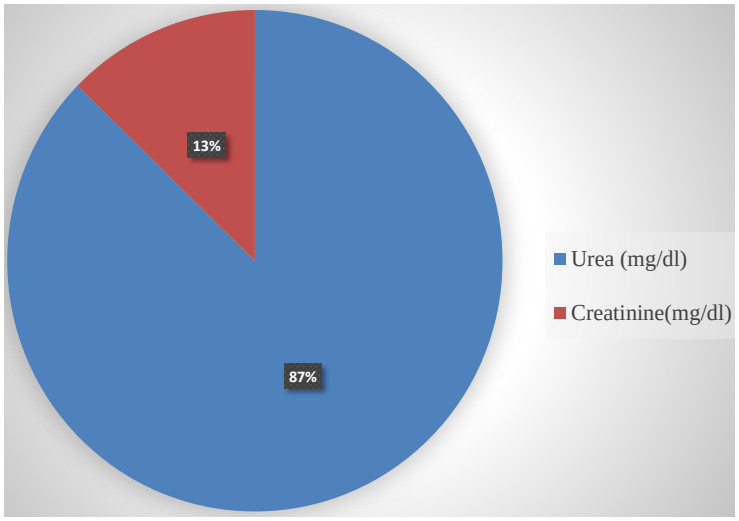

Figure 5. A chart showing the concentration in mg/dl of Urea and Creatinine in male *Tilapia niloticus.*

0.84. The highest level of creatinine recorded is 1.30 mg/dl while the minimum level recorded is 0.08 mg/dl (Figures 7 and 8). In Appendix (Table 4), there is a significant difference between the Weight and Length, Urea and Creatinine of *Tilapia niloticus* (Female). Therefore, the H_O of no significant difference was rejected.

DISCUSSION

Blood biochemical values are not commonly used as a diagnostic tool in fish medicine. This is due to lack of reference intervals for various fish species, as well as changes in blood analysis associated with specific

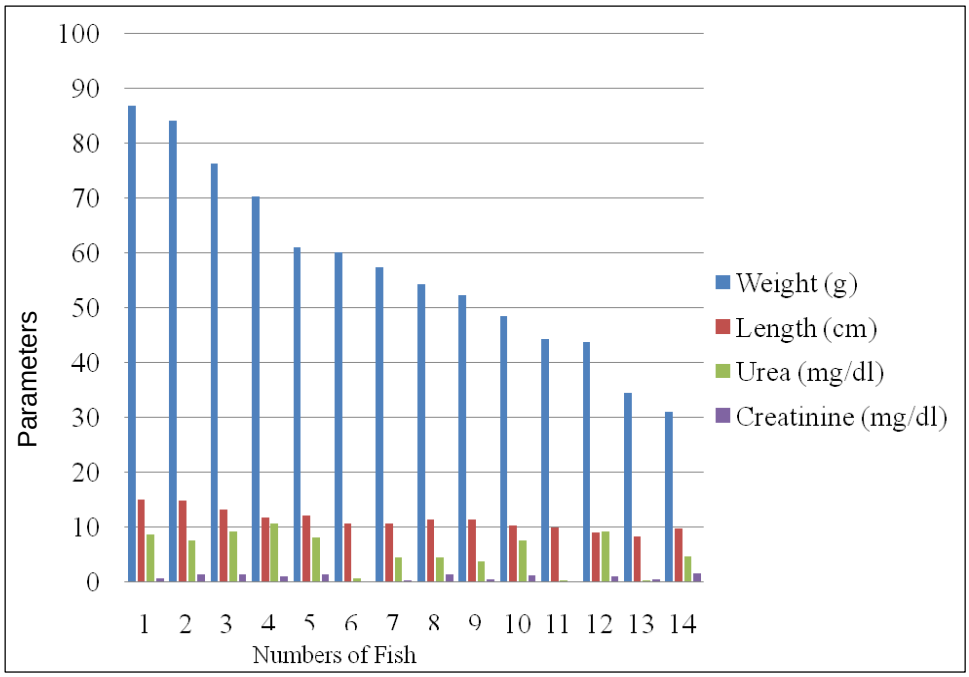

Figure 6. Physical parameters, urea and creatinine concentrations of Male *Tilapia niloticus.*

Table 6. calculation for mean and variance of Male *T. niloticus.*

Groups	Count	Sum	Average	Variance
S/N	**14**	**105**	**7.5**	**17.5**
Weight (g)	14	804.7	57.4785	295.388
Length (cm)	14	157	11.2142	4.06747
Urea (mg/dl)	14	77.95	5.56785	12.4618
Creatinine (mg/dl)	14	11.35	0.81071	0.26031

Table 7. Urea and Creatinine Concentrations of Female *Tilapia niloticus.*

Weight (g)	Length (cm)	Urea (mg/dl)	Creatinine (mg/dl)
90.5	12.8	8.61	1.30
73.4	13.5	8.32	0.91
72.0	12.9	11.40	0.92
65.6	10.9	11.21	0.75
60.3	11.1	0.25	1.00
54.5	11.8	7.60	1.20
50.4	10.9	7.80	1.00
49.6	9.10	5.70	0.68
48.8	10.2	0.51	0.08
48.5	10.0	4.30	0.90
45.0	11.2	3.59	0.89
43.3	15.0	0.79	0.73
39.8	9.00	7.01	0.75
38.9	9.20	7.51	0.73
37.8	9.00	4.56	1.21

diseases and metabolic disorders that are not well characterized.

Creatinine levels observed in this work agrees with the value reported by (Adekunle, 2010). The level of Urea observed in *Clarias gariepinus* and *Tilapia niloticus* was two times higher than those reported by (Agbede et

Table 8. Shows calculation for mean and variance of female *T. niloticus.*

Groups	Count	Sum	Average	Variance
S/N	14	105	7.5	17.5
Weight (g)	14	780.6	55.75	221.43
Length (cm)	14	157.6	11.25	3.182
Urea (mg/dl)	14	84.6	6.04	13.59
Creatinine (mg/dl)	14	11.84	0.84	0.080

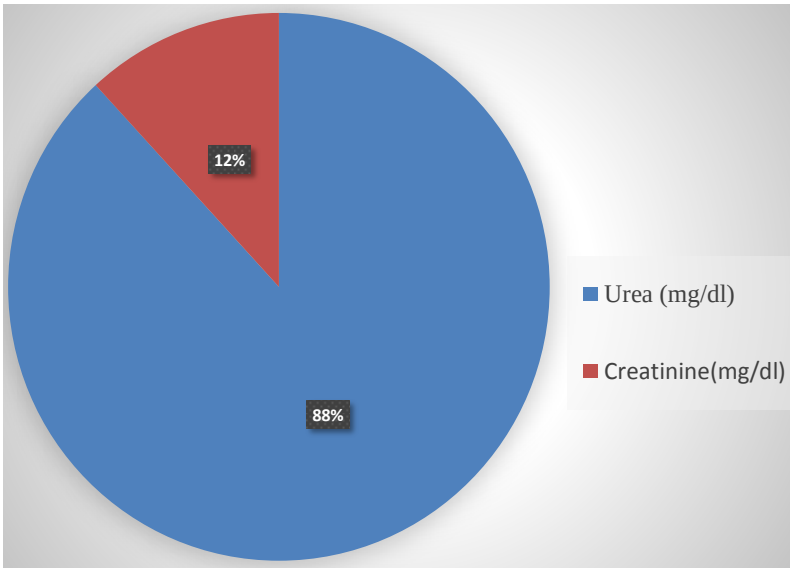

Figure 7. A pie chart showing the concentration in mg/dl of Urea and Creatinine in female *Tilapia niloticus.*

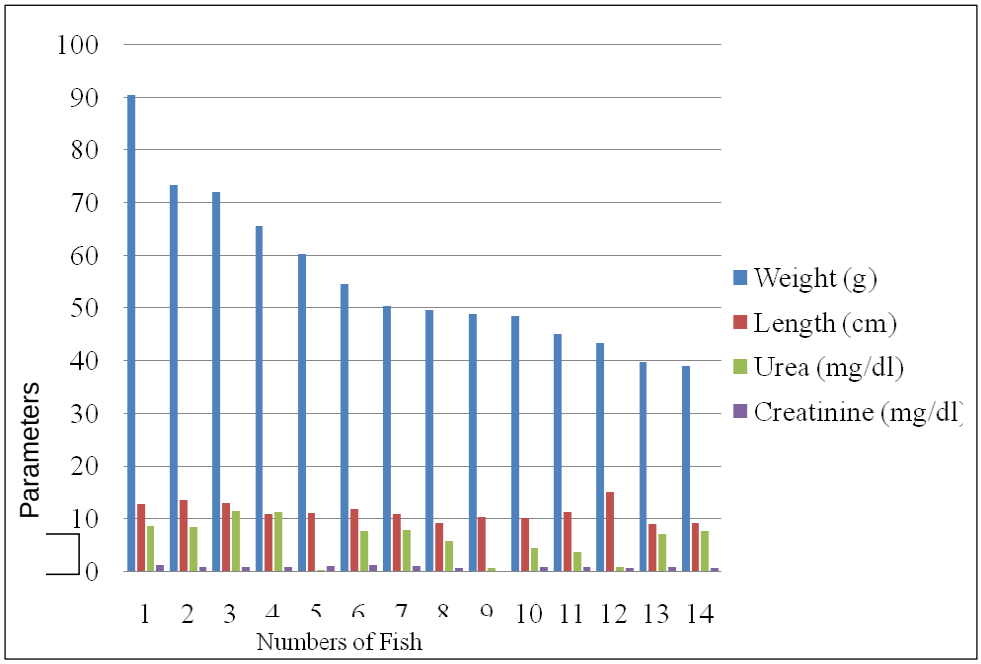

Figure 8. A bar chart showing the physical parameters, urea and creatinine concentrations of Female *Tilapia niloticus.*

al., 1999; Ogamba et al., 2010).

Creatinine values observed in this work is slightly higher than the values reported by (Das and Mukherjee, 2000). There was an increase in Urea levels for both species and a slight increase in creatinine level for female *C. gariepinus* compared to ma*le C. gariepinus.* Creatinine levels are the most commonly ordered tests to show the kidney's ability to excrete metabolic wastes (Tresseles, 1988). The result of this study showed significant increase in the levels of Urea than creatinine for both fish species. Urea level raised out of proportion to creatinine may indicate a pre-renal problem such as volume depletion (Spencer, 1986), (National Kidney Foundation, 2012). Urea levels can also be raised due to consumption of rich protein diet.

The mean Urea and Creatinine levels of *Clarias* and *Tilapia* obtained in this study is not in conformity with that of other workers. The differences may be due to difference in climatic and environmental factors in the places from where the species were obtained as suggested by (Barnhart, 1969). Creatinine level greater than 1.5mgdl or lower than 0.8mgdl is considered high or low meaning it's abnormal, while Urea level less than 7.1mgdl or higher than 20 mgdl is abnormal. Abnormal creatinine levels may be due to any of the following conditions that affect the kidneys or muscle, while abnormal urea level may indicate congestive heart failure, gastrointestinal bleeding, kidney failure or disease also diet that contains much of protein (Anoop and Sander, 2002).

Conclusion

This study has provided valuable data on urea and creatinine values for *Clarias gariepinus* and *Tilapia niloticus* obtained from two commercial ponds (Jeremiah Useni farm and Agricultural Development Project (ADP) farm in Gwagwalada. These values can be used for future studies and also for monitoring the health status of fishes. The high values of urea observed in both species could be majorly as a result of their water been polluted with urea which they excrete and others such as kidney failure, gastrointestinal bleeding and high protein diet.

REFERENCES

Acton, M. N., Melissa, A. S. (1999). Fish production and culturing. *Am. J. Fish Bio*., Pp.123-130.

Adekunle, I. M. (2010). Potential Nephrotoxity in African Mud Catfish following Exposure to Compost Derived Humic Acid. *Pak. J. Bio. Sci*. ,13(17), 835-840.

Agbede, S. A., Ogunsanmim, A. O., Taiwo, V. O., & Ogundipe T. I. (1999). Toxic effects of poultry faeces on Clarias gariepinus broodstock. *Tropical Veterinarian*, 17, 181.

Agbon, A. O., Ofojekwu P.C., Ezenwaka I. S., & Alegbeleye, W. O. (2002). Acute toxicity of Diazinon on rotifers, Cyclops, mosquito Larvac and fish *Journal of applied sciences and environmental Management,* 6(1), 18 -21.

Aitken, M. M, Hall, E., Allen, W. M., Scott, L., & Devot J. L, (2003). Liver- related biochemical changes in the serum of dogs being treated with phenobarbitone. Vet. Record, 153: 13-16

Anoop, J. R., & Sander, J. T. (2002) Broad description of the Clariidae family. *Journal of Fish Biology*.

Barnhart, R. A. (1969). Effects of certain variables on haematological characteristics of rainbow trout, *Salmo gairdneri* (Richardson). Trans Am. Fish Society. p. 98.

Cipriano, R. C. (2001). "Furunculosis and other Diseases. Fish Disease Leaflet 66. US Department of Interior.

Daaniels, V. G., Wheater, P. R., & Burkitt, H. G. (2012). Functional Histology*. Jour Nal of Fisheries.* Pp.70-78.

Das, B. K., & Mukherjee S. C., (2000). Sublethal effects of Quinalphos on selected blood parameters of *Labeo rohita* (Ham) fingerlings. *Asian Fish*. Sci., 13, 225-233.

Davis, M. E., & Beandt, W. O. (1994). Renal methods for toxicology, in Hayes, Aw (ed), principles and methods of toxicology, 3rd ed. New Yark Raven, Pp. 871= 894.

Fagbenro, O. A., Adedire, C. O., Owoseeni, E. A., & Ayotunde, E. O. (1993). Studies on the biology and aqualture potential of feral catfish, *Heterobranchus bidorsalis* (Geofferoy st. Hilaire, 1809) clarridae.Tropical Zoology, 6, 77- 79.

Lim, C., & Webster C. D., (2006). Tilapia*: Boilogy, Culture, and Nutrition Routledge*. p. 462.

Morgan D.B, Carver M.E, & Payne R.B. (1977). Plasma Creatinine and Urea Ratio In Patients with Raised Urea. *Br Med J.,* 2(6092):929-32.

National Kidney Foundation, (2002); Clinical practice guidelines for chronic kidney disease:Evaluation, classification and stratification. *Am J. Kidney Dis.*, 39, 1-266.

Ogamba, E. N., Daka, E. R., & Inyang, I. R., (2010); Changes in electrolyte activities of *Clarias gariepinus* exposed to diazinon. *Bio. Environ. Sc. J. Trop*., 7, 198- 200.

Pratt, P. W. (1996). Laboratory Procedures for Veterinary Techniques. 3rd Edn, Mosby, Philadelphia, Pp. 98-99.

Rahman, K. O., Victor, I. C., & Sander, D. G. (2002). Status of the world aquaculture. *Aquaculture Magazine Buyer's Guide.* Pp. 6-27.

Spencer, K. (1986). Analytical reviews in clinical biochemistry: The estimation of creatinine Ann. Clin. Biochem, 23, 1-25.

Tresseles, K. M. (1988). *Clinical Laboratory and diagnostic tests*. 2nd Ed. Prentice Hall Inc.Englewood Cliffs, NY.

APPENDIX

Appendix Table 1. Analysis of Variance (one-way ANOVA) showing the significant difference between the Length and Weight, Urea, Creatinine for female Clarias *gariepinus.*

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2022476	4	505618.9	69.28	9.8	2.51
Within Groups	474346.4	65	7297.63			
Total	2496822	69				

Appendix Table 2. Analysis of Variance (One of ANOVA) showing the significant difference between the Weight and Length, Urea and Creatinine of Clarias *gariepinus* (Male).

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	30153.85	4	7538.46	114.33	1.10	2.51
Within Groups	4285.80	65	65.93			
Total	34439.66	69				

Appendix Table 3. Analysis of Variance (One-way ANOVA) showing the significant difference between the Weight and Length, Urea and Creatinine, of *Tilapia niloticus* (Male).

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	30153.8	4	7538.46	114.33	1.14	2.51
Within Groups	4285.80	65	65.93			
Total	34439.6	69				

Appendix Table 4. Analysis of Variance (one-way ANOVA) showing the significant difference between the Weight and Length, Urea and Creatinine of *Tilapia niloticus* (Female).

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	28052.9	4	7013.22	137.08	6.26	2.51
Within Groups	3325.269	65	51.157			
Total	31378.17	69				