

2023-06-22

Occurrence and correlates of azotaemia in dogs presented for veterinary care in a tertiary veterinary hospital in Nigeria

N. T. Emejue

University of Nigeria, tochi.emejue@unn.edu.ng

J. N. Omeke

University of Nigeria, tochi.emejue@unn.edu.ng

J. I. Ihedioha

University of Nigeria, tochi.emejue@unn.edu.ng

S. V. O. Shoyinka

University of Nigeria, tochi.emejue@unn.edu.ng

Follow this and additional works at: <https://ciencia.lasalle.edu.co/mv>



Part of the [Agriculture Commons](#), [Animal Sciences Commons](#), and the [Veterinary Medicine Commons](#)

Citación recomendada

Emejue NT, Omeke JN, Ihedioha JI y Shoyinka SV. Occurrence and correlates of azotaemia in dogs presented for veterinary care in a tertiary veterinary hospital in Nigeria. *Rev Med Vet.* 2023;(47):. doi: <https://doi.org/10.19052/mv.vol1.iss47.13>

This Artículo de investigación is brought to you for free and open access by the Revistas científicas at Ciencia Unisalle. It has been accepted for inclusion in Revista de Medicina Veterinaria by an authorized editor of Ciencia Unisalle. For more information, please contact ciencia@lasalle.edu.co.

Occurrence and Correlates of Azotaemia in Dogs Presented for Veterinary Care in a Tertiary Veterinary Hospital in Nigeria*


Nnenna Tochi Emejuo¹, Jacinta Ngozi Omeke, John Ikechukwu Iheodiodia
y Shodeinde Vincent Olu Shoyinka

Abstract

This study evaluated the occurrence of azotemia and the relationship between azotemia, breed, sex, and age in dogs brought for veterinary treatment at a tertiary veterinary hospital in Eastern Nigeria. A total of 304 dogs of varied breeds and ages comprising males and females were evaluated in this study. Renal dysfunction was assessed by evaluation of serum creatinine levels using the International Renal Interest Society criterion for diagnosis of renal dysfunction, a cut-off serum creatinine value of ≥ 1.4 mg/dl was used to classify the dogs as positive for azotemia or not. Results of the study showed that 34 (11.2%) dogs in the sample had azotemia. There were significant variations ($p < 0.05$) in the occurrence of azotemia among breeds, with Caucasians having the highest occurrence (5.9%), followed by Mastiffs (2.6%), Mongrels (2.0%), and Alsatians (0.7%). The occurrence of azotemia was significantly higher ($p < 0.05$) in females than in males. There was significant variation ($p < 0.05$) in the occurrence of azotemia among the different age groups, with young dogs having a higher occurrence than puppies and adults.

Keywords: Azotemia; age; sex; breeds.

* Artículo de investigación

¹ Corresponding author: tochi.emejuo@unn.edu.ng +2348132523813 (Department of Veterinary Pathology and Microbiology, Faculty of Veterinary Medicine, University of Nigeria, Nsukka).
Department of Veterinary Pathology and Microbiology, Faculty of Veterinary Medicine, University of Nigeria, Nsukka
 <https://orcid.org/0000-0002-61324034>

Cómo citar este artículo: Tochi EN, Omeke JN, Iheodiodia JI, Shoyinka SVO. Occurrence and correlates of azotaemia in dogs presented for veterinary care in a Tertiary Veterinary Hospital in Nigeria. Rev Med Vet. 2023;(47): e0009. Disponible en: <http://doi.org/10.19052/mv.vol1.iss47.13>

Ocurrencia y correlaciones de la azotemia en perros presentados para atención veterinaria en un hospital veterinario de tercer nivel en Nigeria

Resumen

Este estudio evaluó la ocurrencia de azotemia y la relación entre azotemia, raza, sexo y edad en perros que llevados para tratamiento veterinario a un hospital veterinario de tercer nivel en Nigeria del este. Un total de 304 perros de diversas razas y edades, machos y hembras, fueron evaluados en este estudio. La disfunción renal se determinó evaluando los niveles de creatinina sérica, usando los criterios de la Sociedad Internacional de Interés Renal para el diagnóstico de disfunción renal, se usó un valor de creatinina sérica de corte ≥ 1.4 mg/dl para clasificar a los perros como positivos para azotemia o no. Los resultados mostraron que 34 (11.2%) perros de la muestra tenían azotemia. Se

encontraron variaciones significativas ($p < 0.05$) en la ocurrencia de azotemia entre razas, los perros caucásicos tuvieron la mayor ocurrencia (5.9%), seguidos del mastín (2.6%), mongrel (2.0%) y alsaciano (0.7%). La ocurrencia de azotemia fue significativamente mayor ($p < 0.05$) en hembras que en machos. Se encontró una variación significativa ($p < 0.05$) en la ocurrencia de azotemia entre los grupos de edad, los perros jóvenes tienen una mayor ocurrencia que los cachorros y los adultos.

Palabras clave: Azotemia; edad; sexo; razas.

INTRODUCTION

Azotemia is an increase in the concentration of non-protein nitrogenous compounds like creatinine and urea in the blood (1). It affects humans and animals including dogs. Serum creatinine and urea are widely used to screen for azotemia and are used to determine the glomerular filtration rate (GFR), with serum creatinine and urea increasing as GFR decreases (2). The impaired ability of the kidney to excrete waste products of protein catabolism, particularly creatinine and urea results in the intravascular increase of nitrogenous waste products which leads to azotemia (3, 4). Azotemia occurs when 75% or more of the nephrons are non-functional (5). It may have a pre-renal, renal, or post-renal origin (6). Pre-renal azotemia occurs when decreased renal perfusion results in a diminished glomerular filtration rate. Common causes of pre-renal azotemia include volume depletion, vascular collapse, thrombotic disease, and shock. Renal azotemia occurs when nephrons are directly damaged by toxins or infectious, inflammatory, ischemic or neoplastic processes. Post-renal azotemia is caused by urinary tract obstruction of any process distal to the renal tubules, which interferes with the collection, containment or excretion of urine (7, 8).

The prevalence of kidney disease in humans in the United States of America (USA) is 7.2% in people aged 30 and older; in the population of 64 years and older, the prevalence is about 23.4-35.8% (9). The prevalence of kidney disease in humans in Nigeria is 11.4% (10) while in Africa it ranges from 2 to 41% (11). The prevalence of kidney disease in cats in the US is estimated at 7.6% with a higher prevalence in older cats (12) while in dogs, the reports say it is at 5.8% of caseload (13). The total incidence rate of kidney disease in a population of 10,000 dogs was estimated at 15.8%, while the mortality rate was 9.7% in Sweden (14). In a clinical study conducted by (15) in Hyderabad, India, involving a population of 237 dogs, 33.33% had various renal disorders associated with several causes. Some risk factors for kidney disease in dogs include age, breed, body size, and periodontal disease (16, 17). There is

no report in the available literature on the occurrence of azotemia in apparently healthy dogs in this locality.

The study aimed to evaluate the occurrence of azotemia in dogs and determine the relationship of variables such as breed, sex, and age in dogs positive for azotemia. The dogs screened were apparently healthy, those diagnosed with renal disorders were grouped considering breed, sex, and age to estimate the effect of these parameters on the occurrence of renal dysfunction.

MATERIALS AND METHODS

This study was conducted at the Veterinary Teaching Hospital (VTH), University of Nigeria, Nsukka. The VTH dispenses clinical services to pet owners and farmers within Enugu State and handles referrals from clinics and communities in the neighboring states of Kogi, Benue, and Anambra.

This research was a cross-sectional survey of apparently healthy dogs that were physically examined and screened for renal dysfunction, comprising both genders, four age groups, and five breeds. A total of 304 dogs were evaluated in the study with the informed consent of the owners. For each dog included in the study, basic bio-data on age, sex, breed and health status were collected and documented. 2ml of blood was collected from each dog from the cephalic vein and dispensed into plain test tubes and allowed 30 minutes to clot. The serum was separated from the clot by centrifugation at 3000 revolutions per minute for 10 minutes and the harvested sera was used for determining the serum's biochemistry parameters.

The determination of the serum creatinine was based on the modified Jaffe method (18, 19).

Dogs were considered positive for azotemia if they had a serum creatinine value of ≥ 1.4 mg/dl, based on the International Renal Interest Society classification (20). Data on the serum creatinine level was subjected to descriptive statistics and occurrence was presented

as percentages. Age, breed, and sex variations in occurrences were subjected to Fisher's exact test.

RESULTS

Out of the 304 dogs sampled, 34 (11.2%) had serum creatinine levels at or above 1.4 mg/dl, while 270 (88.8%) had serum creatinine levels below 1.4g/dl. Out of the 34 dogs positive for azotemia, 18 (5.9%) were Caucasians, 6 (2.0%) were Mongrels, 8 (2.6%) were Mastiffs, and 2(0.7%) were Alsatians (Table 1). There was significant variation ($p < 0.05$) in the occurrence of renal dysfunction among breeds (Table 1). Twenty-four out of the 34 dogs positive for azotemia (7.9%) were

females while 10 (3.3%) were males. The occurrence of renal dysfunction was significantly higher ($p < 0.05$) in females than in males (Table 2). When categorized based on age, 10 out of the 34 dogs positive for azotemia (3.3%) were puppies, 22 (7.2%) were young dogs, and 2 (0.7%) were seniors. The occurrence of azotemia was significantly ($p < 0.05$) higher in young dogs than in all other age groups (Table 3).

DISCUSSION

The 11.2% occurrence of kidney dysfunction in dogs in this study concurs with reports of previous studies that showed one in ten dogs is likely to develop kidney

Table 1. Breed Distribution of Dogs Positive for Azotemia in the Sample Population

S/No.	Breeds	No. of Dogs with Serum Creatinine < 1.4 mg/dl	No. of Dogs with Serum Creatinine \geq 1.4 mg/dl	Total	% of each Dog Breed with Serum Creatinine \geq 1.4 mg/dl
1	Caucasian	80	18	98	5.9%
2	Mongrel	74	6	80	2.0%
3	Mastiff	58	8	66	2.6%
4	Alsatian	50	2	52	0.7%
5	Rottweiler	8	0	8	0%
		270	34	304	11.2%

Table 2. Sex Distribution of Dogs Positive for Azotmia in the Sample Population

S/No.	Sex	No. of Dogs with Serum Creatinine < 1.4 mg/dl	No. of Dogs with Serum Creatinine \geq 1.4 mg/dl	Total	% of each Dog Breed with Serum Creatinine \geq 1.4 mg/dl
1	Females	144	24	168	7.9%
2	Males	126	10	136	3.3%
		270	34	304	11.2%

Table 3. Age Distribution of Dogs Positive for Azotemia in the Sample Population

S/No.	Breeds	No. of Dogs with Serum Creatinine < 1.4 mg/dl	No. of Dogs with Serum Creatinine \geq 1.4 mg/dl	Total	% of each Dog Breed with Serum Creatinine \geq 1.4 mg/dl
1	Puppy (< 1 yr.)	80	18	98	5.9%
2	Young (1 – 3 yrs.)	74	6	80	2.0%
3	Adults (4 – 8 yrs.)	58	8	66	2.6%
4	Seniors (> 8 yrs.)	50	2	52	0.7%
		270	34	304	11.2%

disease (21) and is close to but lower than the 15.3-16.2% reported by Pelander et al. in Swedish dogs (22). Some other researchers had found and reported a lower prevalence (as low as 0.05-3.74%) of chronic kidney disease, specifically, in dogs in the United Kingdom (21, 16). A relatively recent study of the occurrence of renal lesions in dog carcasses presented for necropsy in western Nigeria showed that 15-33.3% of necropsied dogs had lesions of renal failure (23).

The occurrence of renal dysfunction was highest in the Caucasian breed of dogs with 5.9% occurrence followed by Mastiffs (2.6%) and Mongrels (2.0%). Earlier studies by Ahmed (24) reported a higher prevalence in Labradors followed by German Shepherds, while a study by Pelander (22) reported the highest prevalence of renal dysfunction in Burmese mountain dogs. It should be noted that higher occurrence and prevalence tend to follow dog breed size categories —the Caucasians recorded with the highest prevalence in this present study, the Burmese mountain dogs reported by Pelander et al. (22) and the Labradors and German Shepherds reported by Ahmed (24) are all large dog breeds. The findings in this present study and literature reports show the highest occurrence of renal dysfunction in large dog breeds in contrast with breed disposition of a disease such as diabetes mellitus in dogs, which is highest in smaller dog breeds (25). Moreover, earlier studies by Lund et al. (26) and Sosnar et al. (27) showed the reported prevalence of canine renal dysfunction regarding breed varies depending on the population studied.

In this study, the age-specific prevalence of renal dysfunction was highest in young dogs (7.2% prevalence), which may be associated with familial renal diseases that generally result in renal dysfunction before 5 years of age (1), although Nabi et al (28) reported a higher prevalence of renal dysfunction in dogs as they age possibly due to the decrease in blood flow to the kidneys, loss of nephrons (29) and decrease in reabsorption processes of the nephrons (30). Additionally, the findings show females have a significantly higher occurrence of azotemia than males, which is concurring with earlier reports that showed that females (dogs,

cats, and humans) are more prone to urinary tract infections that may result in renal dysfunction (31, 32, 33). A significant association between female urinary tract infections with chronic kidney disease has been reported (34, 35, 36). Bjorling recorded a higher prevalence in males, which they attributed to a more frequent occurrence of urolithiasis in males (37).

CONCLUSION

This research determined the occurrence of azotemia in apparently healthy dogs in this locality. It was concluded that the occurrence of azotemia in the study population was 11.2% and that azotemia occurred more in the Caucasian dog breed, females, and young dogs.

ACKNOWLEDGMENT

This project was done under the supervision of Prof S.V.O Shoyinka and Prof J.I Ihedioha. Ethical approval for animal use was gotten from the University of Nigeria, Nsukka, Faculty of Veterinary Medicine, institutional animal care use committee with approval reference number FVM-UNN-IACUC-2020-0265.

REFERENCES

1. Chew DJ, DiBartola SP, Schenck PA. Familial renal disease in dogs and cats. 6th ed. Oxford: Elsevier Saunder. 2005. 1819-24.
2. Humphris D, Reyers F, Lobetti RG, Descally MP. Are urea and creatinine values reliable indicators of azotaemia in canine babesiosis. *J S Afr Vet Assoc.* 2004;75(3):121-4. <https://doi.org/10.4102/jsava.v75i3.466>
3. Ihedioha JI, Chineme CN. Fundamentals of Systemic Veterinary Pathology Vol. 1 Great AP Express Publishers Limiter, Nigeria; 2004. Part 4, Hematopoietic system; p.107-60.
4. Newman SJ, Confer AW, Pancier RJ. Urinary System. In: MacGavin, M. D., & Zachary, J. F. U, editors.

- Pathologic Basis of Veterinary Diseases. Mossly: Elsevier Inc; 2007; p. 613-50.
5. Polushin YuS, Sokolov DV. Kidney dysfunction in critically ill patients. *Messenger Anesthesiol Resusc.* 2018;15(5):54-64. <https://doi.org/10.21292/2078-5658-2018-15-5-54-64>
 6. Mazzaferro EM, Ford RB. Kirk and Bistner's handbook of veterinary procedures and emergency treatment. 9th Ed. Elsevier; 2012. <https://doi.org/10.1016/C2009-0-59980-1>
 7. Braun JP, Lefebvre HP, Watson AD. Creatinine in dogs. A review. *Vet Clin Pathol.* 2003;193(4):457-64. <https://doi.org/10.1111/j.1939-165X.2003.tb00332.x>
 8. Fischer JR, Lane IF, Stokes J. Acute post renal Azotemia: Etiology, clinicopathology and Pathophysiology. *Compend Contin Educ Vet.* 2009;31(11):520-4.
 9. Zhang Q, Rothenbacher D. Prevalence of chronic kidney disease in population – based studies: Systematic review. *BMC Public health.* 2008;8(1):117. <https://doi.org/10.1186/1471-2458-8-117>
 10. Chukwuonye I I, Ogah OS, Anyabolu EN, Ohagwu KA, Nwabuko OC, Onwuchekwa U, et al. Prevalence of chronic kidney disease in Nigeria: Systematic review of population- based studies. *Int J Nephrolog Renovasc Dis.* 2018;(11):165-72. <https://doi.org/10.2147/IJNRD.S162230>
 11. Elhafeez SA, Boligano D, D'Arrigo G, Dounousi E, Tripepi G, Zoccali, C. Prevalence and burden of chronic kidney disease among the general population and high- risk groups in Africa. A systematic Review. *BMJ Open.* 2017;8(1):e015068. <https://doi.org/10.1136/bmjopen-2016-015069>
 12. Ross SJ, Osborne CA, Kirk CA, Lowry SR, Koehler LA, Polzin, DJ. Clinical Evaluation of Dietary Modification for Treatment of Spontaneous Chronic Kidney Disease in Cats; *J Am Vet Med Assoc.* 2006;229(6):949-57. <https://doi.org/10.2460/javma.229.6.949>
 13. Bartlett PC, Van Buren JW, Bartlett AD, Zhou C. Case-control study of risk factor associated with feline and canine chronic kidney disease. *Vet Med Internation.* 2010;957570. <https://doi.org/10.4061/2010/957570>
 14. Pelander L, Ljunguall L, Egenvall A, Syme H, Elliot J, Häggström J. Incidence of and mortality from kidney disease in over 600000 insured Swedish dogs. *Vet Rec.* 2015176(25)656. <https://doi.org/10.1136/vr.103059>
 15. Kandala S, Karlapudi K. Prevalence of renal disorders in dogs—A clinical study. *Int J Agric Sci Vet Med.* 2014;2(3)146-8. <https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=1fd25807a255e16a64276fa0abe253f8078e8af3>
 16. O'Neil DG, Elliot J, Church DB, McGreeny PD, Thomas PC, Brodbett DC. Chronic Kidney disease in dogs in UK veterinary practice. Prevalence, risk factors and survival. *J Vet Internal Med.* 2013;27(4):814-21. <https://doi.org/10.1111/jvim.12090>
 17. Nnamdi HO, Udegbumam RI, Emejuo NT, Udegbumam SO. Changes in selected haematology and serum biochemistry parameters associated with surgically managed tooth avulsion in a dog: Case Report. *J Vet Applied Sci.* 2019;9(1):32-5. <http://jvasonline.com/JVAS%202018%20063%20F.pdf>
 18. Blass KA, Thiebert RJ, Lam LK. A study of the mechanism of Jaffe reaction. *J Clin Chem.* 1974;12(7):336-43. <https://doi.org/10.1515/cclm.1974.12.7.336>
 19. Lamb EJ, Price CP. Creatinine, urea and uric acid. In: Burtis, C.A., Ashwood ER, Bruns, DE, editors. *Tietz fundamentals of clinical chemistry.* 6th ed. Miasauri: Elsevier, 2008; p. 363-72.
 20. IRIS. IRIS Staging of CKD [internet]. International Renal Interest Society; 2015. Available from: <http://www.iris-kidney.com/guidelines/staging.html>
 21. Brown SA. Management of chronic kidney disease. In Elliot J., Grauer C.F (eds) *BSAVA manual of canine and feline nephrology and urology.* 2nd ed. Gloucester: British Small Animal Veterinary Association; 2007; p. 223.
 22. Pelander L. Chronic kidney disease in dogs: Pathophysiological mechanism and diagnostic aspects [dissertation]. [Uppsala]: Swedish University of Agricultural Science; 2018. Available from: <https://res.slu.se/id/publ/100498>
 23. Mshelbwala FM, Ajayi OL, Adebisi AA, Olaniyi MO, Omotainse SO, Kadiri AK. Retrospective studies on the prevalence, morphological, pathological and aetiology of renal failure of dogs in Lagos and Abeokuta, Nigeria. *Nigerian Vet J.* 2016;37(4). Available from: <https://www.ajol.info/index.php/nvj/article/view/163811>

24. Ahmed, SA. Incidence of renal disorders in canines, evaluating prognostic markers in gentamicin induced nephrotoxic dogs [thesis]. [Izatnagar]: Indian Veterinary Research Institute; 2011.
25. Ihedioha JI, Enahoro G. Prevalence of diabetes mellitus and reference values for fasting blood glucose levels of locally available dogs in Warri, Nigeria. *Comp Clin Pathol.* 2019;28:1107-12. <https://doi.org/10.1007/s00580-019-02938-7>
26. Lund EM, Armstrong PJ, Kirk CA, Kolar LM, Klausnar JS. Health status and population characteristics of dogs and cats examined at a private veterinary practice in the United States. *J Am Vet Med Assoc.* 1999;24(9):1336-41.
27. Sosnar M, Kohout PJ, Ruicka M, Vivasova L, (2003). Retrospective study of renal failure in dogs and cats admitted to university of Veterinary Pharmaceutical Science, Brno during 1999-2001. *Acta Vet Brno.* 2003;72(4):593-8. <https://doi.org/10.2754/avb200372040593>
28. Nabi SU, Dey S, Shah OS, Hussain T, Amin U, Vala J, et al. Incidence of renal disorders in canines and its relationship with age breed and sex. *Pharma Innov J.* 2018;7(1): 87-9. <https://www.thepharmajournal.com/archives/2018/vol7issue1/PartB/7-1-8-406.pdf>
29. Polzin DJ. Chronic kidney disease In: Ettinger SJ, Feldman EC, editors. *Textbook of veterinary internal medicine: Diseases of dogs and cats.* St. Louise MO: Elsevier; 1990.
30. Grauer GF, Lane IF. Acute renal failure: Ischemic and chemical nephrosis. Osborne CA, Finco DR, editors. *Canine nephrology and urology.* Baltimore: Lea and Febiger 1995. p. 441-59.
31. Hall JL, Holmes A, Baines ST. Prevalence and antimicrobial resistance of canine urinary tract pathogens. *Vet Rec.* 2013;173(22);549. <https://doi.org/10.1136/vr.101482>
32. Geerlings SE. Clinical presentation and epidemiology of urinary tract infection. In: Mulvey Ma, Klumpp, DJ, Stapleton, AE, editors. *Urinary tract infections: Molecular pathogenesis and clinical management, 2nd ed.* Washington: American Society for Microbiology; 2016. <https://doi.org/10.1128/9781555817404.ch2>
33. Puchot ML, Cook AK, Pohlit C. Subclinical bacteria in cats: Prevalence findings on contemporaneous urinalysis and clinical risk factors. *J Feline Med Surgery.* 2017;11:1238-44. <https://doi.org/10.1177/1098612X16688806>
34. Kivisto AK, Vasenius H, Sandholm M. Canine bacteruria. *J Small Animal Practice.* 1977;18(11):707-12. <https://doi.org/10.1111/j.1748-5827.1977.tb05843.x>
35. Mayer-Roenne B, Goldstern RE, Erb HN (2007). Urinary tract infection in cats with hyperthyroidism, diabetes mellitus and chronic kidney disease. *J Feline Med Surgery.* 2007;9(2):124-32. <https://doi.org/10.1016/j.jfms.2006.09.004>
36. Thompson MF, Litster AL, Platell JL, Trott DJ. Canine bacterial urinary tract infection: New developments in old pathogens. *Vet J.* 2011;190(1):22-7. <https://doi.org/10.1016/j.tvjl.2010.11.013>
37. Bjorling DE. The urethra In: Slatter D, editor. *Textbook of small animal surgery.* Philadelphia: Saunders; 2003; p. 1638-51.