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Incidence and biochemical parameters of dermatophilosis in Nigerian cattle breeds from livestock markets, Oyo state, Nigeria

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Abstract

Dermatophilosis is one of the major economically important diseases of cattle in Nigeria. Managing the condition has been very challenging and re-occurrence has been reported with moderate to high morbidity and mortality. The incidence and biochemical features of cattle with dermatophilosis was conducted in June to December 2016 across the four geopolitical zones of Oyo state, Nigeria. Clinical diagnosis were made based on appearance of dermatophilosis lesion, breeds morphologically characterized, ageing were based on rostral dentition and severity based on the extent and nature of the lesion. Biochemical analysis was based on standard procedure as prescribed by Fortress International. Fifty cattle were found to be infected with clinical dermatophilosis during the period of the study. Twenty four (48%) in Ibadan zone, 14 (28%) in Oyo/Ogbomosho, 8 (16%) in Oke-ogun and 4 (8%) in Ibarapa zone. Breeds distribution across the zones showed 28 (56%) White Fulani, 5 (10%) Sokoto Gudali, 3 (6%) Adamawa Gudali, 7 (14%) Red Bororo, 5 (10%) Cross breeds while the Kuri was 2 (4%). Regarding animal ages, less than 2 years old were 2 animals (4%) while the adults were 48 animals (96%) and they fall under the categories of 2-2½ years of age, 3-3½ years of age and those which are over 3½ years of age. The different levels of severity were categorized into mild (20 (40%)), moderate (23 (46%)) and severe (7 (14%)). The best parameters were seen in White Fulani, while the least were seen in Adamawa Gudali. The age group in the category of 3 - 3½ years had most of the best serum values while the least values were seen in animals less than 2 years of age. Cattle exhibiting mild lesions had most of the best serum values and the least values were observed in cattle with severe lesions. No significant difference ($p > 0.05$) was observed in the mean values for the various parameters studied among the breeds, age, and severity of condition.

Keywords: Biochemical parameters, Cattle, Dermatophilosis, Incidence, Oyo state.

Introduction

Cattle are major source of meat (beef and veal). Beef is rich in both micronutrients and macronutrients, and therefore an essential part of a healthy diet (Neumann *et al.*, 2002). Ademosun (2000), puts Nigeria's total meat production at 810,000 for a population of about 110 million resulting in a 22g per day, while FAO recommended an average of 35g animal protein intake per day for a healthy living in the developing countries. Therefore, the general well-being of the people is directly dependent on the amount of animal protein consumption available. Diseases of livestock contribute to this shortage in which dermatophilosis is one of the major cattle diseases of immense economic importance ravaging Nigerian cattle industry.

Dermatophilosis is a contagious zoonotic skin disease with wide host range and most commonly affects cattle, sheep and horse. The principal aetiology is *Dermatophilus congolensis* which is a member of the aerobic actinomycete. Dermatophilosis has worldwide distribution and the disease is more common in the tropical and subtropical areas. The disease is characterized by acute or chronic exudative dermatitis

with scab formation that could be localised or extensive (Admassu and Alemu, 2011) and may lead to death of animals in severe acute form, resulting in substantial economic loss to the affected farmers (Ali-Emmanuel *et al.*, 2003). The effect of high relative humidity and devitalizing effect on the skin barriers associated with rainy season enhances the maturation of the infective zoospores, and this has been established to be a major predisposing factor in the spread and epidemiology of dermatophilosis.

In tropical zone, climate is the most important risk factor. For example, rain fall can act indirectly to increase the range and activity of potential arthropod vectors. Tick infestation, particularly with *Amblyomma variegatum*, *Hyalomma asticum* and *Boophilus microplus*, is strongly associated with the occurrence of extensive lesions of dermatophilosis and these arthropod vectors are important in the endemic tropical and subtropical areas than in temperate areas (Radostits *et al.*, 2007). The association of dermatophilosis with infestation by the tick *Amblyomma variegatum* has been extensively documented (Molia *et al.*, 2008). Livestock owners in the region are aware of this and place a lot of

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importance on tick control as a preventive measure by the use of Acaricides. Khan *et al.* (2003) reported that the site of tick attachment is not the predilection area of dermatophilosis lesion as the ticks is thought to be important in producing immune suppression in the host rather than mechanical or biological transmission.

Significant changes can be observed in serum biochemical values when cellular/organ damage occurs. Additionally, there is limited information in the literature about the serum biochemical findings of cattle naturally infected with *Dermatophilus congolense* in Nigeria. Serum biochemical parameters can be a useful tool for assessing animal health and help in better understanding the pathogenesis. This study therefore investigated the clinical incidence of dermatophilosis and correlates it with biochemical features in Nigerian breeds of cattle in Livestock markets in Oyo state, Nigeria.

Materials and Methods

The four geopolitical zones of Oyo state were represented in this study, Akinyele cattle market represents Ibadan zone, Oyo Township Kara market represents Oyo/Ogbomoso zone, Eruwa kara market represents Ibarapa zone and Iseyin Kara market represents Oke-ogun zone of the state. Each location was visited twice in a month for 6 months. Cattle with clinical lesions of dermatophilosis were clinically observed externally for dermatophilosis lesions which include; circumscribed raised moist patch lesion, vesicles, pustules, scabs, loss of hair and crusts. The scabs is of various sizes and thickness, there is underside yellowish exudative surface or bleeding sometime when the scabs are removed. Breed were identified based on specific morphological characteristic. Aging was estimated using rostral dentition. Blood samples were appropriately taken in to EDTA containing sample bottles well labeled for analysis. All 50 animals were sampled and their respective serum analyzed biochemically. Samples were immediately transported to the general laboratory of the Department of Veterinary Medicine immediately after collection for biochemical analysis.

Serum biochemistry analysis

Serum total cholesterol was determined by the enzymatic colorimetric method using reagent kit, glucose was determined by the Trinder reaction method using the reagent kit, serum total protein was determined by the direct Biuret method using reagent kit, the serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activities were determined by colorimetric method using reagent kit, serum alkaline phosphatase (ALP) activity was determined by the phenolphthalin monophosphate method using reagent kit, albumin was determined by the bromocresol green method using a reagent kit, urea was determined by the modified Berthelot-Searcy

method using reagent kit. All the reagents used were Randox laboratory kits manufactured by FORTRESS Diagnostics Limited, based in the United Kingdom.

Results and Discussion

Occurrence of dermatophilosis was highest in Ibadan zone of the state (48%), while it was lowest in the Ibarapa zone of the state (8%) (Table 1). This may be due to different in cattle population and husbandry practice system which favours transmission of dermatophilosis in Ibadan zone compared to Ibarapa zone.

Breeds susceptibility to dermatophilosis across the livestock markets in Oyo state revealed 56% in White Fulani, 14% in Red Bororo, 10% in Sokoto Gudali, 10% in crosses, 6% in Adamawa Gudali and 4% in Kuri breeds of cattle (Table 2). This may be due to the fact that Kuri breed appeared to be more resistance to most infectious diseases of cattle as a result of genetic factors. Occurrence among different age groups showed 4% in less than 2 years old animals, 38% in 2-2½ years old, 34% in 3-3½ years old and 24% in adults (Table 3).

This is in agreement with the work of Woldemeskel and Taye (2002), this might be explained from the point of predisposing factors as adult cattle are more exposed to the disease by environmental factors like thorny bushes, thorns, ticks, insects, pecker birds and rain. This is contrary to the study of Nath *et al.* (2010) who observed a significantly high incidence of dermatophilosis in young cattle less than a year. Classification based on lesions severity indicated 23 (46%) with moderate lesion, followed by 20 (40%) with mild lesion, while only 7 (14%) with severe lesion (Table 4). Clinical findings in this study were in agreement with the work of Tresamol and Saseendranath (2014) who gave detailed description similar of the characteristic lesions.

Of these fifty cattle, three cows with generalized lesion were moribund and were observed on lateral recumbency prior to slaughter. The rest were observed with prominent ribs and weak response to stimulus. With this finding, it can be deduced that stress and immunosuppression during the early stage of the infection with improper management might have resulted in generalization of the disease. This finding is in agreement with the reports of Ambrose *et al.* (1999) who observed that animals with concurrent infection and immunosuppression tend to develop chronic generalised infection.

Breeds with the best and poor serum profile with respect to their mean \pm standard deviation (SD) were expressed. For total protein value, White Fulani (4.66 ± 1.25) had the best value while Adamawa Gudali (3.15 ± 0.04) had the least value. The Cross breeds (140 ± 22.80) had the best cholesterol value and the least value was recorded for Sokoto Gudali (123.6 ± 8.41).

Table 1. Incidence/occurrence of dermatophilosis in different geopolitical zones of Oyo state.

| Zones | Number of cases | Percentage (%) |
|-----------------------------------------------|-----------------|----------------|
| Akinyele cattle market (Ibadan zone) | 24 | 48 |
| Eruwa Kara market (Ibarapa zone) | 04 | 8 |
| Oyo township kara market (Oyo/Ogbomosho zone) | 14 | 28 |
| Iseyin Kara market (Oke-ogun zone) | 08 | 16 |
| Total | 50 | 100 |

Table 2. Breeds distribution and susceptibility to generalized dermatophilosis.

| Breed of Cattle | Frequency of Occurrence | Percentage (%) |
|-----------------|-------------------------|----------------|
| White Fulani | 28 | 56 |
| Sokoto Gudali | 5 | 10 |
| Adamawa Gudali | 3 | 6 |
| Red Bororo | 7 | 14 |
| Kuri | 2 | 4 |
| Crosses | 5 | 10 |
| Total | 50 | 100 |

Table 3. Age distribution and susceptibility to generalized dermatophilosis.

| Age distribution | Frequency of Occurrence | Percentage (%) |
|-------------------|-------------------------|----------------|
| Less than 2 years | 2 | 4 |
| 2 - 2½ years | 19 | 38 |
| 3 - 3½ years | 17 | 34 |
| Adult | 12 | 24 |
| Total | 50 | 100 |

Table 4. Distribution under different level of severity to generalized dermatophilosis.

| Severity of Lesion | Frequency of Occurrence | Percentage (%) |
|--------------------|-------------------------|----------------|
| Mild | 20 | 40 |
| Moderate | 23 | 46 |
| Severe | 7 | 14 |
| Total | 50 | 100 |

The Glucose value for all breeds fell below the normal range; however, White Fulani (48.17 ± 13.72) had the highest value while Adamawa Gudali (31.33 ± 2.30) had the least value. The breed with the best aspartate aminotransferase (AST) value is the White Fulani (48.53 ± 13.02) while Adamawa Gudali (33.66 ± 1.52) had the least of this value.

The alanine aminotransferase (ALT) value for all breeds was markedly high above the reference values; however, Adamawa Gudali (27.33 ± 3.05) had the least (close to normal) value while the Crossbreeds (41.6 ± 20.56) had an abnormally high value. The alkaline phosphatase (ALP) value for all breeds was also markedly high above the reference value; Adamawa Gudali (91.66 ± 4.93) had the best value and the White Fulani (132.32 ± 154.77) value was abnormally high.

The Urea (BUN) value for all breeds fell below the normal range; however, Kuri (1.73 ± 1.03) had the best value while Adamawa Gudali (1.05 ± 0.05) had the least value. There was no significant difference in the mean values for the various parameters (Table 5).

The mean \pm SD of total protein for both male and female fell below the reference range ,however the female value (4.53 ± 1.49) was better when compared to the male value (3.80 ± 1.20). The females had highest value of (1.50 ± 0.43), while the males had (1.33 ± 0.34) as the albumin value. The globulin value for the female group (3.02 ± 1.08) exceeds that of the male group (2.46 ± 0.87), although both values are within the normal range. The cholesterol and the AST values fell within the normal reference range for both sexes; however the female group had better values when compared to their male counterpart.

The values for Glucose level of both sexes fell below the reference range but the female group (46.83 ± 15.87) had a better value when compared to the male group (37.28 ± 12.41). Values for both sexes with regards to their ALT far exceed that of the normal reference values. The male group had (33 ± 10.75) as its value while the female group had (38.83 ± 13.90). The ALP value for both sexes was markedly high above the reference range while the BUN value was low for both sexes. There was no significant difference in the mean values for the various parameters (Table 6).

The mean \pm SD of total protein for all age groups fell below the reference range however, ages 3 - 3½ years (4.65 ± 1.61) had the best value when compared to those that are less than 2 years of age (3.36 ± 0.33). The age group of 3 - 3½ years had the best value of (1.53 ± 0.45) while the age group less than 2 years of age had the least albumin value (1.25 ± 0.21). The globulin value for the age group 3 - 3½ years (3.12 ± 1.22) slightly exceeds that of the reference value whereas the other age group values are within the normal range.

Table 5. Serum chemistry profile in generalized dermatophilosis for the various breeds of cattle (Mean ± SD).

| Parameter | White Fulani (n=28) | SokotoGudali (n=5) | AdamawaGudali (n=3) | Red Bororo (n=7) | Kuri (n=2) | Crosses (n=5) |
|---------------------|---------------------|--------------------|---------------------|------------------|------------|---------------|
| Total protein(g/dl) | 4.66±1.25 | 3.91±1.46 | 3.15±0.04 | 4.59±1.72 | 3.70±2.11 | 4.45±2.40 |
| Albumin(g/dl) | 1.56±0.51 | 1.33±0.41 | 1.10±0.03 | 1.53±0.45 | 1.50±0.70 | 1.32±0.49 |
| Globulin(g/dl) | 3.10±0.74 | 2.58±1.05 | 2.05±0.01 | 3.06 ±1.27 | 2.20±1.40 | 3.12±1.91 |
| Cholesterol(mg/dl) | 134.92±11.51 | 123.6±8.41 | 126.66±3.05 | 135.71±16.19 | 131±32.52 | 140±22.80 |
| Glucose(mg/dl) | 48.17±13.72 | 39.2±15.07 | 31.33±2.30 | 47.85±17.38 | 42±28.28 | 43.4±24.22 |
| AST(U/L) | 48.53±13.02 | 40.6±13.72 | 33.66±1.52 | 46.42±17.45 | 44±25.45 | 48.2±23.27 |
| ALT(U/L) | 40±12.29 | 32.8±12.21 | 27.33±3.05 | 37.28±16.24 | 33±18.38 | 41.6±20.56 |
| ALP(U/L) | 132.32±154.77 | 94.4±8.76 | 91.66±4.93 | 105.14±19.31 | 96.5±22.16 | 109.2±23.77 |
| BUN(mg/dl) | 1.53±0.56 | 1.13±0.16 | 1.05±0.05 | 1.33±0.50 | 1.73±1.03 | 1.61±0.73 |

No significant difference between the mean values (p > 0.05).

Table 6. Serum chemistry profile in generalized dermatophilosis among males and females cattle (Mean ± SD).

| Parameter | Males (n=7) | Females (n=43) |
|----------------------|-------------|----------------|
| Total protein (g/dl) | 3.80±1.20 | 4.53±1.49 |
| Albumin (g/dl) | 1.33±0.34 | 1.50±0.43 |
| Globulin (g/dl) | 2.46±0.87 | 3.02±1.06 |
| Cholesterol (mg/dl) | 127±8.85 | 134.86±14.38 |
| Glucose (mg/dl) | 37.28±12.41 | 46.83±15.87 |
| AST (U/L) | 39.71±11.35 | 47.41±15.16 |
| ALT (U/L) | 33±10.75 | 38.83±13.90 |
| ALP (U/L) | 101±16.27 | 121.39±125.48 |
| BUN (mg/dl) | 1.26±0.51 | 1.48±0.56 |

No significant difference between the mean values (p > 0.05).

The cholesterol values for all age groups were within the reference range, however the highest value was observed in age group 2 - 2½ years (136.94±12.09) while the least value was seen in less than 2 years of age (130.5±6.36). Glucose values in all age groups were not up to the reference value, however, the least value was found in age group less than 2 years of age. The AST values for all age groups except the age group of less than 2 years of age (34.5±0.70, below the ref. range) were within the normal reference range with the best value recorded for ages 3 - 3½ years (48.58±15.12) when compared to the rest of the age groups. Values for all age groups with regards to their ALT and ALP level far exceed that of the normal reference values while the BUN values were generally low for all age groups. There was no significant difference in the mean values for the various parameters (Table 7). Findings from this study revealed that hypoalbuminaemia, hyperglobulinaemia, decrease in A/G ratio and decrease in blood urea nitrogen value are in agreement with Hamid and Musa (2009) who also observed a decrease in both albumin and globulin fractions with subsequent drop in serum total protein value.

Table 7. Serum chemistry profile in generalized dermatophilosis under different age groups in the affected cattle (Mean ± SD).

| Parameter | <2 years (n=2) | 2-2½ years (n=19) | 3-3½ years (n=17) | Adult (n=12) |
|----------------------|----------------|-------------------|-------------------|----------------|
| Total protein (g/dl) | 3.36 ± 0.33 | 4.48 ± 1.37 | 4.65 ± 1.61 | 4.19 ± 1.53 |
| Albumin (g/dl) | 1.25 ± 0.21 | 1.52 ± 0.51 | 1.53 ± 0.49 | 1.38 ± 0.52 |
| Globulin (g/dl) | 2.12 ± 0.12 | 2.96 ± 0.86 | 3.12 ± 1.32 | 2.81 ± 1.01 |
| Cholesterol (mg/dl) | 130.5 ± 6.36 | 136.94 ± 12.09 | 132.11 ± 16.15 | 131.58 ± 14.65 |
| Glucose (mg/dl) | 33 ± 4.24 | 47.47 ± 15.42 | 47.58 ± 16.65 | 41.5 ± 15.55 |
| AST (U/L) | 34.5 ± 0.70 | 47.15 ± 14.93 | 48.58 ± 15.12 | 43.83 ± 15.56 |
| ALT (U/L) | 27.5 ± 3.53 | 39.15 ± 14.37 | 39.35 ± 13.25 | 36.08 ± 13.98 |
| ALP (U/L) | 97 ± 1.41 | 148.52 ± 187.39 | 99.82 ± 14.43 | 101.16 ± 14.86 |
| BUN (mg/dl) | 1.12 ± 0.02 | 1.53 ± 0.60 | 1.42 ± 0.54 | 1.41 ± 0.55 |

No significant difference between the mean values (p > 0.05).

Amakiri (1977) also reported a reduction in albumin values and an increase in the globulin values among dermatophilus infected cattle. But Barre *et al.* (1988) suggested that drop in total proteins in dermatophilosis of cattle could be due to anorexia, failure in albumin fraction synthesis by the hepatocytes and proteinuria. The significantly higher alkaline phosphatase activity recorded in the cattle with dermatophilosis may be due to the release of the hormone corticosteroid in response to stress and irritation of the skin disorder (Ochi *et al.*, 2013).

An increase in AST level in the affected cattle is associated with the several causes of myopathies as a result of immunosuppression and liver impairment. A decrease in urea level may be due to malnutrition as serum urea level is related to dietary protein availability (Coles, 1986; Latimer *et al.*, 2003). Malnutrition associated with low protein diet is a paramount factor that can exacerbate the severity of dermatophilosis in cattle. Decrease in urea level can also be associated to liver disease in cattle. Hypoglycemia which was observed in all breeds can be attributed to starvation due to poor diets.

Conclusion

This study has been able to reveal hyperglobulinemia, increased in ALP and AST, hypoproteinemia, hypoalbuminaemia, hypoglycemia, decreased in urea level and normal cholesterol level among the breeds, sex and age groups. These parameters can be adopted as prognostic and diagnostic tools for clinician and veterinarian in the management of dermatophilosis in Nigerian breeds of cattle.

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Conflict of interest

The authors declare that there is no conflict of interests.

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