

The background of the cover features two brown chickens with prominent red combs and wattles. They are positioned in a white, shallow trough, pecking at a layer of yellow feed. The scene is brightly lit, with a green vertical element on the left side of the frame.

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Full Length Research Paper

Effect of orally administered bitter leaf (*Vernonia amygdalina*) extract on the growth performance and haematological parameters of broiler chicken

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The effect of administering graded concentration levels of *Vernonia amygdalina* (bitter leaf) extract to broiler birds for growth performance and health promoter potential (haematological parameters) was evaluated. The birds were randomly distributed into six treatments with three replicates per treatment, each replicate having 10 birds. Treatment 1 is the control treatment given only water, treatment 2 were given Neocryl® antibiotics (1.5 g at manufactures prescription), treatments 3, 4, 5 and 6 were given bitter leaf extract at different graded concentrations (2.5, 5, 10, 15 g per liter of water, respectively). The highest weight gain (WG) was observed in the birds in treatment 5 compared to those in other treatments. The result showed that the haematological parameters was only significant ($p > 0.05$) at erythrocyte sedimentation rate (ESR), mean cell volume (MCV), mean cell haemoglobin (MCH) and mean cell haemoglobin concentration (MCHC). For growth performance, only final weight gain, daily weight gain, total feed intake and the feed conversion ratio was significantly ($p \leq 0.05$) different by the treatments.

Key words: *Vernonia amygdalina*, aqueous extract, bacteria isolates, health promoter potential, growth performance.

INTRODUCTION

Poultry keeping is one of the common and practical businesses in Nigeria today. It is a good source of livelihood for family subsistence because it requires less

capital investment compared to other domesticated animals (Manyong et al., 2005). Poultry health and good management practices are the core component of the

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operational dynamics of a developing and profitable production industry (Adene, 2004). However, the continuous rise in the cost of medicines (such as antibiotics) affect local broiler producers and also despite the observed improvement in broiler performance, the use of antibiotic growth promoters has been criticized due to its possible role in the occurrence of antimicrobial resistance in humans (Ratcliff, 2000). This has led a lot of poultry and plant experts to think of alternative sources to solve this problem. This new context caused an increase in the search for alternative growth promoters.

In recent years, interest has developed in many countries in the collection and extended use of medicinal plant extract for an alternative production purposes (Griggs and Jacob, 2005). Knowledge of medicinal plants has been the key for the survival of the ethnic groups who live in the interior. People who live far from towns and in forest still rely on traditional cures handed down to them through the generations that preceded them. Antibiotics have been used in poultry feed for improving growth performance, prevention of coccidiosis, some specific pathogenic microorganism and increasing some useful microorganism in intestinal micro flora over the years (Dibner and Buttin, 2002; Pangasa et al., 2007; Singla et al., 2007). In this study, the potentials of *Vernonia amygdalina* in improving the performance and health benefits of broiler was evaluated when administered in drinking water over a period of time .

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the poultry experimental unit of the Teaching and Research Farm of the Federal University of Technology, Akure, Ondo State, Nigeria. The birds were acclimatized for 2 weeks and the experiment was conducted for 7 weeks. Also the laboratory analysis was carried out at the Department of Animal Production and Health in the same institution.

Experimental birds

A total number of 250 day-old broiler chicks of mixed sexes were purchased from a reputable hatchery in Ibadan, Oyo state out of which 180 were used for the experiment. Brooding of the birds was carried out at the farm using deep litter system.

Preparation of plant extract

The plant material used (*V. amygdalina*) was harvested from the Teaching and Research Farm of the Federal University of Technology, Akure previously identified by Dr Ogunika of Forestry and Wood Technology Department of the University. The leaf material was washed and drained before blending with industrial blender in distilled water. The method used was cold water extraction. The filtrate was obtained by sieving the blended leave

extract with muslin cloth folded into eight folds before it was then finally extracted in the extracting machine connected to Buckner funnel. The finest particle obtained was then kept in refrigerator before it was finally used at different inclusion levels on the birds at the experimental site (Osho and Lajide, 2012).

Experimental layout

The completely randomized design was used. After the one week pre-experimental (acclimatization) period, one hundred and eighty chicken broilers of marshal breed were grouped into six treatment and three replicate groups, with 10 chicks per group. Treatment 1 is the control given water only, T2 was given 1.5 g of Neocyrl® antibiotics, T3, T4, T5, and T6 were given 2.5, 5, 10 and 15 g of the extract per liter of water, respectively. Feed and water were offered *ad libitum* throughout the experimental period. The birds were acclimatized for one week and the experiment was conducted for 7 weeks. The live weight was recorded weekly, while feed and water intakes were recorded daily.

Data analysis

Data on bacteriological variable, haematological parameters, growth and performance characteristics were subjected to one-way analysis of variance (ANOVA) using SAS version 9.1 statistical package. Where significant differences were found, and the mean were separated using Duncan multiple range test.

RESULTS AND DISCUSSION

Feed intake

The total feed intake of birds in each treatment is shown in Table 1 in which Treatment 3 (5.71) and treatment 6 (5.71) have the highest total feed intake as compared to the birds in T1, T2, T4, and T5 but this was not significantly ($p > 0.05$) affected.

Weight gain

The effect of bitter leaf plant extract on the weight gain of broiler chicken shows that there was significant ($p < 0.05$) difference on the weight gain of the birds administered orally with bitter leaf plant extract at different inclusion levels of bitter leaf in T4 and T5 (5 and 10 g) compared with those in T1 (control) and T2 for the period of 7 weeks of the experiment (Table 1). However, birds given 10 g inclusion of bitter leaf plant extract (T5) have the highest weight gain (2.04 kg), followed by those in T4 (5 g inclusion) with (1.97 kg) weight gain. Birds in T6 given 15 g of the extract have (1.92 kg) compared with T1 (1.69 kg) and T2 (1.74 kg). This suggests that the inclusion level of treatment 5 could be the highest threshold of bitter leaf extract that could enhance weight gain in broilers. Contrary to this, highest feed conversion ratio was found in treatment 1.

Table 1. Growth and performance of experimental birds orally administered graded concentration of *Vernonia amygdalina* extract.

Parameter	Treatments					
	T1	T2	T3	T4	T5	T6
Initial wt	0.25±0.04	0.23±0.04	0.24±0.04	0.23±0.06	0.23±0.06	0.22±0.04
Final wt	1.95±0.30 ^c	1.96±0.31 ^c	2.04±0.36 ^{bc}	2.20±0.34 ^{ab}	2.28±0.41 ^a	2.14±0.27 ^{abc}
WG	1.69±0.32 ^d	1.74±0.30 ^{cd}	1.80±0.38 ^{bcd}	1.97±0.33 ^{ab}	2.04±0.41 ^a	1.92±0.28 ^{abc}
DWG	0.03±0.01 ^d	0.35±0.01 ^{cd}	0.36±0.01 ^{bcd}	0.04±0.01 ^{ab}	0.04±0.01 ^a	0.03±0.01 ^{abc}
Total FI	5.68±0.26	5.70±0.25	5.71±0.28	5.69±0.25	5.68±0.25	5.71±0.24
DF intake	0.12±0.01	0.12±0.01	0.12±0.01	0.12±0.01	0.12±0.01	0.12±0.00
FCR	3.46±0.69 ^a	3.41±0.86 ^{ab}	3.34±0.93 ^{abc}	2.96±0.52 ^{cd}	2.89±0.63 ^d	3.04±0.48 ^{bcd}

T1 = Water only, T2 = 1.5 g/L of antibiotics, T3 = 2.5 g/L of bitter leaf extract, T4 = 5 g/L of bitter leaf extract, T5 = 10 g/L of bitter leaf extract, T6 = 15 g/L of bitter leaf extract. Weights are measured in kilogram body weight (kg). Means with the same superscript (a, b, c, d) are not significantly different (mean ± standard error). DWG = daily weight gain in kg; FCR = feed conversion ratio; TFI = total feed intake; DFI = daily feed intake and WG = weight gain.

Table 2. Water intake (Litre) of broiler chicken at varying level of treatment.

Parameter	T1	T2	T3	T4	T5	T6
T water intake	117.32±2.66	115.20±2.22	110.15±3.46	116.98±2.74	113.41±2.46	111.98±3.23
D water intake	2.39±0.05	2.35±0.05	2.25±0.07	2.39±0.06	2.31±0.05	2.29±0.07

T1= Water only; T2= 1.5 g/L of antibiotics; T3 = 2.5 g/L of bitter leaf extract; T4 = 5 g/L of bitter leaf extract; T5 = 10 g/L of bitter leaf extract and T6 = 15 g/L of bitter leaf extract.

Feed conversion ratio (FCR)

Feed conversion ratio was calculated as feed intake consumed per unit of gain. The feed conversion ratio of broilers given water only (T1) and T2 given 1.5 g antibiotics was not significantly ($p > 0.05$) different but there was significant ($p < 0.05$) difference between T3 and T5.

Water intake

Table 2 shows the total water intake and daily water intake of the birds in each treatment. The result shows that there was no significant ($p > 0.05$) difference in the water intake of the experimental birds. However, treatment 1 (which was given water only) had the highest water intake (117.32) as compared with T2 (115.20), T3 (110.15), T4 (116.98) and T5 (113.41) while T6 had the lowest water intake (111.98) and this may be due to the high concentration of inclusion of bitter leaf plant extract (15 g inclusion level).

Haematological variable

The red blood cell (RBC) and packed cell volume (PCV)

were found to differ in birds administered orally with *V. amygdalina* and those that were not administered (Table 3). Of the entire haematological variables measured, only ESR (erythrocyte sedimentation rate), MCV (mean cell volume), MCHC (mean cell haemoglobin concentration) and MCH (mean cell haemoglobin) were significantly ($p < 0.05$) influenced by the experiment. The total ESR of birds in T3 (4.17 ± 1.19 mm/h) was significantly ($p < 0.05$) different from those in T4 (1.67 ± 0.21 mm/h) but identical with ($p > 0.05$) to those of T1, T2, T5 and T6. The range goes between 1.67 to 4.17 mm/h. The birds in the treatments were significantly ($p < 0.05$) different for the MCHC value. Birds in T4 (5 g bitter leaf extract level) had the highest MCHC (33.30%) and this positively compared with those in T1 (33.22%), T5 with 10 g inclusion of the extract (33.24%), T6 with 15 g/L inclusion of extract (33.28%), treatment 2 with 1.5 g of antibiotic (33.18%) and also treatment 3 with 2.5 g/L of the extract had the least MCHC value (33.17%) and this was not significantly ($p > 0.05$) lower than those of treatment 1, treatment 5 and treatment 6 but significantly ($p < 0.05$) lower than treatment 5. Also for MCV, there was significant ($p < 0.05$) difference between T1, T2, T3 compared to those in T4, T5 and T6. MCH value of birds in T4 is significantly ($p < 0.05$) different from T6 as compared to those in T1, T2, T3 and T5 which are not significant ($p > 0.05$). All these parameters fell within the range of the normal haematological

Table 3. Haematology profile of broiler chicken orally administered graded concentration of *Vernonia amygdalina* extract.

Variables	Treatments					
	T1	T2	T3	T4	T5	T6
ESR(mm/h)	2.00±0.37 ^{ab}	3.17±0.48 ^{ab}	4.17±1.19 ^a	1.67±0.21 ^b	2.33±0.33 ^{ab}	3.67±0.92 ^{ab}
PCV (%)	30.00±0.73	28.33±0.71	27.83±2.20	31.33±0.71	29.83±0.65	28.17±1.82
RBC×10 ⁶ /mm ³	2.08±0.07	1.88±0.11	1.92±0.25	2.31±0.09	2.15±0.12	1.85±0.21
Hb (g/100 m)	9.97±0.24	9.40±0.24	9.23±0.73	10.43±0.23	9.92±0.22	9.37±0.59
LYM (%)	59.67±1.02	60.00±1.98	59.17±1.33	60.17±1.51	58.00±1.29	58.67±1.45
NEU (%)	24.33±0.84	24.00±0.97	25.67±0.99	24.17±0.79	24.83±0.48	24.50±0.76
MONO (%)	12.83±1.14	13.17±1.45	12.17±0.87	12.50±0.99	14.17±1.14	13.50±1.28
BAS (%)	2.17±0.17	2.00±0.00	2.00±0.00	2.17±0.17	2.17±0.17	2.33±0.21
EOS (%)	1.00±0.00	0.83±0.17	1.00±0.00	1.00±0.00	0.83±0.17	1.00±0.00
MCV (µm ³)	144.40±1.88 ^a	152.44±4.94 ^a	150.32±8.45 ^a	136.2±3.4 ^b	140.1±5.3 ^b	156.1±6.1 ^b
MCHC (%)	33.22±0.04 ^{ab}	33.18±0.04 ^b	33.18±0.04 ^b	33.30±0.02 ^a	33.24±0.03 ^{ab}	33.27±0.04 ^{ab}
MCH (pg)	47.97±0.64 ^{ab}	50.57±1.64 ^{ab}	49.86±2.79 ^{ab}	45.37±1.15 ^b	46.58±1.77 ^{ab}	51.94±2.29 ^a

Means with similar superscripts on the same column are not significantly ($p > 0.05$) ± mean standard error. PCV = packed cell volume; LEUM = leucocyte; BAS = basophil; Neu = neutrophil; EOS = Eosinophil; Hb = haemoglobin; MONO = monocytes; MCHC = mean Cell haemoglobin concentration; MCH = mean cell haemoglobin; MCV = mean cell volume; ESR = erythrocyte sedimentation rate.

variables for chicken MCH which was slightly higher for birds in the treatment 2, 3 and 6. Basophil was slightly lower for birds in T2 and T3 and the Eosinophil values were generally lower across the six treatments as shown in Table 3.

DISCUSSION

Blood represent a means of assessing clinical and nutritional health status of animals in feeding trials and the haematological variables most commonly in nutritional studies include packed cell volume (PCV), red blood cell (RBC), Hb, MCHC, MCV and the clotting time (Aletor and Egberongbe, 1992). The result of this study shows that the ability of the extract to alter the distribution and occurrence of lymphocyte, neutrophil, eosinophils, basophil and monocytes suggest the potentiality of the extract acting as an immunostimulant. However, neutrophil count was lower and lymphocyte higher in the birds that were treated with the extract. Neutrophil is the most abundant circulating granulocytes and their granules contain numerous molecules and when a chemotactic factor is produced as a result of infection or injury, in the extracellular site, these cells enter the tissues (Weir and Stewart, 1999).

The haemoglobin level and PCV were higher in treatment 5 with 10 g of the extract than the rest treatments. Acute inflammation from most pathogenic microorganisms results in haemolysis which is manifested in lower haemoglobin level and PCV (Kumarnsit et al., 2006). The higher values of these haematological indices in the treatment administered the extract can be due to

their inability to cause haemolysis resulting from the anti-inflammatory potentials inherent in *Vernonia amygdalina*. Some haematological variables measured (ESR, MCV, MCHC, MCH) were significantly ($p < 0.05$) influenced in the experiment. Cole (1986) reported that caged birds have a PCV of 35 to 55% and a PCV of less than 35% indicates anaemia, while one greater than 55% suggests dehydration. However, Ross et al. (1978) gave a range of 25 to 45% as been normal. The PCV values obtained were within this range, this signifies that there were no symptoms of physiological anaemia in the experimental birds. However, there were low RBC values obtained in treatments 2 and 6.

The significance differences in MCHC, MCH and MCV values suggested that there were differences in corpuscular sizes even when the blood collected had similar haemoglobin content. The relevance of MCHC, MCH and MCV measurement lies in their use in the diagnosis of anaemia and an index of the capacity of bone marrow to produce RBC (Aletor and Egberongbe, 1992). With regards to the blood physical properties, the erythrocyte sedimentation rate (ESR) as well as the haematological indices in this present study fell within the normal range reported by Ross et al. (1978) and Mitruka and Rawnsley (1977). It is believed that the frictional resistance of the surrounding plasma, which holds the cells in suspension and the gravitational pull on the erythrocyte, mostly determines the ESR. Wide ranges of normal haematological values were also reported by other authors (Bell and Freeman, 1971; Mitruka and Rawnsley, 1977; Oyewale, 1985; Mhatre and Joshi, 1993; Ogbe et al., 2003; lheukwumere et al., 2006). Fluctuations in haematological values of avian blood are

normal phenomenon and in most instances the variations in haematological values may depend on the physiological state of birds (Islam et al., 2004).

The growth performance shows that the final weight (FW), total weight gain (TWG), and feed conversion ratio (FCR) of the birds were significantly ($p < 0.05$) different. Though the experimental birds were selected at random, they have almost the same live weight at the beginning of the experiment. Treatment 5 had the highest weight gain (2.04) at the end of the experiment. This shows an optimum level of extract administration to which performance is also good and this could be recommended for farmers. The findings of the research might present balanced alternative for the use of antimicrobial.

This also creates an environment of intestinal tract balance and which results to better utilization of feed and eventually weight gain. The better FCR in T5 (2.89) were due to the effect of medicinal extract that has been reported to increase production of digestive enzymes and improved utilization of digestive products through enhanced liver function (Hernandez et al., 2004). The efficiency of feed conversion ratio ranged between (2.89 and 3.46) which is higher than the value (0.13 and 0.2) observed by Bonsi et al. (1995) but far less than the value (19.8) reported by Rankis (1996).

Powdered *V. amygdalina* leaf was able to increase the FCR of cockerels without affecting their haematological profile (Olobatoke and Oloniruha, 2009). The lower the FCR, the higher it is for the birds to convert the feed to muscle which treatment 5 was able to do. However, there was no significant difference in the water intake of the treatments but T1 and T4 have the highest water intake (117.32 and 116.98 ml). These results could be correlated with Durrani et al. (2007) who reported that medicinal herb extract, given in drinking water had no significant effect ($p > 0.050$) on the water intake of the broiler chicks.

Conclusion

The result obtained in this study shows that bitter leaves extract could be a source of medicinal application in water for poultry birds. It improved body maintenance and it was tolerable, acceptable and favourable to the poultry. It could also be concluded therefore that bitter leaf improves the water intake. Relatively lower counts of bacteria were obtained in nearly all the specimens examined, which imply that the bacteria growth might not likely be highly attained beyond this level.

Conflict of Interest

The author(s) have not declared any conflict of interests.

REFERENCES

- Adene DF (2004). Poultry health and production: principle and practices 1st Edition Stirling-Horden publisher (Nig) Ltd. Pp. 296.
- Aletor VA, Egberongbe O (1992). Feeding differently processed soya bean part 2. An assessment of haematological responses in the chicken. *Die Nahrung* 36:364-369.
- Bell DJ, Freeman BM (1971). *Physiology and Biochemistry of the Domestic Fowl*. Vol. 2. Academic Press Inc, London
- Bonsi HL, Haresign DJ, Cole A, Bedford MR (1995). Study on plant protein and amino content of different medicinal plant: *Medicinal plant chem.* 42:200-250.
- Coles EH (1986). *Veterinary Clinical Pathology*. 4th Edition, W.B. Saunders Co. Philadelphia.
- Dibner JJ, Buttin P (2002). Use of organic acid as a model to study the impact of gut microflora on nutrition and metabolism. *J. Appl. Poult. Res.* 11:453-463
- Durrani F, Sultan R, Marri A, Chand MC, Durrani Z (2007). Effect of wild mint (*Mentha longifolia*) infusion on the overall performance of broiler chicks. *Pak. J. Biol. Sci.* 10:1130-1133.
- Griggs JP, Jacob JP (2005). Alternatives to antibiotics for organic poultry production. *J. Appl. Poult. Res.* 14:750-756
- Hernandez F, Madrid J, Garcia V, Orengo J, Megias MD (2004). Influence of two plant extracts on broilers performance, digestibility, and digestive organ size. *Poultry Sci.* 83:169-174.
- Ihekumwure FC, Abu AH, Ameh M (2006). Effect of human menopausal gonadotropin on haematological and serum biochemical parameters of Nigerian indigenous chickens. *Int. J. Poult. Sci.* 5(7):632-634.
- Islam MS, Lucky NS, Islam MR, Ahad A, Das BR, Rahman MM, Siddiu MSI (2004). Haematological parameters of Fayoumi, Assil and local chickens reared in Sylhet region in Bangladesh. *Int. J. Poult. Sci.* 3(2):144-147.
- Kumarnsit E, Keawpradub N, Nuankaew W (2006). Acute and long term effects of alkaloid extract of *Mitragyna speciosa* on food and water intake and body weight in rats. *Fitoterapia* 7:339-345.
- Manyong VM, Ikpi A, Olayem JK, Yusuf SA, Omonona BT, Okoruwa V, Idachaba FS (2005). Agriculture in Nigeria: Identifying opportunities for increased commercialization and investment. International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. P 189.
- Mhatre AJ, Joshi VG (1993). Effect of different temperature regimens on some haematological parameters in broilers. *Indian Vet. J.* 70:915-920.
- Mitruka BM, Rawnsley HM (1977). *Clinical biochemical and haematology reference values in normal and experimental animals*. Masson Publishing USA, Inc. pp. 83,134-135.
- Ogbe AO, Adeyefa CAO, Joshua RA (2003). Growth rate and haematological parameters of broiler chickens vaccinated with IBD susceptibility tests: Evaluation of overnight age culture. *J. Chin. Microbiol.* 17:140-457.
- Olobatoke RY, Oloniruha JA (2009). Haematological assessment of bitter leaf (*Vernonia amygdalina*) efficiency in reducing infections in cockerels. *Afr. Tradit. Complement. Alternative medicines*. Abstracts of the world congress on medicinal and aromatic plants, Cape Town. November, pg : 472-473
- Oyewale JO (1985). Haematological studies on apparently healthy Nigeria domestic chickens, *Gallus domesticus*. *IBAR*, 35:108-221.
- Pangasa A, Singla LD, Sood N, Singh A, Juyal PD (2007). Histopathological evaluation of anticoccidial activity of an ayurvedic coccidiostat, in induced *Eimeria tenella* infection in chicken. *Indian J. Anim. Sci.* 77(3):214-216
- Rankis DL (1996). Proceeding options for sheep, feed mix. The international formal of feed, nutrition and technology 1:8-12.
- Ratcliff J (2000). Antibiotic bans—A European perspective. In: JA Doerr (ed.) *Proceedings of the 47th Maryland Nutrition Conference for Feed Manufacturers*, Baltimore. University of Maryland, College Park. pp. 135-152.
- Ross J, Christie G, Halliday W, GadeJone, RM (1978). Haematological and blood comparison value for clinical pathology in poultry. *Vet. Rec.* 102:29-31.

Singla LD, Pangasa A, Juyal PD (2007). Caecal coccidiosis: efficacy of ayurvedic and allopathic coccidiostats in immunomodulated broiler chicks. In: Proceedings of the 12th International conference of the Association of Institutions of Tropical Veterinary Medicine held at Montpellier, France from 19-22 August, 2007. pp 89-93.

Weir DM, Stewart (1999). Immunology. 8th Edition, Churchill Livingstone. P 362.

Full Length Research Paper

Abomasal nematodes of small ruminants slaughtered in Bahir Dar Town, North West Ethiopia

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This study was conducted during November, 2013 to March, 2014 to identify the species and to determine the burden of abomasal nematodes of small ruminants slaughtered in Bahir Dar town. A total of 384 abomasas (269 sheep and 115 goats) were collected and examined according to the standard procedures. An overall prevalence of 55.7% was recorded for abomasal nematodes of sheep and goats. The host specific prevalence of abomasal nematodes was 60.2 and 45.2% in sheep and goats, respectively. Two nematodes, *Haemonchus* spp. and *Trichostrongylus axei* were identified both in sheep and goats. The prevalence of *Haemonchus* and *T. axei* was 53.5 and 48.7% in sheep and 43.5 and 26.1% in goats, respectively. Mean worm counts of *Haemonchus* spp. and *T. axei* were 413.5 and 225.3 in sheep and 316.5 and 71.3 in goats, respectively. Sheep had higher ($P < 0.01$) prevalence (48.7%) and worm burden (225.3) of *T. axei* compared to goats (45.2 and 71.3%). Both sheep and goats with lean body condition had higher ($P < 0.001$) prevalence and worm count for both *Haemonchus* spp. and *T. axei* compared to their counterparts with good body condition. The great majority of the infected sheep and goats were with light to medium degree of infection. This study adds information to the epidemiology of abomasal nematodes in Ethiopia and may be used in the design of control strategies.

Key words: Abomasum, goat, *Haemonchus*, sheep, *Trichostrongylus axei*

INTRODUCTION

In Ethiopia, small ruminants play important roles in all agricultural production systems. They thrive and produce in all agro-ecological zones; from semi-arid to arid lowlands to the Afro-Alpine (*Guassa*) ecosystem. Although Ethiopia is endowed with the highest population of small ruminants in Africa, with 24.2 million sheep and 22.6 million goats (CSA, 2012), the benefit the country is

obtaining from the resource is way below expected due to multitude of factors. Diseases are among the constraints affecting the productivity of small ruminants in Ethiopia (Njau et al., 1988; Bekele et al., 1992; Zewde and Lidetu, 2008; Petros et al., 2014). Diseases cause mortality; reduce growth, milk production, reproductive performance and product and by-product quality and interfere

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interfere with international trade of livestock and livestock products. Among diseases, helminthoses are perhaps the most prevalent and cause huge economic losses due to mortality and morbidity (Njau et al., 1988; Bekele et al., 1992; Kaur et al., 2008; Kaur et al., 2013) in addition to the most important insidious losses associated to them (Singla, 1995).

Epidemiological information of parasites of a geographical location is important in prioritizing diseases for intervention and design of control strategies. There are reports on the prevalence, species composition and burden of abomasal parasites in sheep and goats from different parts of Ethiopia. These studies revealed the presence of *Haemonchus* spp., *Trichostrongylus axei*, and *Ostertagia/Teladorsagia circumcincta*, with overall prevalence of 61.8 to 92.9% of abomasal parasites (Kumsa and Wossene, 2006; Abunna et al., 2009; Bitew et al., 2011; Demissie et al., 2013). Yet, there is shortage of such information in some areas of the country including Northern Ethiopia. The aim of this study was, therefore, to identify the species and to determine the degree of infection of abomasal nematodes in sheep and goats slaughtered in Bahir Dar, North Western Ethiopia.

MATERIALS AND METHODS

Study area

Bahir Dar, the capital of Amhara Region, is situated on the southern shore of Lake Tana, the sources of the Blue Nile (or Abay). The city is located approximately 578 km northwest of Addis Ababa, having a latitude and longitude of 11° 36' N 37° 23' E and an elevation of 1,800 meters above sea level (http://en.wikipedia.org/wiki/Bahir_Dar).

Study animals

The study included 269 sheep and 115 goats (384 small ruminants) of both sexes slaughtered in Bahir Dar town between November, 2013 and March, 2014. Sheep and goats slaughtered at Bahir Dar usually originate from Bahir Dar zuria, Farta and Estae districts.

Study methodology

Sampling units were selected using two stage sampling. Restaurants and hotels were selected based on convenience. Study animals were selected using systematic random sampling technique. Species, sex, body condition score (BCS) and origin of animals were recorded before slaughter by interviewing the responsible individuals and observation of the animals. BCS was assessed according to Abebe and Yami (2008). For convenience, the score was categorized into two groups: lean (scores 1 and 2) and good (scores 3 and 4).

Abomasa were collected soon after evisceration usually within 30 min. The two ends at omaso-abomasal junction and pylorus were ligated to avoid leakage before separated from omasum and duodenum. The abomasa were then immediately transported to the Bahir Dar Regional Veterinary Laboratory for parasitological examination. Worm recovery, identification and counting were made

according to standard procedures (MAFF, 1977; Hansen and Perry, 1994). The degree of infection by adult *Trichostrongylus* spp. and *Haemonchus* spp. was categorized as light (1 to 1000; 1 to 500), moderate (1001 to 10000; 501 to 1500) and heavy (>10000; >1500), respectively as described by Hansen and Perry (1994).

Data management and analysis

All the data collected (species, sex, BCS, origin, parasite species and count) were entered to MS Excel and analyzed using STATA version 11.0 software (Stata Corp., College Station, TX 77845, USA). Prevalence was calculated as the percentage of the animals with the parasite of interest of the total animals examined. Associations between predictor variables (species, sex, BCS) and response variable (parasite prevalence) considered in the study were assessed using logistic regression analyses. Effect of the factors on abomasal nematode count was tested using *t*-test and one way ANOVA.

RESULTS

Two nematodes namely *Haemonchus* spp. and *Trichostrongylus axei* were identified infecting the abomasa of the study sheep and goats. Out of a total of 384 abomasa of sheep (n = 269) and goats (n = 115) examined, 214 (55.7%) were positive for at least one of the nematodes. The prevalence of abomasal nematodes was 60.2 and 45.2% in sheep and goats, respectively. The prevalence was significantly ($P < 0.01$) higher in sheep than in goats. The prevalence of *Haemonchus* spp. and *T. axei* was 53.5 and 43.5%, in sheep and was 48.7 and 26.1% in goats, respectively. The prevalence of *Haemonchus* spp. just failed to be significantly different ($P = 0.07$) between sheep and goats. However, the prevalence of *T. axei* was significantly higher ($P < 0.001$) in sheep than in goats (Table 1). The effects of sex, body condition and origin of the animals on the prevalence of abomasal nematodes were assessed. Of these factors, a statistically significant association ($P < 0.001$) was observed only between body condition of the animals and abomasal nematode prevalence in both sheep and goats. Accordingly, lean sheep and goats had higher prevalence of *Haemonchus* spp. (71.1 and 60.3%) and *T. axei* (63.6 and 25.0%) compared to their counter parts with good body condition (21.9 and 21.9%, 19.1 and 4.3%) (Tables 2 and 3).

Mean worm counts for *Haemonchus* spp. and *T. axei* in sheep and goats were 413 and 316.5, and 225.3 and 71.3, respectively. The difference in mean count of *Haemonchus contours* between sheep and goats just failed to be statistically significant ($P = 0.0652$). The difference in the count of *T. axei* was, however, significantly higher in sheep than in goats ($P < 0.001$) (Table 4). Among the factors considered, worm burden was significantly ($P < 0.001$) associated only with body condition of the animals. The counts of both *Haemonchus* spp. and *T. axei* were significantly higher in lean sheep

Table 1. Prevalence of abomasal nematodes in sheep and goats.

Species	n	<i>Haemonchus</i>			<i>T. axei</i>			At least one parasite		
		Positive (%)	OR	P-value	Positive (%)	OR	P-value	Positive (%)	OR	P-value
Sheep	269	144 (53.5)	1.5	0.07	131(48.7)	2.7	0.000	162 (60.2)	1.8	0.006
Goat	115	50 (43.5)	1		30 (26.1)	1		52 (45.2)	1	
Overall	384	194 (50.5)	-		161(41.9)			214 (55.7)		

Table 2. Effects of sex, body condition score (BCS) and origin of sheep on prevalence of abomasal nematodes.

Variable	n	<i>Haemonchus</i>			<i>T. axei</i>			
		No (%)	OR	P-value	No (%)	OR	P-value	
Sex	Male	152	81 (53.3)	1	0.927	75 (49.3)	1	0.809
	Female	117	63 (53.8)	1.02		56 (47.9)	0.94	
BCS	Good	96	21 (21.9)	1	0.000	21 (21.9)	1	0.000
	Lean	173	123 (71.1)	8.79		110 (63.6)	6.24	
Origin	B/Dar	97	54 (55.7)	1	0.694	51 (52.6)	1	0.586
	Estae	94	47 (50.0)	0.80		45 (47.9)	0.83	
	Farta	78	43 (55.1)	0.98		35 (44.9)	0.73	

Table 3. Effects of sex, body condition score (BCS) and origin of goats on prevalence of abomasal nematodes.

Variable	n	<i>Haemonchus</i>			<i>T. axei</i>			
		No (%)	OR	P-value	No (%)	OR	P-value	
Sex	Male	64	27(42.2)	1	0.754	16(25)	1	0.766
	Female	51	23(45.1)	1.13		14(27.5)	1.14	
BCS	Good	47	9(19.1)	1	0.000	2(4.3)	1	0.000
	Lean	68	41(60.3)	6.4		28(25.0)	15.75	
Origin	Bahir Dar	44	18(40.9)	1		11(25)	1	0.934
	Estae	32	14(43.8)	1.12	0.89	8(25)	1	
	Farta	39	18(46.2)	1.24		11(28.2)	1.18	

and goats compared to their contemporaries with good body condition. The mean counts of *Haemonchus* spp. in lean and good body conditioned sheep were 548.6 and 168.8, respectively, while the mean counts of *T. axei* were 298.8 and 92.7, respectively. The corresponding counts in goats for *Haemonchus* spp. and *T. axei* in lean and good body conditioned goats were 455.9 and 114.9 and 113.2 and 10.6, respectively (Tables 5 and 6).

Among infected sheep and goats the majority were with light degree of infection by both *Haemonchus* spp. and *T. axei*. Accordingly, 70.1% of the infected sheep and 80.0% of the infected goats were with light degree of infection with *Haemonchus*, and 64.1 and 100% of the infected sheep and goats, respectively were with light degree of infection with *T. axei*. Moderate degree of infection was recorded in relatively small proportion of

Table 4. Mean worm count of sheep and goats.

Species	n	<i>Haemonchus</i>				<i>T. axei</i>			
		Mean	S.E.	Max	P-value	Mean	S.E.	Max	P-value
Sheep	269	413.0	29.4	1500	0.0652	225.3	18.9	1200	0.000
Goat	115	316.5	40.4	1400		71.3	13.1	600	

Table 5. Association of mean worm count with sex, body condition score (BCS) and origin of sheep.

Variable	n	<i>Haemonchus</i>			<i>T. axei</i>			
		Mean	S.E.	P-value	Mean	S.E.	P-value	
Sex	M	152	414.5	39.4	0.9550	229.6	24.7	0.7944
	F	117	411.1	44.4		219.7	29.3	
BCS	Good	96	168.8	30.1	0.0000	92.7	21.8	0.0000
	Lean	173	548.6	36.5		298.8	25.1	
Origin	B/Dar	97	420.6	48.1	0.7566	230.9	30.6	0.9585
	Estae	94	433.0	53.9		218.1	31.7	
	Farta	78	379.5	50.6		226.9	36.8	

Table 6. Association of mean worm count with sex, body condition score (BCS) and origin of goats.

Factor	n	<i>Haemonchus</i>			<i>T. axei</i>			
		Mean	S.E.	P-value	Mean	S.E.	P-value	
Sex	M	64	325.0	56.9	0.8152	65.6	16.4	0.6297
	F	51	305.9	57.1		78.4	21.4	
BCS	Good	47	114.9	39.5	0.0000	10.6	7.6	0.0001
	Lean	68	455.9	56.9		113.2	20.1	
Origin	B/Dar	44	300.0	64.6	0.9468	84.1	25.2	0.7310
	Estae	32	321.9	79.2		59.4	21.5	
	Farta	39	330.8	69.8		66.7	19.9	

of infected sheep and goats: 29.9 and 33.6% in sheep and 20.0 and 0% in goats with *Haemonchus* and *T. axei*, respectively. Heavy infection was not observed for both species of parasites in both hosts.

DISCUSSION

We identified only *Haemonchus* spp. and *T. axei* from the abomasa of the study animals. In agreement with our finding, Kumsa and Wossene (2006) and Sissay et al. (2007) reported only these two genera of nematodes in sheep and goats in Eastern Ethiopia. However, other

studies reported *Teladorsagia* spp., in addition to the two genera, from central (Abunna et al., 2009; Shankute et al., 2013) and Southern Ethiopia (Asha, 2005; Bitew et al., 2011; Demissie et al., 2013). Asha (2005), in his study in Southern Ethiopia, showed that *Teladorsagia* spp. was limited in distribution to the highland areas. *Ostertagia/Teladorsagia* is important, especially in temperate climates and subtropical regions (Urquhart et al., 1996).

This study revealed an overall prevalence of 55.7% for abomasal nematodes in sheep and goats which is low compared to 86.7% prevalence recorded in Bishoftu in central Ethiopia (Abunna et al., 2009) but higher than

30.98% reported from Iran (Nabavi et al., 2011). The host specific prevalence of abomasal nematodes recorded in our study (60.2% for sheep and 45.2% for goats) was low, compared to reports from central (83.6 and 77.6%) (Abunna et al., 2009), southern (82 and 76.4%) (Demissie et al., 2013) and eastern part of the country (92.9 and 90.2%) (Kumsa and Wossene, 2006).

A prevalence of 53.5% and 43.5% for *Haemonchus* spp. and 48.7% and 26.1% for *T. axei* was registered in sheep and goats, respectively. The prevalence of *Haemonchus* spp. both in sheep and goats was low compared to reports from different parts of the country which ranged from 75.9 to 91.2% in sheep and from 55.9 to 82.9% in goats (Kumsa and Wossene, 2006; Abunna et al., 2009; Bitew et al., 2011; Demissie et al., 2013). The prevalence of *T. axei* in sheep (48.7%), observed in this study, is low compared to 90.4% reported from central Ethiopia (Abunna et al., 2009) while it is high compared to the 25.7% (Demissie et al., 2013) and 37.7% (Kumsa and Wossene, 2006) prevalence reported from southern and eastern part of the country, respectively. The 26.1% prevalence of *T. axei* in goats is low compared to 81.3% prevalence recorded in Central Ethiopia (Abunna et al., 2009) and 40.2% prevalence from Eastern Ethiopia (Kumsa and Wossene, 2006). However, it was higher than 9.8% reported from Hawassa in South Ethiopia (Demissie et al., 2013).

The variation in prevalence among the different studies may be due to differences in agro-ecological conditions. The fact that the present study was conducted in dry season in slaughter animals may have underestimated the prevalence of abomasal nematodes in sheep and goats in the study area as helminth prevalence is high in the wet seasons (Bekele et al., 1987; Regassa et al., 2006) and animals with better body conation usually are preferred for slaughter.

Species of the host had no significant effect ($P = 0.07$) on *Haemonchus* spp. prevalence. This is consistent with reports from Central Ethiopia (Abunna et al., 2009; Shankute et al., 2013). *T. axei* prevalence, however, was higher in sheep (48.7%) than in goats (26.1%). A number of previous studies in Ethiopia have reported high prevalence of helminthes in sheep than in goats (Negasi et al., 2012; Zeryehun, 2012). On the other hand, in a coprological study conducted in Central Ethiopia, Kumsa et al. (2011) could not find significant difference in prevalence of nematodes between sheep and goats. As goats generally prefer to browse than graze, they were expected to be less affected with gastrointestinal parasites than sheep.

The adult worm count of *Haemonchus* in sheep (413.0) and goats (316.5) in our study is high compared to the count recorded (275.44 and 245.31) in Central Ethiopia. However, the count of *T. axei* in our study (225.3 in sheep and 71.3 in goats) is low compared to 469.3 and 395.3 recorded in the same study (Abunna et al., 2009).

Research outputs in Ethiopia (Regassa et al., 2006; Sissay et al., 2007) and elsewhere (Lone et al., 2012) indicated the influence of geographical location on parasite prevalence and burden. Contrary to this, origin of the animals had no effect on prevalence and count of abomasal nematodes in our study.

We found body condition significantly associated ($P < 0.001$) with the prevalence and worm count of *Haemonchus* and *T. axei* both in sheep and goats. This is in agreement with Shankute et al. (2013) who recorded highest prevalence of abomasal nematodes in sheep and goats with poor body condition. Chronic haemonchosis and trichostrongylosis are associated with weight loss, poor growth rates and inappetence (Urquhart et al., 1996). Sex was not associated ($P > 0.05$) with both prevalence and count of the parasites. Similarly, Regassa et al. (2006) did not find association between parasitic egg prevalence and count with sex. The species of the host had no statistically significant ($P = 0.0652$) effect on adult *Haemonchus* count. The count of *T. axei*, however, was very high in sheep than in goats ($P < 0.001$). Kumsa and Wossene (2006) reported higher mean monthly worm count in sheep than in goats.

All the infections observed in the present study fall under light to moderate degree. This was in a general agreement with reports from Ethiopia (Kumsa and Wossene, 2006; Shankute et al., 2013) and elsewhere in Africa (Almalai et al., 2008) where majority of the sheep and goats were affected with light to moderate degree of infection. Moderate infection with *Haemonchus* was reported to cause chronic anemia, severe loss of body condition and death in sheep grazing on poor quality pasture (Allonby and Urquhart, 1975).

This study added to the knowledge of the epidemiology of abomasal parasites in sheep and goats in Ethiopia in general and revealed that *Haemonchus* spp. and *T. axei* are prevalent with light to moderate degree of infection in small ruminants slaughtered in Bahir Dar. The information may be used in design and application of control strategies.

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Conflict of Interest

The author(s) have not declared any conflict of interests

REFERENCES

Abebe G, Yami A (2008). Sheep and Goat Management. In: Yami A.

- and Merkel, R.C., (Eds): Sheep and Goat Production Handbook for Ethiopia, Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP). pp 33-56.
- Abunna F, Tsedeke E, Kumsa B, Megersa B, Regassa A, Debella E (2009). Abomasal nematodes: prevalence in small ruminants slaughtered at Bishoftu town, Ethiopia. *Internet J. Vet. Med.* 7:3-12.
- Allonby EW, Urquhart GM (1975). The epidemiology and pathogenic significance of haemonchosis in a merino flock in East Africa. *Vet. Parasitol.* 1(2):129-143.
- Almalaik AH, Bashir AE, Abakar AD (2008). Prevalence and dynamics of some gastrointestinal parasites of sheep and goats in Tulus area based on post-mortem examination. *Asian J. Anim. Vet. Adv.* 3:390-399.
- Asha A (2005). Epidemiology of Gastrointestinal nematodiosis of small ruminants in three different agro-ecological zones of Southern Ethiopia. MSc Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.
- Bekele T, Kasali OB, Woldeab T (1992). Causes of lamb morbidity and mortality in the Ethiopian highlands. *Vet. Res. Comm.* 16(6):415-424.
- Bekele T, Mukasa-Mugerwa E, Scholtens RG (1987). Seasonal changes in nematode fecal egg counts of sheep in Ethiopia. *International Livestock Center for Africa (ILCA) Bulletin No. 29.*
- Bitew M, Yeshitla A, Belachew K (2011). Abomasal and Small Intestinal nematodes of Small Ruminants Slaughtered in Different Restaurants in Hawassa. *Vet. Res.* 4(2):39-44.
- Community-Supported Agriculture, CSA (2012). Report on Livestock and Livestock Characteristics (Private Peasant Holdings). Agricultural Sample Survey 2011/12 (2004 E.C.), Federal Democratic Republic of Ethiopia, Central Statistical Agency (CSA), Addis Ababa, Ethiopia.
- Demissie T, Tesfaye D, Fekadu A, Assefa I (2013). Study on abomasal nematodes of sheep and goats: Comparison and characterization of vulvar morphology of *Haemonchus* in Hawassa, Ethiopia. *Afr. J. Agric. Res.* 8(41):5181-5186.
- Hansen J, Perry B (1994). The Epidemiology, Diagnosis and Control of Helminth Parasites of Ruminants. *International Livestock Center for Africa, Addis Ababa Ethiopia.* pp 97-119.
- Kaur S, Singla LD, Hassan SS, Juyal PD (2008). Evaluation of Dot-ELISA for immunodiagnosis of *Paramphistomum epiclitum* in ruminants. *J. Parasitol. Dis.* 32:118-122.
- Kaur S, Singla LD, Hassan SS, Juyal PD (2013). Application of indirect plate ELISA in early diagnosis of paramphistomosis using purified polypeptides of somatic antigen of *Paramphistomum epiclitum*. *Trends Parasitol. Res.* 2(1): 9-15.
- Kumsa B, Wossene A (2006). Abomasal nematodes of small ruminants of Ogaden region, eastern Ethiopia: prevalence, worm burden and species composition. *Rev. Med. Vet.* 157:27-32.
- Kumsa B, Tadesse T, Sori T, Duguma R, Hussen B (2011). Helminthes of sheep and goats in central Oromia (Ethiopia) during the dry season. *J. Anim. Vet. Adv.* 10(14):1845-1849.
- Lone BA, Chishti MZ, Ahmad F, Tak H (2012). A Survey of Gastrointestinal Helminth Parasites of Slaughtered Sheep and Goats in Ganderbal, Kashmir. *Glob. Vet.* 8(4):338-341.
- MAFF (1977). Manual of Veterinary Parasitological Laboratory Techniques. Ministry of Agriculture, Fisheries and Food (MAFF), Agricultural Development and Advisory Service, Technical Bulletin No. 18. Her Majesty's Stationery Office, London.
- Nabavi R, Eslami A, Shokrani HR, Bokaie S, Shayan P, Saadat D (2011). Study on the prevalence, intensity and seasonal dynamics of abomasal helminths in sheep from different climatic zones of Iran. *World Appl. Sci. J.* 12:441-445.
- Negasi W, Bogale B, Chanie M (2012). Helminth parasites in small ruminants: prevalence, species composition and associated risk factors in and around Mekelle town, northern Ethiopia. *Eur. J. Biol. Sci.* 4(3):91-95.
- Njau BC, Kasali OB, Scholtens RG, Degefa M (1988). Review of sheep mortality in the Ethiopian highlands 1982-86. *International Livestock Centre for Africa (ILCA), Bulletin No. 31.*
- Petros A, Aragaw K, Shilima B (2014). Pre-weaning kid mortality in Adami-tulu Jedokombolcha district, mid Rift valley, Ethiopia. *J. Vet. Med. Anim. Health* 6(1):1-6.
- Regassa F, Sori T, Dhuguma R, Kiros Y (2006). Epidemiology of gastrointestinal parasites of ruminants in western Oromia, Ethiopia. *Int. J. Appl. Res. Vet. Med.* 4(1):51-57.
- Shankute G, Bogale B, Melaku A (2013). An Abattoir Survey on Gastrointestinal Nematodes in Sheep and Goats in Hemex- Export Abattoir, Debre Ziet, Central Ethiopia. *J. Adv. Vet. Res.* 3:60-63.
- Singla LD (1995). A note on sub-clinical gastro-intestinal parasitism in sheep and goats in Ludhiana and Faridkot districts of Punjab. *Indian Vet. Med. J.* 19:61-62.
- Sissay MM, Uggla A, Waller PJ (2007). Prevalence and seasonal incidence of nematode parasites and fluke infections of sheep and goats in eastern Ethiopia. *Trop. Anim. Health Prod.* 39:521-531.
- Urquhart GM, Armour J, Duncan JL, Dunn AM, Jennings FW (1996). *Veterinary Parasitology.* 2nd ed. Blackwell Science. pp 10-42.
- Zeryehun T (2012). Helminthosis of sheep and goats in and around Haramaya, southeastern Ethiopia. *J. Vet. Med. Anim. Health* 4(3):48-55.
- Zewde S, Lidetu D (2008). Sheep and Goat Flock Health. In: Yami, A. and Merkel RC, (Eds.), *Sheep and Goat Production- Handbook for Ethiopia, Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP).* pp. 213- 272.

Full Length Research Paper

Evaluation of safety and quality of surgical care at a Veterinary Teaching Hospital

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A retrospective review of 463 case notes of surgical procedures performed on dogs at the surgery unit of the Veterinary Teaching Hospital, University of Ibadan Nigeria between 2003 and 2013 was conducted to evaluate the level of compliance with safety and quality of care standards. Quality of patients' records of major surgical procedures was evaluated with reference to pre-surgical evaluation protocols, anesthetic protocols, events during and after operation, complications and surgical outcomes. The results showed that records of significant number of indicators of safety and quality evaluated were not documented in 69.23% of procedures. Records of anesthetic monitoring, pre-surgical protocol and post-operative follow-up were documented in only 5.83, 19.00 and 25.05% of procedures, respectively, while complications were recorded in 38.01% of procedures audited. Records of anesthetic and surgical risks assessments were not reported in over 80.00% of procedures while complications were documented in 38.01% of audited procedures. These findings indicate substantial non-compliance with standard practices and guidelines on documentation of surgical procedures and a possible influence on surgical outcomes.

Key words: Safety, quality, surgical, care.

INTRODUCTION

Establishment of standards for veterinary practice facilities, be it private or state owned, requires that some basic facilities irrespective of diversity and location of practices, must be put in place, to ensure safety and guarantee quality of practice. While the development of a single set of specific standards applicable to all practices is somewhat not realizable, the desirability of some general guidelines aimed at ensuring safety and good quality of practice had received tremendous appropriate attention by numerous regulating bodies globally. Key

among those guidelines are cleanliness and neatness of personnel and facilities, access to adequate equipment for resolution of diagnostic conflicts, adequate and complete patient and personnel records, proper equipment for anesthesia management and monitoring and provision of surgery in an aseptic environment with appropriate pre and post operative considerations (Russel, 2006; HSSEC, 2012).

Surgery being any procedure that exposes tissues normally covered by skin or mucosa can result in pain,

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damage to tissue and post-operative infections. It thus demands strict adherence to stringent guidelines, regarding training, surgical facilities, asepsis, surgical preparation, anesthesia, intra-operative records, analgesia, surgical technique and post-operative monitoring.

Attempts at producing high quality research information with respect to safety and quality of surgical practice have received tremendous boost in recent times. This is attested to by the number of institutions and decision-making and policy-formulating bodies that were established to help improve the safety and quality of surgical practice. To further underscore the importance of safety and quality in surgical practice, many organizations under the auspices of the Council on Surgical and Peri-operative Safety were established with a common goal that focuses on patient safety and promotion of policies and best practices that create safe and high quality healthcare environments. Among these institutions are: The Agency for Healthcare and Research Quality (HRQ); Anaesthesia Patient Safety Foundation (APSF); Joint Commission International for Patient Safety (JCIPS); Keystone Centre for Patient Safety and Quality (KCPSQ) and Vet Medical Board for Hospital Standards and Self Evaluation (HSSEC).

The ultimate goal globally regarding healthcare givers, whether human or veterinary is to deliver safe, high quality healthcare to patients in all clinical settings. This goal remains a tall order due to inadequacy in health systems resources particularly in a resource constrained setting, such as Nigeria (Kabe et al., 2006). Case note review methodology has been used by Peer Review Organizations through holistic implicit review methods, to determine standards of care, adverse events and clinical auditing in the U.S.A, Australia and the UK (Darzi, 2008). Despite its shortcomings, the use of case notes as the basis for assessing safety and quality of care is still almost universally used as a primary data source to provide process or care data and establish a relationship with outcome of care (Thomas et al., 2002).

The present study was informed by the need to develop best practices and guidelines for safe and quality surgical care in the study centre. It also aims at setting in processes for ensuring that surgeons and hospitals implement best practices by evaluating their level of compliance with minimum safety and quality of care standards required by law for best practices.

MATERIALS AND METHODS

A retrospective review of 654 case notes of surgical procedures performed on dogs at the surgery unit of the veterinary teaching hospital, University of Ibadan, between January, 2003 and December, 2013 was undertaken. All the procedures performed during the period under reference were classified into major and minor surgery. Procedures that involved entering into the body cavity (thorax, abdomen) and those with potential of having significant complications for example, orthopedic procedures were

classified as major and included in the study. Other procedures that did not meet these criteria were classified as minor and excluded from the study. Twenty nine diagnosed surgical cases were not treated either because it was considered that the animals would not benefit from treatment or owners could not afford the cost. They were excluded from the study. A critical analysis of the 463 out of 654 that satisfied the inclusion criteria, was painstakingly undertaken by evaluating the quality of detailed patient records contained in individual case files, with reference to pre-surgical evaluation protocol, anesthetic induction, maintenance and monitoring including complications, events during operative procedure, surgical antibiotic prophylaxis, surgical outcomes/fatalities, post-operative complications including surgical site infection and post-operative follow-up. Data obtained were subjected to descriptive statistical analysis.

RESULTS AND DISCUSSION

A total of 654 surgical procedures were documented during the period of study. Table 1 shows the categorization of procedures performed on the animals. Of the 654 procedures audited, 463 (70.79%) and 191 (29.21%) were categorized as major and minor, respectively. Open reduction of fracture/luxation were the most performed major procedure (201 out of 463; 43.41%), while splenectomy and cyatotomy procedures were the least performed and recorded (3 out of 463; 0.65%). Records of anesthesia used and prophylactic antibiotic administration were documented in all the procedures evaluated (Figure 1). Records of post-operative follow-up, pre-surgical evaluation tests, temperature maintenance during surgery and anesthetic monitoring were not documented in about 75.00% or more of procedures. Distribution of recorded complications according to procedures is presented in Table 2.

Percentage in Parentheses

One hundred and seventy six (38.01%) of the procedures audited were attended with various complications which included surgical site infections (14.47%), anesthetic complications (3.67%), post-operative complications aside from surgical site infections (18.79%) and fatalities (1.07%). Among the procedures evaluated, open reduction of fracture/luxation was associated with the highest number (91 out of 201; 45.2%) of recorded complications.

Medical record review has become a standard means of assessing quality and safety of care. This is despite uncertainty about which methods of record review are most effective and reliable (Hutchison et al., 2010). Similarly, review of quality care as described in written case notes has become a standard means of assessing variation from quality standard and for identifying adverse incidents, either concerning individual or groups of patients (HSSEC, 2012).

The present study utilized criterion-based review method that assessed quality of care that is anchored on a set of specific criteria, drawn from information from

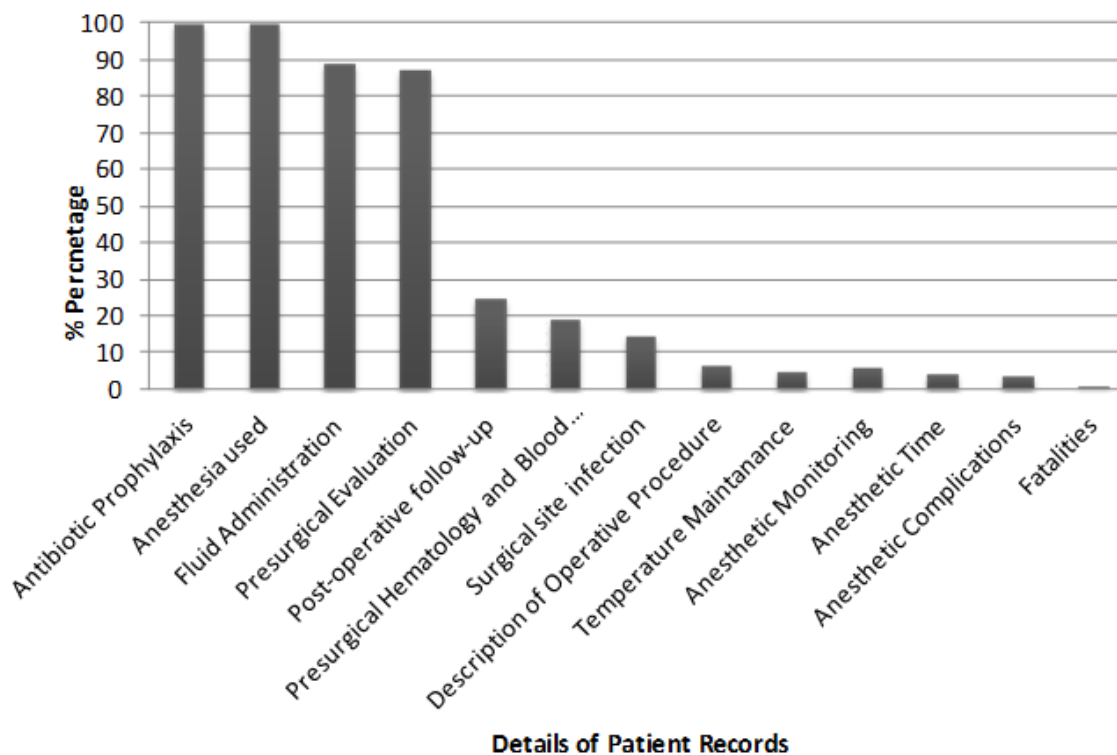


Figure 1. Details of patient records on 463 documented major surgical procedures evaluated (2003-2013).

Table 1. Categorization of major surgical procedures documented (2003-2013).

Procedure	Number (n)	Percentage (%)
Open Reduction of fracture/Luxation	201	43.41
Ovariohysterectomy	119	25.70
Caesarian operation	62	13.39
Hernioraph/Hernioplasty	26	5.62
Intestinal Procedures	17	3.67
Gastric Operation	11	2.37
Eye Operation	8	1.72
Thoracotomy/Esophagotomy	4	0.86
Ear Resection	5	1.08
Exploratory Lapatomy	4	0.86
Splenectomy	3	0.65
Cystotomy	3	0.65
Total	463	100

patients from patients' record. Safety and quality of surgical care was evaluated using information regarding the process, procedure, complications and outcome of surgical procedures as documented in individual case files of the hospital. Quite a substantial number of documented procedures (70.79%) performed in the hospital during the period under reference were

categorized as major surgeries. This class of procedures requires adequate attention to safety and quality of care, in addition to demanding greater skill and precision on the part of the surgeon, to influence positive outcome.

Most performed procedure, open reduction of fracture/luxation was attended with incidence rates of post-operative complication and surgical site infection of 21.39

Table 2. Distribution of documented complications of major surgical procedures.

Procedure	No. of complications documented	Distribution complication			
		Surgical site infection	Anesthetic complications	Post-operative complications	Fatalities
Ovariohysterectomy (n=119)	47 (39.49)	18 (15.12)	5 (4.20)	24 (20.16)	-
Caesarian operation (n=62)	16 (25.80)	3(4.83)	2(3.22)	9 (14.51)	2 (4.83)
Gastric procedures (n=11)	2 (18.18)	--	--	(9.09)	--
Intestinal procedures (n=17)	6 (35.29)	3 (17.64)	2 (11.76)	1 (5.88)	--
Herniorrhaphy/Hernioplasty (n=26)	8 (30.76)	2(7.69)	1(3.84)	4(15.38)	1 (3.84)
Open Reduction of fracture/luxation (n=201)	91 (45.27)	39(19.4)	7 (3.48)	43(21.39)	2 (0.99)
Thoracotomy/esophagotomy (n=4)	1(25.00)	--	--	1 (25.00)	--
Splenectomy (n=3)	--	--	--	--	--
Eye operation (n=8)	2 (25.00)	--	--	2 (25.00)	--
Ear Resection (n=5)	2 (40.00)	1(20.00)	--	1 (20.00)	--
Cystotomy (n=3)	1 (33.33)	--	--	1 (33.33)	--
Exploratory Laparotomy (n=4)	--	--	--	--	--
Total (n=463)	176 (38.01)	67(14.47)	17 (3.67)	87 (18.79)	5 (1.07)

and 19.40%, respectively. These findings are considered high when compared with previous reports (Idowu et al., 1994; Morgan et al., 2008). Management of fractures is reported to pose serious challenges to clinicians due to failure of treatments resulting from faulty clinical management and pre, peri and post-operative complications (Idowu et al., 1994; Halling et al., 2002). Surgical outcomes from this most performed procedure may to a large extent, be an indicator of safety and quality of care received at the hospital. Based on the quality of available patient records which was considered to be quite inadequate, the incidence of post operative complications reported in this study may probably not represent the true values, perhaps higher in the opinion of the author.

The quality of records contained in the case notes reported in this study was most unsatisfactory, as it fell short of the guidelines as stipulated by regulating bodies (Hutchinson et al., 2010).

Records of anesthetic and surgical risk assessment through preoperative hematology, blood biochemistry and urinary tests were not documented in over 80% of procedures. Similarly, documentation with respect to anesthetic monitoring and temperature maintenance during surgery were not documented in about 95% of procedures audited. These factors have been reported to influence surgical outcomes (Mant, 2001). Since evaluation of safety and quality of care through case notes review is critically dependent on the quality of information obtained from case notes, it is the opinion of the author that the indices of safety and quality of surgical care as reported in this study may be suggestive of apparent deviation from standard practices and minimal compliance with safety and quality guidelines (Russel, 2006). Veterinary Medical Board Hospital Standard Self Evaluation Check-list recommend that record keeping of surgical procedure shall include a description of the procedure, the types

of anesthesia, prophylactic antibiotic medication used and the route of administration; anesthesia monitoring include all events that occur, pre, peri and post-operative (HSSEC, 2012).

Review of quality care as described in written case notes has become a standard means of assessing variation from quality standards and for identifying adverse incidents, either concerning individuals or groups of patient (Vincent et al., 2004; Krecker et al., 2009). Assessment of the quality of recording in case notes using appropriate clinical guidelines has equally been used to seek associations between recorded quality of care and outcomes (Hutchinson et al., 2010).

The low fatality reported in the study may not be a true reflection of the actual situation, considering the fact that records of post-operative follow-up was not documented in a significant number of major procedures performed. It may equally be said that fatalities probably maybe more than the 5 (1.07%) reported in this study. Lack of information

on fatalities with respect to 98.93% of procedures hindered an objective evaluation of safety and quality based on surgical outcomes. Previous studies have documented the use of surgical outcomes for evaluation of safety and quality of care (Russel, 2006; Kruckler, 2009). Some of the reports were anchored on textual review in which quality of care was assessed using the reviewers' professional opinion, while others were based, as it was in this study, the use of specific criteria drawn from patient records (Vincent et al., 2004; Hutchison et al., 2010).

Research into surgical outcomes for assessment of safety and quality has primarily focused on the role of patients' pathological risk factors and on the skills of the surgeon aside from quality of patients' records. The role of patients' pathophysiological risk factors, as well as the skills of the Surgeons that performed the operative procedure, were not determined in this study due to insufficient information. Outcomes of surgery as an evaluation tool is also dependent on the quality of care received throughout the patients stay in the hospital and the performance of a number of health professionals/support staff. All these factors are also subject to the environment in which they operate (Hutchinson et al., 2010). Records of hospital stay and the role of other health professionals in the prosecution of procedures were not documented in the case notes evaluated in this study.

An incidence rate of 38.01% complications that attended major procedures evaluated in this study is quite instructive. Notwithstanding the low fatality reported, the observed incidence rate of complication in the author's opinion may be an indicator of the level or degree of safety and quality of care provided in the hospital. The findings of this study suggest a compromised process procedure of safety and quality of care in the hospital characterized by non-compliance with standard practices and surgical care guidelines (Krucker et al., 2009; HSSEC, 2012). Tools for assessment of safety and quality of surgical practice are normally anchored on the reviewed criteria generated by National clinical guideline. This presently does not exist in Nigeria. Every country needs to review these guidelines from time to time as these remain a significant part of tools needed in formulation of any new quality improvement programmes.

In view of the need to develop best practices and guidelines for safe and quality surgical care in Nigeria, the author recommends the establishment of Veterinary Hospital Standards Evaluation Board by the Veterinary Council of Nigeria (VCN) to review the minimum standards for safe and quality surgical practice and enforcement of strict compliance with the guidelines of the board. This will be achieved through random routine inspection and compliant initiated inspections.

Limitations of study

The tools used in the study have its shortcomings. There

is need to expand operative assessment beyond patient's factors. The technical skill of the surgeon and other health professionals including available surgical facilities should be considered in the evaluation process. Evaluation of safety and quality of surgical care based on retrospective case note review are insensitive for detecting potential adverse effects (Sari et al., 2007). Evaluation based on care process that takes cognizance of frequency of harmful outcomes and detection of potential adverse events would be more effective in monitoring care quality and safety (Kreckler et al., 2009).

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Conflict of Interest

The author(s) have not declared any conflict of interests

REFERENCES

- Darzi A (2008). High Quality Care for All. NHS Next Stage Review Final Report, Department of Health, London, U.K.
- Halling KB, Lewis DD, Cross AR, Kerwin SC, Smith BA, Kubilis PS (2002). Complication rate and factors affecting outcome of olecranon osteotomies repair with pin and tension-band fixation in dogs. *Can. Vet. J.* 43(7):528-534.
- Hutchinson A, Coster JE, Cooper KL, McIntost AJ, Walters SJ, Bath PA, Pearson TA, Young K, Rantell TA, Campbell MJ, Ratcliffe J (2010). Comparison on case note review methods for evaluating quality and safety in healthcare. *Health Tech. Asses.* 14:10.
- Idowu AL, Adetunji A, Atilola MA, Babalola GO (1994). A three year survey of fractures in Dogs. *Trop. Vet.* 12(2):200-206.
- Kabe SM, Orchard C, Howard Jh, Sariano MA, Lebec R (2006). The importance of human resources management in health care: A global context. *Hum. Resour. Health* 4(20):1-17.
- Kreckler S, Catchpole KR, New SJ, Handa A, McCulloch PG (2009). Quality and safety on an acute surgical wound: an exploratory cohort study of process and outcome. *Ann. Surg.* 250(6):1035-1040.
- Mant J (2001). Process versus outcome indicators in the assessment of quality healthcare. *Int. J. Qual. Health Care* 13:475-480.
- Morgan OD, Reetz JA, Brown DC, Tucker SM, Mayher PD (2008). Complication rate, outcome and risk factors associated with surgical repair of fractures of the lateral aspect of the humeral condyle in dogs. *Vet. Comp. Orthop. Traumatol.* 21(5):400-405.
- Russel T (2006). Safety and Quality Improvement in Surgical Practice. *Ann. Surg.* 244(5):653-655.
- Sari AB, Sheldon TA, Cracknell A (2007). Extent, nature and consequences of adverse effects: result of a retrospective case note review in a large NHS hospital. *Qual. Safe Health Care* 16:434-439.
- Thomas EJ, Studdert DM, Brennan TA (2002). The reliability of medical records review for estimating adverse event ratio. *Ann. Int. Med.* 136:812-816.
- Veterinary Medical Board (VMB) (2012). Hospital Standards Self Evaluation Checklist (HSSEC).
- Vincent C, Moorthy K, Sarker SK, Anvil Chang, Darzi A (2004). System approaches to surgical quality and safety. *Ann. Surg.* 239(4):475-482.
- World Health organization (WHO) (2009). Guidelines for safe surgery. Geneva, World Health Organization.



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