Journal of Veterinary Research Advances
ISSN: 2582-774X

Research Article
Open access

Prevalence of parasitic helminthes of veterinary and zoonotic importance among cattle, sheep and goats slaughtered in Sabon – Tasha Abattoir, Chikun LGA, Kaduna State, Nigeria

Eke SS[1*], [1]Michael NE, [1]Owoh Etete U, [2]Josiah JG, [1]Bello RO, [3]Nnaji CI, [4]Odoh VU, [5]Hussaini FA and [6]Ogunwole AT

[1]Biology Unit, Air Force Institute of Technology, Kaduna, Kaduna State, Nigeria
[2]Deparment of Biotechnology, Mewar International University, Masaka, Nasarawa State, Nigeria
[3]National Biotechnology Development Agency, Abuja, Nigeria
[4]Biology Department, Kogi State College of Education (Technical), Kabba, Nigeria
[5]Department of Zoology, Nasarawa State University, Keffi, Nigeria
[6]Department of Chemistry, Federal College of Education, Odugbo, Benue State, Nigeria

Corresponding author: ekesamuel2012@gmail.com

Received on: 03/10/2023 Accepted on: 11/05/2024 Published on: 21/05/2024

ABSTRACT

Aim: The study was aimed investigate and provide data on the prevalence and zoonotic impact of parasitic helminthes of ruminants slaughtered in Sabon-Tasha Abattoir, Chikun LGA of Kaduna State, Nigeria.
Method and materials: Faecal samples were collected and examined using direct wet mount and sedimentation methods, respectively. A total of 329 diarrhoeic faecal samples were collected from 117 Cattle, 102 Sheep, and 110 Goats, respectively.
Results: Of the total 329 faecal samples collected and examined, 65.96% were positive for gastrointestinal helminthes parasites. Goats had higher prevalence of gastrointestinal parasites 84.55%, while Cattle and Sheep had a prevalence of 55.56 % and 57.84%, respectively. The difference in the three species of ruminants was statistically significant ($p<0.05$). Males had the highest infection 58.06% than females as 41.94%. In sheep, young animals were more infected than the adult animals with 54.24% and 45.76% respectively. Also, in goats, adult animals had the highest infection rate of 61.29% than the young animals 38.71%, while in Cattle, adult animals recorded the highest infection rate of 60.0% than the young animals 40.0%. There was no significant difference ($p>0.05$) on the infection rate in relation to sex and age. Considering the months of study, the overall prevalence of 23.05%, 16.13%, 21.20%, 17.05%, and 22.12% were recorded in the months of July, May, April, August, and June. The differences in infection rates were not statistically significant ($p>0.05$) even though the prevalence was higher in the month of July.
Conclusion: It was concluded that helminthosis, especially haemonchosis is a threat to small ruminants in the study area. Based on the observations, it has been highlighted the urgent need for the development of epidemiologically-based control strategies for control of helminth parasites of small ruminants in this area.

Keywords: Diarrhoea, gastrointestinal parasites, prevalence, ruminant, Sabon-Tasha.

Cite This Article as: Eke SS, Michael NE, Owoh Etete U, Josiah JG, Bello RO, Nnaji CI, Odoh VU, Hussaini FA and Ogunwole AT (2024). Prevalence of parasitic helminthes of veterinary and zoonotic importance among cattle, sheep and goats slaughtered in Sabon – Tasha Abattoir, Chikun LGA, Kaduna State, Nigeria. J. Vet. Res. Adv., 06(01): 20-27.

Introduction

Helminths of ruminants refer to a group of complex multi cellular eukaryotic parasites which are infective to animals and humans in which case they are called zoonoses (Garcia *et al*., 2007). The group of parasite cause serious economic and public health problems in many resource-limited countries across the globe. The problems are influenced by inadequate health care as well as inadequate policies on disease control among other factors in Nigeria (Ugbomoiko *et al*., 2008).

Helminth parasites of ruminants are broadly grouped into two phyla, namely nemathelminthes which are nematodes or roundworms such as *Haemonchus, Bonostomum, Oesophagostomum* and Chabertia and platyhelminthes which include cestodes (e.g. *Avitellina, Moniezia, Stilesia* and *Taenia*) and trematodes such as *Dicrocoelium, Eurytrema, Fasciola* and *Paramphistomum* (Urquhart *et al*., 2003). Transmission of these parasites may be through the ingestion of parasitic eggs and infective larvae on contaminated pasture, water, soil, human hands or tissues of infected vertebrate intermediate hosts, skin penetration, transplacental as well as arthropod and gastropod intermediate

hosts (Greenland *et al*., 2015). Transmission is influenced by factors including poor hygiene and sanitation, indiscriminate and open defecation (Lee *et al*., 2010), as well as environmental factors like temperature, humidity, rainfall (Steinmaann *et al*., 2007) and soil moisture (Cundill *et al*., 2011). Lack of strategic deworming of livestock (WHO, 2002; Brooker and Michael, 2007), poverty and overcrowding (Brooker *et al*., 2004) are additional factors.

The negative impacts of helminthes on livestock productivity still remain a major challenge in the livestock industry globally (Wilson, 2011) despite the projected increased dependence on agriculture in the nearest future (Herrero and Thornton, 2013).

These parasites cause serious economic losses in ruminants ranging from growth rate decrease and poor quality of skin and hides to reductions in the production of milk, meat and wool (Qamar *et al*., 2011). For instance, evidence revealed that lactating cows may lose 294.8 kg of milk on average perlactation due to helminth parasites (Nodtvedt *et al*., 2002). In Nigeria, infection prevalence rates range between 25.6 and 91.4% (Ibukun and Oludunsin, 2015; Odeniran *et al*., 2016). Economic losses caused by the rejection of editable organs of slaughtered food animals during veterinary meat inspections were also documented (Danbirni *et al*., 2015; Karshima *et al*., 2016a).

From the public health point of view, reports of zoonotic meta-cestodes; *Cysticercus bovis* and hydatid cyst (Rabiu and Jegede, 2010; Okolugbo *et al*., 2014), nematode; *Oesophagostomum* (Adedipe *et al*., 2014; Ani and Nshiru, 2015; Nwoke *et al*., 2015) and trematodes; *Dicrocoelium dendriticum, Eurytrema pancreaticum* and *Fasciola gigantic* (Karshima *et al*., 2016a) entering the food chain in Nigeria are of great public health concern. Human infections with these parasites may result in diarrhoea, retarded growth, intellectual and cognitive retardation (Hotez *et al*., 2004), cystic echinococcosis and cysticercosis (Diop *et al*., 2003).

The livestock industry plays a vital role in the economy of Nigeria. It serves as a major source of income and livelihood for majority of Nigerians who are rural settlers and contributes about 5.2% of the National Gross Domestic Product (GDP) (Adedipe *et al*., 1996). In addition, cattle, sheep and goats contribute over 80% of the total meat produced in Nigeria (Ugwu, 2007). Despite these benefits, helminth infections still cause serious economic losses in Nigeria as a result of reductions in milk production, weight gain, fertility and carcass quality. The aim of this study was to provide epidemiological information which will help in instituting sustainable control programmes against these parasites, thus reducing economic losses associated with these helminthes and maximizing the contribution of the livestock industry to Nigeria's GDP.

Materials and Methods

The study was carried out in Sabon – Tasha, Kaduna State, Nigeria and study area was Sabon – Tasha abattoir. Kaduna State is a state of the Federal Republic of Nigeria located in the northwestern geopolitical zone of the country. Kaduna is one of the largest centres of education in Nigeria.

Study Design and Sample Size: A cross-sectional type of study was done. The sample size was calculated according to the formula given by Thrusfield (2005) by using 95% level of confidence and expected prevalence was 89.1% from previous study of Ajanusi and Chiezey (2005) and desired absolute precision of 5%. Therefore, Three hundred and twenty nine (329) faecal samples were collected. One hundred and seventeen (117) from Cattle, 110 from Goats, and 102 from Sheep.

Faecal Samples Collection and Analysis: Faecal samples were collected directly from the rectum of the animals using clean disposable polythene gloves, as described by Pratt, (Oyerinde, 1999). These were taken to the faculty of Science general laboratory, Air Force Institute of Technology, Kaduna, and were processed immediately. After simple flotation, all nematode eggs were identified using a combination of keys given by Foreyt (2001). The nematode eggs present were identified in general terms as strongylid eggs, except for the eggs of *Moniezia, Strongyloides* and *Trichuris* species.

Parasitological Examination: In Endoparasites, 5gm of each fresh faecal samples of each sheep and goats will be collected, smashed with glass rod, using direct wet mount, a drop of normal saline was placed at the center of a clean slide, with a pipette dispenser. With an applicator stick a small quantity of the smashed faecal matter was mixed with a drop of normal saline to form smear. This was covered with cover slip for some minutes and viewed under the microscope with X40 objective lens. The parasites observed were isolated into different vials for further identification (Cheesbrough, 2005).

Data Analysis: The data obtained were reduced to Tables and charts. The percentage Prevalence of parasite species was calculated as number of individuals of a host species infected with a particular parasite species divided by the number of host examined times 100. Chi- square was used to test for association between the presence of helminths eggs and variables like sex, age, species and months of the study period. Value of $p< 0.05$ was considered significant.

Results and Discussion

Overall Prevalence of Gastrointestinal Helminth Eggs Encountered in Sabon – Tasha Abattoir: A total of Three hundred and Twenty Nine (329) faecal samples from 117 Cattle, 110 Goats and 102 Sheep were examined for the presence of helminth eggs. The overall prevalence of helminth eggs in ruminants was observed (Table 1). The overall prevalence of helminth eggs recorded was 217 (65.96%). Goats had higher prevalence of gastrointestinal parasites 93 (84.55%) as compared to Sheep 59 (57.84%) and Cattle 65 (55.56%). The difference in three species of ruminants was statistically significant ($p<0.05$).

Prevalence of Gastrointestinal Helminths in Relation to Sex and Age of Ruminants in Sabon – Tasha Abattoir: Gender and Age wise prevalence of gastrointestinal helminths ruminants were also observed. Based on gender, the males had the highest infection 126 (58.06%) than their female counterparts 91 (41.94%) of gastrointestinal helminthes. There was no significant difference ($p = 3.847$) on infection rate in relation to gender. The comparison of the frequency of infection between young and adult age groups of the animals showed that in sheep, adult animals were more frequently infected than the young animals with 123 (56.68%) and 94 (43.32%) respectively. Also, in goats, adult animals had the highest infection rate of 57 (61.29%) than the young animals 36 (38.71%), while in Cattle, adult animals recorded the highest infection rate of 39 (60.0%) than the young animals 26 (40.0%). In sheep, young animals were mostly infected 32 (54.24%) as compared to adult animals with an infection rate of 27 (45.76%) There was no significant difference ($p>0.05$) on infection rate in relation to sex and age.

Prevalence of Gastrointestinal Helminthes in relation to the months of the study period in Sabon – Tasha Abattoir: Considering the months of study, the overall prevalence of 51 (23.05%), 35 (16.13%), 46 (21.20%), 37 (17.05%), and 48 (22.12%) were recorded in the months of July, May, April, August, and June, respectively. The differences in infection rates were not statistically significant ($p>0.05$) even though the prevalence was higher in the month of July. Cattle were mostly infected in June 17 (24.64%) followed by August with 16 (23.19%). Goats had higher infection rate of 34 (24.46%) in July while Sheep were mostly infected in April with 14 (25.93%) (Table 3).

Prevalence of each species of Gastrointestinal Helminthes ova in Ruminants in relation to Species: This study revealed the presence of Eight (8) parasites of various genera in Cattle, Sheep and Goats. These include; *Fasciola* sp (11.98%), *Taenia* sp (11.06%), *Monieza* sp (11.52%), *Haemonchus* sp (23.04%), *Trichuris* sp (10.14%), *Strongyloides* sp (11.52%), *Ascaria* sp (12.90%), and *Oesophagostomum sp* (7.83%). *Haemonchus* sp. was the most prevalent 50 (23.04%) helminth parasite encountered followed by *Ascaria* sp 28 (12.90%), while *Oesophagostomum* sp. 17 (7.83%) was the least prevalent helminth parasite encountered. In Cattle, *Haemonchus* sp had the highest prevalence of 15 (23.08%) of gastrointestinal helminth parasites followed by *Taenia* 9 (13.83%), while *Oesophagostomum* sp was the least prevalent 5 (7.69%) helminth parasite recorded. In Goats, *Haemonchus* sp. was the most prevalent 23 (24.73%) intestinal helminth parasite followed by *Strongyloides* sp. 13 (13.98%), while *Trichuris* sp and *Taenia* sp were the least prevalent 8 (8. 60%) each intestinal parasites encountered. *Haemonchus* sp was also the most prevalent helminth parasite 12 (20.34%) in Sheep, followed by *Fasciola* sp and *Monieza* sp 11 (11.83%) each, while *Oesophagostomum sp* recorded the least 3 (5.08%) number of helminth parasites (Table 4 and Fig 1). The distribution of parasites ova in sheep and goats showed no significant difference.

Gastrointestinal parasitic helminths infection is a worldwide problem for both small and large scale farmers. Infection by gastrointestinal parasitic helminths in small ruminants including sheep, goats, and cattle can result in severe loses. Economic losses caused by gastrointestinal parasitic helminths vary in so many ways. It was caused loses through infertility, reduced work capacity, a reduction in food intake and lower weight gains, treatment costs, and mortality in heavily parasitized animals (Waller, 2006).

The result of the faecal examination during the study revealed an overall prevalence rate of helminths as 217 (65.96%) in small ruminants examined at Sabon – Tasha abattoir. The prevalence

of gastrointestinal parasitic helminthes infection among small ruminants were showed that goats had highest prevalence of parasitic infection 93 (84.55%) as compared to sheep 59 (57.84%) and cattle 65 (55.56%). These findings were higher than results of other surveys in sheep and goat carried out in North-eastern Nigeria (Nwosu *et al*., 2007) and lower than 78.54% recorded by Eke *et al*. (2020) in Minna Niger State, Nigeria.

The variations in these parasitic helminthes may be attributable to factors including grazing habits, nutritional status, husbandry and production systems, host immunological status (McNeilly and Nisbet, 2014), availability of intermediate hosts as well as the number of viable infective larvae and eggs in the environment (Radostits *et al*., 1994). The differences between time of sample collection and analysis as well as the specificity and sensitivity of the diagnostic methods employed by the various studies may also be possible reasons for the variations in the parasitic helminthes infections. Studies from Ethiopia (Sissay *et al*., 2007) and Andhra Pradesh, India (Murthy and Rao, 2014) also reported similar helminth species as those reported in Nigeria.

From economic standpoint, cattle and small ruminants (sheep and goats), serve as major sources of income and livelihood, and contribute 50 and 35% of the total meat produced in Nigeria, respectively (Ugwu, 2007; Adedipe *et al*., 2014) despite the fact that over 90% of them were managed traditionally with inadequate veterinary care (Tibi and Aphunu, 2010). Therefore, this study which provided information on the burden of helminth infections in cattle and small ruminants became necessary to curtail economic losses that may be associated with unidentified and uncontrolled helminth infections.

The high prevalence of these parasitic helminthes observed in goats was in agreement with the findings of Solomon-Wisdom *et al*. (2014) and Nwigwe *et al*. (2013) who in their independent studies reported that gastrointestinal parasitic helminths were more dominant in goats and were among the successful parasites of animals because of their sufficient life cycle ranging from the very simple to the extremely complicated stage. The high prevalence might be due to the system of management that these goats were subjected to as they were always left to wander about scavenging and feeding indiscriminately on anything they come in contact with and then return to their poorly kept sheds. These findings were in agreement with the work of Forse (1999) and Adejinmi *et al*. (2015) who stated that animals are exposed to massive parasitic infections when they are kept in poor ranches/conditions and also when they are fed with contaminated food and water. Higher humidity and rainfall recorded in the study area could be another contributing factor to the high prevalence of gastrointestinal parasitic helminthes recorded in the study area. The prevalence however, agrees with previous reports from other geographical regions of Nigeria which ranged from 77 - 100% (Nwosu *et al*., 1966a, 1996b; Okaiyeto *et al*., 2008; Jatau *et al*., 2011).

The study revealed that the gender (sex) of the animal did not show any significant difference in prevalence, even though the rate was higher in males. Adua and Hassan (2016) reported that gender does not really have direct influence on the epidemiology and distribution of gastrointestinal parasitic helminthes infection among sheep, cattle, and goats. The absence of gender difference in parasitic infection was also consistent with other reports (Hassan *et al*., 2013b; Keyyu *et al*., 2003; Regassa *et al*., 2006; Ghanem *et al*., 2009). These findings were corroborated the report of Eke *et al*. (2019) who reported a higher prevalence of gastrointestinal parasites among small ruminants in Minna. This disagrees with the reports of Dagnachew *et al*. (2011) who reported a higher prevalence rate of helminth infection in females.

In respect to age of the animals studied, adult animals recorded the highest number of gastrointestinal parasitic helminth infection 123 (56.68%). This finding were in agreement with the reports of Nwosu *et al*. (2007) and Ntonifor *et al*. (2013) which clearly showed that adult animals could have been harbouring matured worms. Age was considered an important risk factor in gastrointestinal helminthosis. Several authors have documented that adult animals are more pruned to infection (Urquhart *et al*., 1996; Tawar *et al*., 2010) as they mature due to repeated exposure (Dagnachew *et al*., 2011).

The relative proportion of each of the seven genera recovered in this study is similar to the reports of Fakae (1990b) and Gadahi *et al*. (2009), who suggests that *Haemonchus* is the predominant helminth of small ruminants in the country. It has been suggested that *Haemonchus* can acquire resistance to environmental factors faster than other gastrointestinal nematodes, like *Trichostrongylus*,

because of its high biotic potential (Torres – Acosta *et al*., 2003). This probably accounted for its high prevalence and total worm burden in this study. The helminth egg types recovered in this study were *Haemonchus, Strongyloides, Fasciola, Oesophagostomum, Ascaria, Taenia sp, Trichuris* and *Moniezia*. The result showed that *Haemonchus* ova were the most prevalent with prevalence rate of 23 (24.73%) in goats, cattle 15 (23.08%) and sheep 12 (20.34%) *Moniezia* egg was higher in sheep 21 (17.36%). This result was in line with the previous report from other geographical regions in Nigeria (Nwosu *et al*., 1996a, 1996b) and in Ethiopia (Tesfaheywet, 2012).

The findings of this study have several implications. Looking from the epidemiological point of view, the detection of helminths in congregations of livestock like markets and abattoir may suggest possible increased risk of transmission of these parasites as majority of farmers buy these animals from the markets and abattoirs and introduce them into their herds without any veterinary care. On the other hand, the presence of these helminths in ruminants on farms may probably cause contamination of grazing pasture and sources of drinking water for these animals resulting in new foci of infections. There are obvious public health implications of finding zoonotic helminths like hydatid cyst, *Cysticercus bovis, Fasciola gigantica* and *Oesophagostomum* sp. among others in ruminants. These include the risk of environmental contamination that may result in human infections or of acquiring such infections through the consumption of slaughtered food animals that enter the food chain. These parasites are associated with different conditions in humans ranging from diarrhoea, retarded growth, intellectual and cognitive retardation (Hotez *et al*., 2004) to cystic echinococcosis and cysticercosis.

Conclusion

In conclusion, it was established the overall prevalence rate of parasitic helminth infection through faecal examinations to be 65.96% in small ruminants. Goats had higher prevalence of helminth eggs 84.55%compared to cattle and Sheep. Seven (7) helminthes genera were recovered at faecal examinations namely, *Haemonchus sp, Strongyloides sp, Fasciola sp, Ascaria sp, Taenia sp, Oesophagostomum sp, Trichuris sp* and *Moniezia sp* in sheep, cattle, and goats. Of these parasitic helminths, *Haemonchus sp* was the most prevalent of all the helminthes than other genera encountered during the study while *Oesophagostomum sp* was the least prevalent.

The study had therefore, confirmed that helminthosis, especially haemonchosis is a threat to small ruminants in the study area. Based on these observations, this study has highlighted the urgent need for the development of epidemiologically-based control strategies for control of helminth parasites of small ruminants in this area. On-farm good agricultural practices including effective strategic deworming of livestock according to parasites' seasonality and abundance, ranching instead of nomadism, standard veterinary meat inspection and adequate hygiene and sanitation in abattoirs and livestock markets will reduce the economic, public health and veterinary threats caused by these parasites.

Reference

Adedipe NO, Bakshi JS, Odegbaro OA and Aliyu A (1996). Evolving the Nigeria Agricultural Research Strategy Plan: Agro-Ecological Inputs, National Agricultural Research Project (NARP).

Adedipe OD, Uwalaka EC, Akinseye VO, Adediran OA and Cadmus SIB (2014). Gastrointestinal helminths in slaughtered cattle in Ibadan, South-Western Nigeria. J Vet Med., 2014: 923561.

Adejinmi OO, Adejinmi JO, Falohun OO, Aderoju OR and Dauda WJ (2015). Prevalence of Gastrointestinal Parasites of Goats in Ibadan, Southwest, Nigeria. World Journal of Agricultural Research, 3 (2): 49-51.

Adua MM and Hassan DI (2016). Prevalence of Nematode Infestation in Goats reared in Nasarawa State, Nigeria. Nigerian J. Agri., Food and Environment, 12 (3): 79-84.

Ajanusi OJ andChiezey NP (2005). *Haemonchus contortu s*and some *haemosporozoan* infections in goats in Zaria. Nigerian Journal of Parasitology, 26: 13-17.

Ani OC and Nshiwu GN (2015). Assessment of intestinal parasites in goats slaughtered at Abakaliki abattoir, Ebonyi state, Nigeria. Nig. J Parasitol. 36(2): 81–4.

Brooker S and Michael E (2007). The potential of geographical information systems and remote sensing in the epidemiology and control of human helminth infections. Adv Parasitol., 47: 245–87.

Brooker S, Bethony J and Hotez PJ (2004). Human hookworm infection in the 21st century. Adv Parasitol., 58: 197–288.

Cheesbrough M (2005). District Laboratory Practice for Tropical Countries. Part 2. Cambridge University Press, UK. p. 434.

Cundill B, Alexander N, Bethony JM, Diemert D, Pullan RL and Brooker S (2011). Rates and intensity of re-infection with human helminths after treatment and the influence of individual, household, and environmental factors in a Brazilian community. Parasitology. 138: 1406–16.

Dagnachew S, Amamute A and Temesgen W (2011). Epidemiology of gastrointestinal helminthiasis of small ruminants in selected sites of North Gondar zone, Northwest Ethiopia. Ethiopia Veterinary Journal, 15: 57-68.

Danbirni S, Ziyauhaq H, Allam L, Okaiyeto SO, Sackey AKB (2015). Prevalence of liver condemnation due to fascioliasis in slaughtered cattle and its financial losses at Kano old abattoir, Nigeria. J Vet Adv., 5(6):1004–9.

Diop AG, de-Boer HM, Mandlhate C, Prilipko L and Meinardi H (2009). The global campaign against epilepsy in Africa. Acta Trop., 87:149–59.

Eke SS, Omalu ICJ, Ochaguba JE, Urama AC, Hassan SC, Otuu CA and Okafor ID (2019). Prevalence of gastrointestinal parasites of sheep and goats slaughtered in Minna Modern Abattoir, Niger State, Nigeria. J. Animal Sci. and Vet. Medicine, 4 (2): 65– 70.

Fakae BB (1990). Seasonal changes and hypobiosis in *Haemonchus contortus* infection in the West African Dwarf sheep and goats in the Nigerian derived savanna. *Veterinary Parasitology,* 36: 123- 130

Foreyt WJ (2001). Veterinary Parasitology Reference Manual, 5th. Edition. Blackwell Publishers, Iowa, Pp. 137-150.

Forse AM (1999). *Where there is no vet. 1st ed.* Macmillian press Ltd, London and Oxford publisher. Pp. 380.

Gadahi JA, Arshed MJ, Ali Q, Javaid SB and Shah SI (2009). Prevalence of gastrointestinal parasites of sheep and goat in and around Rawalpindi and Islamabad. Pakistan Veterinary World, 2 (2): 51-53.

Garcia HH, Moro PL, Schantz PM (2007). Zoonotic helminth infections of humans: echinococcosis, cysticercosis and fascioliasis. Curr Opin Infect Dis., 20: 489–94.

Ghanem YM, Naser MH, Abdelkader AH and Heybe A (2009). An epidemiocoprological study of protozoan and nematode parasites of ruminants in tropical semi-arid district of Somalilan D (North of Somalia). Veterinary Medical Journal, Pp. 768-787.

Greenland K, Dixon R, Khan SA, Gunawardena K, Kihara JH and Smith J (2015). The epidemiology of soil-transmitted helminths in Bihar state, India. PLoS Neg Trop Dis., 9(5):e0003790.

Hassan DI, Musa-Azara IS, Mohammed J and Zanwa IA (2013). Influence of age, sex and season on haematology and serum chemistry of Red Sokoto goats in Lafia, Nasarawa State Nigeria. International Journal of Agricultural Science and Veterinary Medicine, 1(4): 57 63.

Herrero M and Thornton PK (2013). Livestock and global change: emerging issues for sustainable food systems. Proc Natl Acad Sci U S A. 110:20878–81.

Hotez PJ, Brooker S, Bethony JM, Bottazzi ME, Loukas A and Xiao S (2004). Current concepts: hookworm infection. N Engl J Med., 351: 799–807.

Ibukun AV and Oludunsin F (2015). Prevalence of intestinal helminths and protozoa parasites of ruminants in Minna, north-central, Nigeria. IOSR J Agric Vet Sci., 8(2): 62–67.

Jatau ID, Abdulganiyu A, Lawal AI, Okubanjo OO and Yusufu KH (2011). Gastrointestinal and haemoparasitism of sheep and goats at slaughter in Kano, northern-Nigeria. Sokoto Journal of Veterinary Sciences, 9 (1): 7-11.

Karshima NS, Bata SI and Bobbo AA (2016). Prevalence, risk factors and economic losses associated with fasciolosis in slaughtered cattle in Bauchi, North- Eastern Nigeria. Alex J Vet Sci., 50(1): 87–93.

Keyyu JD, Kassuku AA, Kyvsgaard NC and Willingham AL (2003). Gastrointestinal nematodes in indigenous zebu cattle under pastoral and nomadic management systems in the lower plains of southern highlands of Tanzania. Veterinary Resources Communication, 27 (5): 371-380.

Lee AC, Schantz PM, Kazacos KR, Montgomery SP and Bowman DD (2010). Epidemiologic and zoonotic aspects of ascarid infections in dogs and cats. Trends Parasitol., 26(4): 155–61.

McNeilly TN and Nisbet AJ (2014). Immune modulation by helminth parasites of ruminants: implications for vaccine development and host immune competence. Parasite., 2014;21:51.

Murthy GSS, Rao PV (2014). Prevalence of gastrointestinal parasites in ruminants and poultry in Telangana region of Andhra Pradesh. J Para Dis., 38(2): 190–2.

Nodtvedt A, Dohoo I, Sanchez J, Conboy G, DesCôteaux L and Keefe G (2002). Increase in milk yield following eprinomectin treatment at calving in pastured dairy cattle. Vet Parasitol., 105(3): 191–206.

Ntonifor HN, Shei SJ, Ndale NW and Mbunkur GN (2013). Epidemiological studies of parasitic infections in ruminants in Jakiri, Bui Division, North-West Region of Cameroon. *Journals* of Veterinary Medicine and Animal Health, 5 (12): 344-352.

Nwigwe JO, Njoku OO, Odikamnoro OO and Uhuo AC (2013). Comparative study of intestinal helminths and protozoa of cattle and goats in Abakaliki metropolis of Ebonyi State, Nigeria. Advances in Applied Science Research, 4 (2): 223-227.

Nwoke EU, Odikamnoro OO, Ibiam GA, Umah OV and Ariom OTA (2015). Survey of common gut helminths of goats slaughtered at Ankpa abattoir, Kogi state, Nigeria. J Parasitol Vect. Biol., 7(5): 89–93.

Nwosu CO, Madu PP and Richards WS (2007). Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi-arid zone of north-eastern Nigeria. Veterinary Parasitology, 144 (1-2): 118-124.

Nwosu CO, Ogunrinade AF and Fagbemi BO (1996a). The seasonal prevalence of *Haemonchus species* in Red Sokoto (maradi) goats in Nigeria. Veterinary Research Communications, 20: 367-370.

Nwosu CO, Ogunrinde AF and Fagbemi BO (1996b). Prevalence and seasonal changes in the gastro-intestinal helminths of Nigeria goats. Journal of Helminthology, 70: 329-333.

Odeniran PO, Jegede HO and Adewoga TOS (2016). Prevalence and risk perception of adult-stage parasites in slaughtered food animals (cattle, sheep and goat) among local meat personnel in Ipata abattoir, Ilorin, Nigeria. Vet Med Anim Sci., 4(1): 1.

Okaiyeto SO, Tekdek LB, Sackey AKB and Ajanusi OJ (2008). Prevalence of haemo and gastrointestinal parasites in sheep and goats kept by the Normadic Fulanis in some Northern states of Nigeria. Research Journal of Animal Science, 2 (2): 31-33.

Okolugbo BC, Luka S and Ndams IS (2014). Enzyme linked immunosorbent assay in the serodiagnosis of hydatidosis in camels (*Camelus dromedarius*) and cattle in Sokoto, northern Nigeria. Int J Infect Dis., 13(1):1–6.

Oyerinde JPO (1999). *Essential of Tropical Medical Parasitology*. University of Lagos press, Akoka, Lagos, Nigeria. Pp. 347-358.

Qamar MF, Maqbool A and Ahmad N (2011). Economic losses due to haemonchosis in sheep and goats. Sci Intern., 23(4): 321–4.

Rabiu BM and Jegede OC (2010). Incidence of bovine cysticercosis in Kano state, north-western, Nigeria. Bayero J Pure Appl Sci., 3(1): 100–3.

Radostits OM, Blood DC and Gay CC (1994). Diseases caused by helminth parasites, in veterinary medicine: a textbook of diseases of cattle, sheep, pigs, goats and horses, 8th ed. London; 1994.

Regassa F, Sori T, Dhuguma R and Kiros Y (2006). Epidemiology of gastrointestinal parasites of ruminants in Western Oromia, Ethiopia. J. Applied Res. in Vet. Medicine, 4 (1): 51.

Sissay MM, Uggla A and Waller PJ (2007). Prevalence and seasonal incidence of nematode parasites and fluke infections of sheep and goats in eastern Ethiopia. Trop Anim Hlth Prod., 39(7): 521–31.

Solomon-Wisdom GO, Matur BM and Ibe KC (2014). Prevalence of intestinal helminth infection among sheep and goats raised for slaughtering in Gwagwalada Abattoir, Abuja, Nigeria. Journal of Global Pharmaceutical Sciences, 2 (1): 12-19.

Steinmann P, Zhou XN, Li YL, Li HJ, Chen SR and Yang Z (2007). Helminth infections and risk factor analysis among residents in Eryuan county, Yunnan province, China. Acta Trop., 104: 38–51.

Taswar Z, Ahmad S, Lashari MH and Hayat CS (2010). Prevalence of *Haemonchus contortus* in sheep at Research Centre for Conservation of Sahiwal Cattle (RCCSC) Jehangirabad, District Khanewal Punjab, Pakistan. Pakistan Journal of Zoology, 42: 735-739.

Tesfaheywet Z (2012). Helminthosis of sheep and goats in and around Haramaya, Southeastern Ethiopia. Journal of Veterinary Medicine and Animal Health, 4(3): 48-55.

Tibi KN and Aphunu A (2010). Analysis of cattle market in Delta state: the supply determinants. Afr J Gen Agric., 6(4): 199–203.

Torres-Acosta JFJ, Dzul-Canche U, Caballero AJA and Vivas RIR (2003). Prevalence of benzimidazole resistant nematodes in sheep flocks in Yucatan, Mexico. Veterinary Parasitology, 114: 33–42.

Ugbomoiko US, Ariza L and Heukelbach J (2008). Parasites of importance for human health in Nigerian dogs: high prevalence and limited knowledge of pet owners. BMC Vet Res., 4:49.9.

Ugwu DS (2007). The role of small ruminants in the household economy of southeast zone of Nigeria. Res. J Appl. Sci., 2(6): 726–32.

Urquhart GM, Armour J, Duncan JL and Jennings FW (2003). Veterinary Parasitology, second edition, Blackwell publishers, 2003, pp. 157–158.

Urquhart GM, Armour J, Duncan JL, Dunn AM and Jennings FW (1996). *Veterinary Parasitology*, 2nd edition Blackwell Science, Pp. 213-356.

Waller PJ (2006). From discovery to development: current industry perspectives for the development of novel methods of helminth control in livestock. *Veterinary Parasitology*, 139 (1-3): 1-14.

Wilson P (2011). Decomposing variation in dairy profitability: the impact of output, inputs, prices, labour and management. J Agric Sci., 149: 507–17.

World Health Organization (2002). Prevention and control of schistosomiasis and soil transmitted helminthiasis. World Health Organ Tech Rep Ser., 912(i-vi): 1–57.

******