Journal of Sustainable Veterinary & Allied Sciences
P-ISSN-2695-2661 e-ISSN: 2811-1346
JoSVAS 2021, Vol 1, Issue 2: 157-161
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Original Research Article

Anthelminthic resistance of gastrointestinal nematode parasites of West African Dwarf goats in Ikwuano LGA, Abia State, Nigeria

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ABSTRACT

Goat production in Nigeria has faced a major constraint resulting from parasitic infections, notably the parasitic gastrointestinal (GI) nematode which has resulted in high morbidity, mortality, high cost of treatment and high economic losses. Another problem encountered in the treatment of gastrointestinal nematode infection is anthelmintic resistance, hence, the need to investigate the anthelmintic resistance status of GI nematodes of West African Dwarf (WAD) goats in Ikwuano area of Abia State, Nigeria. A faecal egg count reduction test (FECRT) was carried out in naturally infected WAD goats. A total of 60 WAD goats were randomly assigned into 3 groups of 20 WAD goats in each group and screened for GI nematode eggs. Group A treated with ivermectin, group B was treated with levamisole and group C was treated with fenbendazole. The percentage reductions in FEC in male and female WAD goats in ivermectin treated group were 72.42% and 67.98%, Levamisole treated group were 61.67% and 65.22% in male and female WAD goats respectively and 59.50% and 52.63% for male and female in fenbendazole treated group. The percentage reduction of FEC in young and Adult WAD goats treated with ivermectin were 63.05% and 70.52%, and 58.08% and 67.04% for levamisole treated group respectively, while fenbendazole treated group had 60.03 and 54.08% reduction respectively. Resistance was observed in all the anthelmintic drugs used, which poses a huge threat to livestock production in the study area.

Keywords: Anthelmintic, gastrointestinal nematode, resistance.

INTRODUCTION

West African Dwarf (WAD) goat is the most indigenous breed of goats in South Eastern Nigeria. The rearing of goat and sheep has been a source of income especially to the marginal farmers (Pathak and Pal., 2008). WAD goat production promotes crop production by supplying farm manure and raw materials to the agro-allied industries. Goat meat (Chevron) is a healthier alternative compared with other red meats. It has low saturated fatty acids and cholesterol with percentage polysaturated fatty acids of 68.5% to 72.3% (Anaeto *et al*., 2010). Also milk from goat is highly nutritional and is composed of small fat globules with higher protein and mineral content than cow milk. Goat milk is easily digestible and can be used in persons with cow milk allergy (Gizaw *et al*., 2010).

Livestock production especially goat and sheep production has been hindered by parasitic infection among which gastrointestinal nematode infections causes serious health problems and severely limits the productivity of these animals (Biu *et al.*, 2009; Jegede *et al*., 2013). Parasitic gastroenteritis has continued to pose a serious health threat and limitation to the productivity of small ruminants due to associated morbidity, mortality and cost of treatment (Martinez-Gonzalez *et al*., 1998; FAO, 2002). Economically, a decrease in profitability of up to 15% and weight loss of up to 50% due to GI nemato de infections have been reported in Pakistan (Bhat *et al*., 2011; Shahnawaz *et al*., 2011). In Nigeria, prevalence of gastrointestinal nematode infections has been reported in Sokoto Gudali and WAD goats to be as high as 77% to 100% throughout the year with or without minor seasonal variation (Fakae, 2009). However, to tackle the problem of gastrointestinal nematode infections, several control measures have been practiced over the years to ensure the production of livestock with minimal damaging effect. Although anthelmintic treatment has been the most widely adopted means of controlling nematode infections,

http://doi.org/10.54328/covm.josvas.2021.039

anthelmintic resistance has been a major problem in livestock production. (Rahman, 2016; Hassan *et al*., 2013).Ruminants have one of the highest anthelminthic resistance to gastrointestinal nematode infections (Islam *et al*, 2018).

Martínez-Valladares *et al.*, 2013 indicated that resistance to anthelmintics is a growing problem in ruminants worldwide. Surveys on 59 farms in South Africa indicated that 90% of the sheep in South Africa were resistant to drugs from at least one of the anthelmintic groups. Forty percent (40%) of these farms showed multiple resistance to compound from Benzimidazole group (Van Wyk *et al*1999). Resistance was reported against ivermectin and levamisole in dairy goats in Punjab, Pakistan (Jabber *et al*., 2008).

This study was aimed at investigating the rate of infection in herd of WAD goat with naturally acquired gastrointestinal nematode infections; and to ascertain the rate of resistance of GI nematodes to Levamisole, ivermectin and fenbendazole in Ikwuano area of Abia State.

MATERIALS AND METHODS

STUDY AREA

The study was carried out in three localities in Ikwuano local government area of Abia State, South east Nigeria. This area lies at latitude 5.4527˚N and longitude 7.5248˚E.

Experimental Animals

Sixty (60) naturally infected WAD goats were used for the study. They were purposively selected from households within the study area. 30 males and 30 females were included in the study on the basis that they were apparently healthy and have not been dewormed in the last three months. The goats were randomly assigned into three groups: Ivermectin treated group, Levamisole treated group and Fenbendazole treated group, with 20 WAD goats in each group.

ANTHELMINTIC TREATMENT

The drugs (Ivermectin, Levamisole and Fenbendazole) were acquired from a Veterinary clinic located in the study area. Each animal in group A was given a dose of ivermectin (Agimect®, India) of 0.2mg/kg body weight orally, each animal in group B was given Levamisole (Ergamisol®, USA) orally at a dose of 7.5mg/kg body weight and Fenbendazole (Aniprazol® , Poland) was given to each animal in group C at a dose of 5mg/kg body weight.

SAMPLE COLLECTION

Faecal samples were collected pre–treatment on day 0 and day 10 post–treatment directly from the rectum of the animals. Faecal samples collected were taken to the Department of Veterinary Parasitology and Entomology laboratory, Michael Okpara University of Agriculture, Umudike for faecal egg count.

EXAMINATION OF THE FAECAL SAMPLES

The faecal samples were examined for the presence of GI nematode eggs, using the Modified McMaster and Flotation techniques (Soulsby, 1982; Zajac and Conboy, 2006). Resistance to anthelmintic drugs was determined using the Faecal Egg Count Reduction Test (FECRT) according to the World Association for the Advancement of Veterinary Parasitology (WAAVP) (Coles *et al*., 1992). The efficacy of the anthelmintic treatment was calculated using the pre-treatment and post-treatment results obtained according to the formular, FECR= 100 X (1- FEC post) (FEC Pre) and the lower confidence interval as calculated from the formula presented by Dobson *et al*, 2012.

DATA ANALYSIS

The efficacy of different anthelmintics used was evaluated by computing the mean faecal egg counts reduction for each treatment group. Computation of the arithmetic mean, percentage of egg reduction, 95% upper and lower confidence limits and results of resistance presented as mean ± SEM were interpreted as described by Coles *et al*., (1992).

RESULTS

Of the three drugs used, ivermectin had the least efficacy with total percentage resistance of 72%(126.73 ± 29.09) in male and 68%(106.04 ± 26.72) in female respectively , followed by levamisole with percentage resistance of 68% (104.09 ± 10.44) in male and 64% (82.65 ± 18.57) in female respectively, and then fenbendazole 60% (86.18 ± 12.18) in male and 54% (66.10 ± 12.82) in female respectively. The resistance was more in male WAD than in the female as seen in Table I.

On the age related groups, ivermectin was the least in efficacy with percentage resistance of 63 %(75.55 ± 17.22) in young and 71% (175.78 ± 47.31) in adult respectively (Table II). On the other hand levamisole showed 58% (76.78 ± 4.39) and 67% (110.23 ± 27.92) in young and adult respectively, and fenbendazole showed 60% (74.13 ± 16.86) and 54% (78.03 ± 9.15) in young and adult respectively. There was much resistance in adult WAD goat than young WAD goat in ivermectin and levamisole treated groups as shown in Table II. However, fenbendazole showed much resistance in young WAD goat than in adult WAD goat. (Table II).

DISCUSSION

Anthelmintic resistance has been a major issue in small ruminant industry across the world with many parasites of veterinary importance having genetic features that favour development of such resistance (Kaplan, 2004). This is more so because treatment against helminth infections is usually totally dependent on this anthelminthic. The present study revealed the presence of anthelmintic resistance by gastrointestinal nematodes to ivermectin, levamisole and

Table 1: Percentage resistance within sex group

Legend: Iver- Ivermectin, Leva- Levamisole, Feb- Febendazole.

Sex	No of Animals			Pre-treatment			Post-treatment			% Resistance		
	Iver	**Leva**	**Feb**	**Iver**	**Leva**	**Feb**	**Iver**	**Leva**	**Feb**	**Iver**	**Leva**	**Feb**
Male	10	10	10	192.04± 21.73	171.63± 13.77	149.38± 14.37	126.73± 29.09	104.09± 10.44	86.18± 12.18	72.42	65.22	59.50
Female	10	10	10	157.75± 36.08	128.31± 25.34	133.70± 14.36	106.04± 26.72	82.65± 18.57	66.10± 12.82	67.98	64.38	52.63

Table II: Percentage resistance within age groups

Legend: Iver- Ivermectin, Leva- Levamisole, Feb- Febendazole.

	No of Animals			**Pre-treatment**			**Post-treatment**			**% Resistance**		
	Iver	**Leva**	**Feb**	**Iver**	**Leva**	**Feb**	**Iver**	**Leva**	**Feb**	**Iver**	**Leva**	**Feb**
Young	11	9	8	121.82± 17.25	128.67± 7.61	131.88± 17.98	75.55± 17.22	76.78+4.39	74.13± 16.86	63.04	58.08	60.03
Adult	9	11	12	251.89± 63.03	167.91± 38.27	147.97± 11.60	175.78± 47.31	110.23+27.92	78.03± 9.15	70.52	67.00	54.00

fenbendazole irrespective of age or sex. The total percentage reduction of levamisole, ivermectin and febendazole suggests low efficacy of these drugs against gastrointestinal nematodes. Ivermectin recorded 72% (126+29.09) in male and 67% (106+04) in female and 63% (75.55+17.22) in young and 70% (175.78+47.31) in adult respectively. Levamisole recorded 61% (104.09+10.44) in male and 65% (82.65+18.57) in female and 58% (76.78+4.39) in young and 67% (110.23+27.92) in adult respectively and Fenbendazole recorded 59% (86.18+12.18) in male and 52% (66.10+12.82) in female and 60% (74.13+16.86) in young and 54% (78.03+9.15) in adult respectively. Generally, the WAD goats showed resistance to the three anthelmintic used for the study, however, resistance to ivermectin was high followed by levamisole and then fenbendazole as their percentage resistance was below 50%. According to Panday *et al* (1994), a helminth population was classified as sensitive if the adjusted percentage reduction was more than 90% to a particular drug, suspected resistant if the percentage reduction was 80-90% and resistant if the percentage reduction was less than 80%. Thus, all the drugs were considered to be \resistant based on the explanation above. In Uganda 58%, 52% and 38% anthelmintic resistance prevalence in goat farms were detected for ivermectin, levamisole and fenbendazole respectively (Nabukenya *et al*., 2014). The current study reported the development of anthelmintic resistance to all tested drugs (Ivermectin, Levamisole and Fenbendazole), which was in line with studies from other parts of the world, study from India has revealed that most of the GI nematodes were found to have some degree of resistance against ivermectin, levamisole and fenbendazole in goats (Gelot *et al*.,2016). Also Zanzani *et al*.,(2014) revealed that 60%, 40% and 20% of goats flock in Italy had resistant GI nematodes for ivermectin , levamisole and fenbendazole respectively. In addition, Adediran and Uwalaka (2015) reported that GI nematode of goat showed low resistance to ivermectin and levamisole but susceptibility to albendazole which was contrary to the findings by Sissay *et al*.,(2007) who reported a high level of efficacy of ivermectin, levamisole and fenbendazole. This difference may explain the development of drug resistant parasitic nematode through time.

It is important to note that the resistant population will be increasing as reliance on anthelmintics to control nematodes continue unabated. Wherever resistant

populations of strongyles to anthelmintics have been reported, it heralded the failure of the anthelmintics concerned in that area, this will make the control of such worms very difficult. In South Africa, several reports of resistance to all the classes of anthelmintics occur and as a result of anthelmintic failure,some farms have closed down (Van Wyk, 1991). Over the past 10 to 15 years, there has been a rapid increase in both the prevalence and magnitude of anthelmintic resistance, and these increases appear to be a worldwide phenomenon. Reports of anthelmintic resistance to multiple drugs in individual parasite species, and in multiple parasite species across virtually all livestock hosts, are increasingly common (Kaplan & Vidyashankar., 2012).

CONCLUSION

Factors like illegal marketing of drugs by non-animal health professional and purchasing of drugs by self-experience possibly allow inappropriate dosing or misuse that ends with survival of heterozygous resistant nematode (Aga *et al*., 2013). In addition, species difference is also associated with anthelmintic resistance and goats have a higher metabolic rate and require higher dose rates of drugs than sheep, this may explain the fact that anthelmintic resistance is of greater concern in goats than in sheep (Domke, *et al*., 2012). Therefore, an appropriate nematode control strategies including management practices of pasture rotation and supplementary feeding should be encouraged.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Article history:
Received: Oct., 21, 2021,
Revised: Dec. 26, 2021
Accepted: Dec.31, 2021