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Popular Article

Anthelminc Resistance: An Emerging Problem in Livestock

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The control of worm population in livestock is daunted by emergence of Anthelmintic resistance in most parts of the world. Anthelmintic resistance (AR) may be defined as genetically transmitted loss of sensitivity of a drug in worm populations that were previously sensitive to the same drug. It is the ability of the parasites to survive doses of drugs that would normally kill parasites of the same species and stage. There may be a decrease in the time a drug exerts its effect, with resistant populations requiring more frequent treatments. It is inherited and the genes for resistance pass on to the offspring. These genes are initially rare in the population of the parasites. The proportion of the genes increases as does the resistant parasites when they are not removed. Anthelmintic resistance in nematode has become a significant practical problem in a number of countries.

The development of resistance is mostly due to intensive anthelmintic use for the management of helminths in livestock. The main anthelmintic drugs used – benzimidazoles (BZs), imidazothiazoles (IMs) and macrocyclic lactones (MLs) were initially very effective, so their use spread rapidly. This large-scale use led to the emergence of resistance to these drugs, Currently, this phenomenon affects all anthelminthic drugs, especially Benzimidazole and multidrug resistance has been reported. The resistance against drugs belonging to the same anthelmintic drug class is called side resistance, whereas cross and multidrug resistance refer to resistance against two or multiple drugs belonging to different anthelmintic drug classes. The resistance occurs chiefly in geographic areas where *Haemonchus contortus*, a blood sucking round worm predominates and the annual numbers of cycles

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of infection and anthelmintic treatments are numerous.

The underlying mechanism for resistance development is believed to be upregulation of cellular efflux mechanisms, a change in drug receptor sites that reduces drug binding or the functional consequences of drug binding, an increase in drug metabolism and decrease in drug receptor abundance through reduced expression within the parasite.

What has led us to this situation?

Anthelmintic resistance is a multifaceted process and affected by the treated animal, the parasite, type of anthelmintic and its utilization.

- Treatment of all animals at the same time on the same farm
- Continued administration of the same anthelmintic
- Substandard quality of drug
- Repetition of same group of anthelmintics
- Under dosing or insufficient dosing
- Single drug regimen
- Frequency of deworming (high treatment frequency)
- Underestimation of real weight has a potential to lead to underdosing

Diagnosis of anthelmintic Resistance

- Use of egg count reduction tests (FECRT)
- In vitro assays- larval development assay and egg hatch assay etc
- PCR based assay to determine the resistance genotype of individual worms
- The Tests suitable for field conditions is the Fecal egg count reduction test (FECRT)-
- Suitable for all anthelmintics and all animals.
- Suitable for any nematode parasites that shed eggs in faeces.
- Provides anthelmintic efficacy by comparing egg counts before and after treatment.

Control of anthelmintic resistant nematodes

Development of AR can be limited by ensuring that the parasites are exposed to an effective drug dose and to consider the timing and frequency of anthelmintic drug treatments so that only a small proportion of the population is exposed to the anthelmintic. The following recommendations are essential for slowing the spread of anthelmintic resistant nematodes.

- **Administration of the correct dose:**

Underdosing is likely to speed the selection for anthelmintic resistance. Some of theanimals to

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be treated should be weighed, because weights are likely to be undesestimated if theyare guessed. The dosing gun should be working correctly and every farmer should have a plasticmeasuring cylinder to check that the delivery is accurate.

- **The minimum number of treatments should be used:**

  Frequent treatments have been shown to increase the rate of selection for anthelmintic resistance. Target selective treatment of animal is followed; that the animals with high wormburden alone is drenched. There is a need to maintain refugia which are the size of the unselected proportion of the nematode population can help to reduce the build-up of resistance by preserving susceptible nematode genotypes which helps to dilute the frequency of resistance alleles and maintain anthelmintic efficacy. Targeted selective treatment (TST), involves the treatment of selected individuals that require treatment as opposed to treatment of the entire group. Animals are selected based on their need to receive treatment, which is based on their level of parasitism

In the FAMACHA chart, the severity of parasitism can be estimated by using a conjunctival colour chart which correlates to anaemia to choose affected animals for selective treatment. TST helps in the removal of worms from the most severely infected and affected animals, thereby minimizing production losses in the most impacted animals. These animals also shed more eggs than other animals, so targeted treatment of a small proportion of the flock reduces a large proportion of pasture contamination. It also aids in reducing chemical use and maintaining refugia

- **Management techniques should be adopted that do not require the frequent use of anthelmintics.**

  The type of anthelmintic used should be reported annually. There are only three broad spectrum types of anthelmintics currently available for ruminants, the benzimidazoles, levamisole and ivermectin. On farms with benzimidazole resistant, nematodes only two alternatives can be used, levamisole and ivermectin or their combination products.

- **Use of phytotherapeutic agents/nematode trapping fungi should be explored**

  The medicinal botanicals contain various active moeties such as phenols, flavonoids,tannins, alkaloids, terpenoids, glycosides which have reported promising results against worms. Another environmentally safe alternative for control of worms that can lessen the AR issues is use of nematode trapping fungi as biological agent. These fungi like *Duddingtonia flagrans, Metarhizium anisopliae* capture nematodes by producing sticky, sophisticated traps on their growing hyphae and survive in

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the intestinal tract of ruminants. After passing through the gastrointestinal tract, spores germinate and looped hyphae trap the developing larval stages in the fecal environment.

- **Resistant nematodes should not be purchased with animals/Strict quarantine measures**

  Movement of livestock is probably one of the major causes for the spread of anthelmintic resistant nematodes. New stock should be quarantined, dosed with anthelmintic therapy, fecal egg count reduction tests need to be performed. There should be withdrawl of feed 24 hours before treatment. Since resistance to benzimidazole is the major type of anthelmintic resistance, it is recommended that animals should be treated with non-benzimidazole anthelmintics and held in a yard for at least 24hrs before they are put out to graze.

- **Sheep and goats should not be kept on the same farm**

  It is normal practice to keep goats and sheep together, but, the practice should be avoided owing to the likely transmission of resistant nematodes from goats to sheep. If they must be kept on the same farm the same drug in correct dose should be given.Farms should be checked regularly to see if resistant nematodes are present by FECRT because continued use of an anthelmintic for which resistant nematodes are already present will only worsen the situation.

- **Provide good nutrition to livestock**

  A high protein intake is believed to provide immunity against gastro intestinal nematode infection. Supplementation with copper and phosphorous have reported to lessen the burden of nematodes in animals.

The way to control of anthelmintic resistance requires an integrated approach that incorporates management of the environment along with proper drug regimen and alternative control strategy so that the pressure on adaptation by parasites lessens.

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