Antidotal potential of specific diets in Norway rats

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Some commensal rodent species can cause significant damage to stored produce and infrastructure and transmit pathogens to humans, livestock and companion animals. The most common approach to manage over-abundant populations of commensal rodents is the use of anticoagulant rodenticides. In several rodent species, including Norway rats (*Rattus norvergicus*), genetic resistance to anticoagulant compounds occurs throughout the world. This can hamper the success of control operations. In addition, predators and scavengers can be at elevated risk because poisoned, resistant prey individuals can carry considerable amounts of anticoagulant residues.

Some nucleotide polymorphisms in the vitamin K reductase complex subunit 1 (VKORC1) gene are associated with rodenticide resistance. They are also related to several pleiotropic effects such as increased vitamin K requirement in Norway rats. It is possible that the uptake of dietary vitamin K from food sources that are present on farms mitigate these effects and/or acts as an antidote to anticoagulant compounds.

In this study the preference for food rich in vitamin K1 was assessed in Norway rats that were either susceptible or resistant to bromadiolone due to the homozygous nucleotide polymorphism Tyr139Cys (Y139C). In addition, the effect of vitamin K1 consumption from several food sources on blood clotting in bromadiolone-resistant and susceptible adult male Norway rats was assessed. In preliminary trials, the effect of the consumption of corn silage on blood clotting time was tested in bromadiolone-dosed Y139C rats.

Rats did not generally prefer the consumption of food sources rich in vitamin K1. Interestingly, there was no effect of vitamin K1 uptake on blood clotting times. However, the uptake of four out of five corn silages prevented a rise in blood clotting times that otherwise occurred in vitamin K-deficient bromadiolone resistant Y139C rats. This was apparently due to compounds with vitamin K activity present in silage.

Preliminary trials indicated that the effect on blood clotting of a dose of bromadiolone equivalent to nine time the ED_{50} was significantly lower in bromadiolone-resistant rats that consumed silage versus than in resistant rats that were fed standard rodent pellets. This effect was not evident in bromadiolone-susceptible individuals.

Possible antidotal effects, and the prevention of vitamin K related pleiotropic effects in Y139C rats, may contribute to the maintenance and spread of nucleotide polymorphisms related to rodenticide resistance. Corn silage is becoming increasingly available to rats due to the expansion in bio-energy generation from corn silage. Therefore, there may be an increase in the occurrence of anticoagulant-resistant Norway rats and associated problems in agro-ecosystems in the future.