Acknowledging the potential role of animal self-medication

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ABSTRACT

Much research on animal health and welfare assumes that animals passively endure the pathogens, diet, and environmental conditions that come their way. Natural selection however has honed behavioural strategies for optimising health. Some of these involve the selection of 'medicines' to modulate health. Although it is not yet known to what extent domestic species retain the ability to self-medicate, it is vital that researchers acknowledge the potential role such behaviour might play when designing research protocols.

INTRODUCTION

Natural selection has honed a range of behavioural strategies that reduce physiological health threats from injury, poisons, and pathogens (Engel, 2002; Hart, 1990). Surprisingly, such behaviours are poorly researched despite their relevance to organic livestock husbandry—and despite that husbandry being traditionally modelled on natural systems. The way animals actively modulate their health through diet, for example, is rarely acknowledged in research yet has important implications for animal health and welfare.

THE IMPORTANCE OF DIETARY SELF-REGULATION

Most nutritional research focuses at the species level rather than on the individual. Individuals differ in their dietary requirements and are capable of fine-tuning an optimal diet if provided with suitable choices. Physiological feedback processes match dietary choice with consequence. Sheep, for example, can monitor the carbohydrate and protein content of their food and adjust their feeding accordingly. When infected with parasites, they consume more protein to compensate for nutritional losses. What is more, sheep are able to learn the consequences of their dietary choices. They will develop a preference for foods that previously corrected a nutrient deficiency.

Animals do not need to 'know' what is missing from their diet in order to remedy that deficiency. When deprived of the amino acid thiamine, rats seek out thiamine-rich foods not by locating thiamine specifically but by sampling a wide range of foods until

they find what makes them feel better. They can find what they need given sufficient dietary choice.

Research in animal nutrition and diet selection appears to assume that animals seek nutrients and avoid toxins, yet in many circumstances this is clearly not so. Deer, for example, prefer a diet containing moderate (rather than low or high) levels of astringent tannins, normally considered feeding deterrents. Although high concentrations of tannins cause poisoning, moderate levels have been shown to reduce intestinal worm loads, suggesting that such a preference may be adaptive. In a similar manner, laboratory mice drink water containing bitter chloroquine even when plain water is available. Consequently, those mice infected with malarial parasites survive, suggesting that this 'sample bitters' strategy may be adaptive (Vitazkova *et al*., 2001).

Broiler chicks normally avoid bitter-tasting medicated food. However, when suffering the pain of broken limbs they will consume proportionate amounts of bitter-tasting analgesics, suggesting that gustatory/olfactory tolerances change with health status (Danbury *et al*., 2000).

Animals may *need* and, therefore, seek non-nutrients—even those that we consider toxic, and even those which individuals might normally avoid when healthy.

THE IMPORTANCE OF NATURAL CONDITIONS

It is important to study animal health under conditions in which any health-maintenance behavioural strategies can manifest. Rick Karban and his colleagues at Davis, California, were studying the effects of parasitoids (lethal parasites) on woolly moth caterpillars when they accidentally discovered that the caterpillars could help themselves. Normally, they studied caterpillars in indoor cages with carefully controlled conditions and diets. However, overcrowding forced them to use outdoor enclosures containing natural vegetation. Caterpillars in these enclosures were able to survive the normally lethal parasites by changing their diet from lupine to more 'toxic' hemlock plants (Karban & English-Loeb, 1997). Such important self-help strategies would not have been observed in the laboratory.

Bearing animal self-medication in mind allows us to uncover research-leads from anecdotal observations. Many cattle farmers report that their livestock dig down to sub soils, and it is commonly assumed that the cattle are attempting to rectify a mineral deficiency. However, North American ranchers have long known that their sick cattle will travel many miles to find and lick at clay—and that after doing so they usually recover. Recent studies of free-ranging cattle in the Venezuelan highlands confirm that these cattle dig down to sub soils primarily for the fine-particle clay rather than for any particular mineral (Manhaney, et *al*., 1996). Clay can deactivate toxins, and adsorb pathogenic bacteria and viruses—among them bovine rotavirus

and œronavirus—and is thus an excellent remedy for gastrointestinal malaise (Clark *et al.*, 1998). The health benefits of geophagy (earth-eating) have been quantified in laboratory rats, which eat clay as an illness-response behaviour—especially in response to gastrointestinal malaise. More interestingly, they will eat clay when only conditioned to feel sick. Despite the medicinal benefits of clay for many species, it is poorly understood and, therefore, under-utilized as a safe organic self-help remedy.

Observational studies of wild animals reveal several 'general rules of thumb' that could be pivotal in improving livestock health without recourse to allopathic drugs. One such example is self-medication with herbal scours to dislodge intestinal parasites (seen in bears, dogs, geese and great apes). Such simple, safe strategies may form the basis of a non-chemical method of parasite control in livestock (Huffman, 2001).

An opportunity for self-medication can be enhanced by careful experimental design. Stressed broiler chicks do not produce enough ascorbic acid (vitamin C) yet inappropriate administration of vitamin C is detrimental. The solution would be to allow chicks to self-administer their own vitamin intake but vitamin-laced food has no identifying features on which chicks can learn an association. However, by colouring only food laced with vitamin C, researchers enabled the chicks to successfully learn to associate coloured food with health benefits and thereby self-medicate against stress from heat, parasites or production pressures (Kutlu & Forbes,1993).

CONCLUSION

In designing research protocols looking at livestock health, researchers should:

- Acknowledge that animals attempt to modulate their own health and that individuals will vary in this regard
- Acknowledge the subjective definitions of nutrients, non-nutrients, medicines, and toxins
- Provide an environment that closely matches the species' natural habitat in order to observe and utilize self-help strategies
- Study the 'general rules of thumb' for health maintenance behaviour in the wild to see if there are transferable lessons for organic agriculture
- Include self-selection as a model for establishing the health requirements of livestock in organic research

DISCUSSION

Animal self-medication has huge implications for research in animal health and welfare under organic systems. Animal behaviour can be utilised to identify appropriate amounts and varieties of nutrients and medicines. Studies are urgently needed to establish how self-regulation and self-medication can be applied to organic livestock husbandry. In the meantime, it is important for researchers to

become familiar with those behavioural health-maintenance strategies, which have implications for design protocols.

Self-medication also contributes to conclusions drawn from research already undertaken. An adaptive preference for food containing small amounts of 'toxins' and non-nutrients could explain the recent findings that animals prefer organic feedstuffs over non-organic vegetables, i.e., it may be less important whether organic vegetables contain different nutrient profiles and more important that they contain more of their natural defensive 'toxins' that also play a medicinal role in vertebrates.

The need for nutritional self-regulation and health modulation explains why biodiversity is so important in organic pastures, i.e. biodiversity provides a range of medicines as well as a variety of nutrients. In other words, providing an opportunity for individual self-medication should be considered one of the fundamental principles of organic livestock management, and therefore incorporated into research protocols.

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