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AN EVALUATION OF THE EFFICACY OF INDOCID *(INDOMETACIN)* FOR THE CONTROL OF SOME LABORATORY AND WILD RODENTS

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Abstract

Rodents are well-known pests of stored and cultivated agricultural products. Their control is of great concern to human societies worldwide. Different rodenticides exist but most of these pose varying degrees of risk to the general public. The study aims to establish the efficacy of a human anti-inflammatory drug, Indocid, as a potential rodenticide, using the widely-used Baraki as a reference rodenticide. Doses of indocid found to be lethal to laboratory rats (*Rattus rattus*) were lower than that of Baraki and, for a given concentration of active ingredients, death occurred relatively faster in indocid-administered than baraki-administered rats. Indocid further proved lethal to five species of wild rodents. There is the need for further work on recommended lethal doses required for the control of the various wild rodent species.

Résumé

FORSON, R. A., GBOGBO, F. & ATTUQUAYEFIO, D. K.: *Une évaluation de l'efficacité d'indocid (Indometacin) pour le contrôle de quelques rongeurs du laboratoire et de la brousse.* Les rongeurs sont des ravageurs bien-connus de produits agricoles stockés et cultivés dont le contrôle est très inquiétant pour les sociétés humaines dans le monde entier. Les rodenticides différents existent mais la plupart d'eux posent des différentes degrés de risque aux utilisateurs et au grand public. Cette recherche vise à vérifier l'efficacité d'un médicament humain anti-inflammatoire, indocid, comme un rodenticide potentiel, en utilisant Baraki, qui est communément utilisé comme un rodenticide référentiel. Les doses d'indocid considérées d'être mortelle pour les rats de laboratoire *(Rattus rattus)* étaient plus faibles que les doses de baraki et pour une certaine concentration d'ingrédient actif la mort se produit relativement plus vite dans les rats donnés l'indocid que les rats donnés baraki. Indocid se montre encore mortelle aux cinq espèces de rongeur de la brousse. Il est nécessaire de faire de recherches complémentaires sur les doses mortelles exigées pour le contrôle de différentes espèces de rongeurs de la brousse et ses implications pour les rongeurs ravageurs des cultures du champ ainsi que pour les prédateurs et les charognards de rongeurs.

Introduction

Rodents are the most successful group of mammals living today both in terms of numbers of individuals and species (Carrington 1963). The order Rodentia comprises 2,015 species belonging to 28 living families (Wilson & Reeder, 1993), constituting over 40 per cent of all living mammal species. Rodents positively impact on humans and the ecosystem as a whole, serving as food sources for man and many wild carnivores. Some are of economic importance because of their valuable fur (e.g. beaver, muskrat and chinchilla) (Walker, 1964), while others are used as experimental animals in biology and medicine.

Rodents also impact negatively on human populations, with the Muridae (family of rats and mice) particularly being of medical importance in the transmission of parasitic diseases (Leslie, 1942) and of economic importance in the damage they cause to stored agricultural products and cultivated crops. As much as 20 per cent of stored grains may be consumed by rodents in some developing countries (Ware, 1972). Rodents were also reported to have caused up to 57 per cent destruction of oil palm plantations in the Eastern Region of Ghana by gradually chewing the succulent apical buds of oil palm seedlings and killing them in the process (Appiah & Attuquayefio, 2000). Rodents also contaminate and render unfit for human consumption large amounts of stored foodstuff that they may not necessarily eat.

Owing to the destructive nature of rodents, researchers worldwide have sought the best possible rodent pest control methods. Many rodenticides have been identified and proven effective but they are also poisonous to humans and, therefore, dangerous to use, causing massive haemorrhage from minor or moderate poisoning, to death in the more serious cases (Ware, 1972; Eddleston, 2000). Baraki is a popular rodenticide in Ghana whose active ingredient, *Difethialone*, kills rodents by reducing the clotting ability of blood. The manufacturers recommend placing Baraki pellets at designated locations in 30 g and 15 g quantities for rats and mice, respectively, to kill rodents within 3 days after a single dose but warn users to avoid any direct contact since human oral contamination could cause oral and nasal bleeding, excessive bleeding from minor cuts or abrasions and blood in the stool and urine.

Although no scientific basis has been established for the use of Indocid as a rodenticide, this cheap but effective 'over-the-counter' painkiller, belonging to a group of "non-steroidal anti-inflammatory drugs" (NSAIDS), was seen being used to control household rodents at Benya in the Western Region of Ghana (Mintah-Afful, 2004). With *Indometacin* as its active ingredient, Indocid is administered as a pale yellow capsule which works by blocking the production of prostaglandin, a chemical that the body produces in response to injury or certain diseases to effect swelling, pain and inflammation (British National Formulary, 2002).

The study aims to evaluate the relative efficacies of Indocid and Baraki in the control of rodent pests. If Indocid is established as a potent rodenticide, it could offer a cheaper and less dangerous alternative rodent control method to Baraki, with immense economic benefits to developing economies currently facing serious rodent pest control problems.

Experimental

Sources of rodents

Adult white laboratory rats (*Rattus rattus)*, weighing between 200-220 g, were purchased from the Noguchi Memorial Institute of Medical Research (NMIMR), University of Ghana, Legon. Using 5 cm × 5 cm × 10 cm Sherman collapsible traps, wild rodent species were live-trapped from two locations in the Eastern Region (an oil palm plantation and some forest reserves) and one location in the Greater Accra Region (University of Ghana Botanical Gardens at Legon).

Testing for bait preference of laboratory rodents

To determine the bait preferences of the laboratory rats, six individual rats were placed in different rectangular (40 cm × 15 cm × 15 cm) wire-mesh cages. Three types of bait were tested: (i) groundnut paste-corn flour mixture, (ii) groundnut paste-corn dough mixture, and (iii) dry corn flour only. Each rat was deprived of food but provided with water for 24 h and then provided with 10 g each of the three bait types. The dry corn flour emerged as the most preferred and was, therefore, used as the bait for mixing with the indocid and baraki.

Relative efficacies of Indocid and Baraki in the control of laboratory rodents

Forty-eight laboratory rats were divided into eight groups of six individuals each. Four groups were each exposed to 10 g of corn flour-Indocid mixture at dosages of 0.1 g, 0.2 g, 0.5 g, and 1.0 g, while the other four groups were exposed to corresponding dosages of Baraki. Six other rats were provided with 10 g of corn flour only and used as a control group. Individuals in a particular rat group were separately administered with four concentrations of the Indocid-corn flour mixture weighing 10 g. The Baraki baits were administered directly as pre-concentrates, using the concentration of the active ingredient Difethialone on the container label to determine the weight of bait that contained Difethialone corresponding to the mass of Indocid used. The rats were starved for 24 h prior to administration of the two baits to ensure that they consumed large amounts of the baits. After the first day, any other poisoned bait left unconsumed was removed, and non-poisoned bait re-introduced. Observations were carried out for 10 days. Water was provided throughout the experiment, and the cages were cleared of litter and droppings daily. Death of the rats was established by looking out for movement, breathing seizures, and their inability to respond to pin-pricks.

Effect of Indocid on wild rodents

Ten individuals of five species of wild rodents, namely soft furred rats *(Praomys tullbergi*), brush-furred mice *(Lophoromys flavopunctatus)*, multimammate rats *(Mastomys erythroleucus)*, pygmy mouse *(Mus minutoides)* and striped mouse *(Hybomys* sp.*)* were used to determine the effect of Indocid on wild rodents. There were four individuals of Praomys *tullbergi*. Out of these four, two individuals were administered with 1.0 g of indocid in 10 g maize mixture [10% (w/w)] and the other two used as a control. Similarly, out of two individuals each of *Lophoromys flavopunctatus* and *Mastomys erythroleucus* one each of each species was was administered with 10 per cent (w/w) Indocid-maize flour mixture while the other individual of each of these two species was used as a control. There were only one individual each of *Mus minutoides* and *Hybomys* sp. one. Each of these individuals was subsequently administered with 10 per cent (w/w) Indocid-maize flour mixture without a control. Normal bait was re-introduced on the second day to determine whether an encounter with Indocid over a single day was enough to kill the rodents.

Results and discussion

Effect of consumption of Indocid and Baraki on the behaviour of laboratory rats

After consumption of either of the poison baits, a series of behavioural patterns were observed in the laboratory rats. There was some hesitation before feeding was attempted, refusal to feed, illness, then death. The hesitation phase manifested as a slackening in eagerness to accept poison-free feed after consuming the poisoned bait, probably resulting from discomfort. Eight rats, after initial hesitation, continued to accept the feed until death occurred. In four other rats, the hesitation phase was followed by outright refusal to feed on the poison free diet until death occurred. Such rats ate their own droppings instead of their normal diet. This phenomenon occurred in four of the six rats that were administered with 1.0 g Indocid.

Southern & Chitty (1954) reported an association between discomfort or illness and bait consumed among rodents, suggesting that poison-induced discomfort could be severe enough to cause a complete aversion to food. All the rats, except those administered with 0.1 g of *Difethialone*, which remained healthy throughout the 10-day observation period, exhibited symptoms of illness before death. Illness was characterised by an apparent reduction in activity and dullness of the white fur of the laboratory rats probably due to their inability to continue cleaning their fur by licking it. Each of the dead

rats sported a dark red ring around their eyes, which was more pronounced in rats administered with Indometacin than in those administered with Difethialone.

Comparative performance of Indocid and Baraki

Death occurred in the laboratory rats at all dosages except the 0.1 g dosage of Difethialone, but all the control rats survived the 10-day observation period. Consumption of 0.1 g of both Indocid and Baraki. The higher the dosage consumed therefore, the shorter the rats lived. Also, the Indometacin-administered rats died earlier than the Bifethialone-administered ones at the same dosage (Fig. 1).

The inability of 0.1 g Difethialone to kill the rats indicates that the amount of the drug consumed was too low to produce any significant effect. Furthermore, occurrence of death at 0.1 g dosage of Indometacin indicated a higher

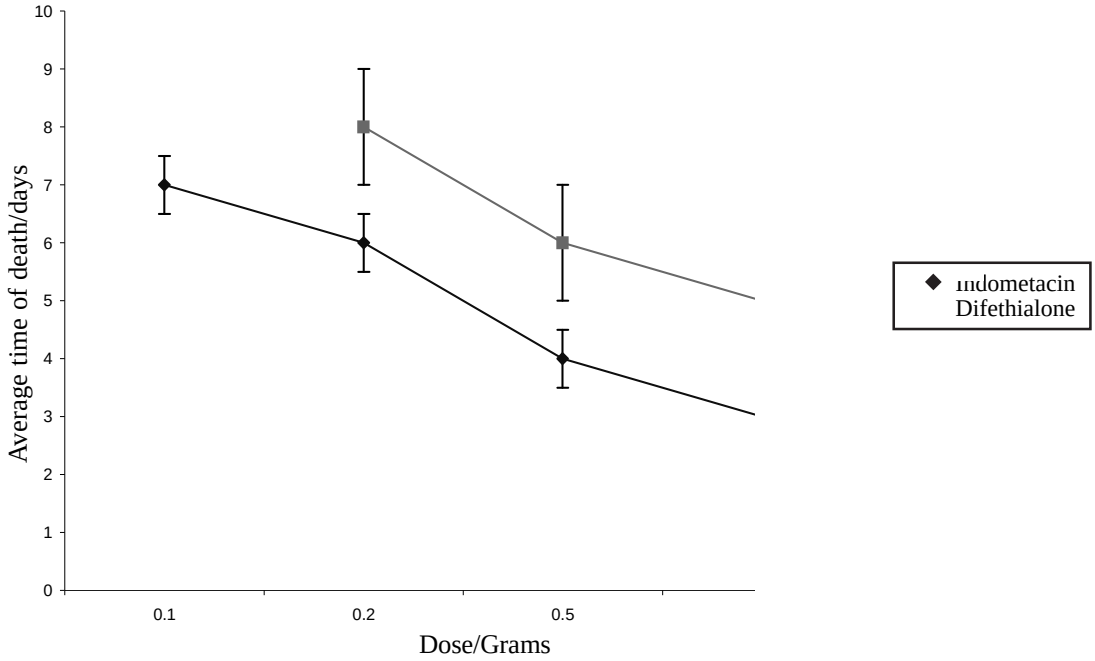

Fig. 1. Approximate time of death at different dosages of Indometacin and Difethialone

Indocid resulted in death approximately 7 days after drug administration, but no death occurred with 0.1 g of Difethialone within the same period. Consumption of 0.5 g of Indocid resulted in all the rats dying by the fourth day, while it took 6 days for the rats to die at 0.5 g of Difethialone. At 1.0 g dosage, Indometacin-administered rats died within 3 days, while Difethialone-administered ones died within 5 days (Fig. 1). There was a high negative correlation between dosage and average time of death (r = -0.9) after the consumption of potency and faster killing of the rodents by the drug than Difethialone (Fig. 1), apart from the lower risk of human poisoning with the use of Indometacin, which is a painkiller used by humans. Baraki and other active rodenticides are toxic to humans at any dosage, and because larger amounts would also have to be consumed to ensure death because of their bulk, they are inconvenient for use with rodents. Indocid could also easily be mixed with the dry corn flour, which is a normal rat diet and would, therefore, be more

acceptable to the rats than the green pellets of Baraki, which need to be handled with extreme care due to its harmful effects on humans.

Effect of Indocid on wild rodents

The individuals of *Mastomys erythroleucus* and *Praomys tullbergi* died 3 days and 5 days respectively, after consuming 1.0 g of Indocid. Individuals of *Lophuromys flavopunctatus* died 3 days after the consumption of 1.0 g Indocid, while *Mus minutoides* and the *Hybomys* sp. died 2 days after consuming less than half of the 10 g bait of 10 per cent (w/w) of Indocid. All the control wild rodents survived the 10-day observation period. The fact that death occurred after a day's encounter with Indocid suggests that it is highly toxic to the rodents. Even though Indocid proved fatal to the wild rodents, the numbers of individuals of each species used in the experiment were too small to enable definite conclusions to be drawn. These results may, however, have some implications for the future use of Indocid as a potential commercial rodenticide for the control of rodents on crop farms or plantations. Further research is, however, required on the rodenticidal properties of Indocid.

Conclusion and recommendations

Indocid mixed with dry corn flour proved lethal to both laboratory and wild rodent species. It killed faster and at lower concentrations than a well recognised rodenticide, Baraki. All the species of the wild rodents used died after exposure to 10 per cent (w/w) Indocid maize-flour mixture. Indocid, therefore, has prospects of offering households and farmers a cheap and less dangerous rodenticide. There is the need for further work on the effects of Indocid on wild rodent species to establish lethal doses for the various species, as well as the implication of the presence of Indocid in the food chain to common scavengers and predators of rodents like cats, snakes, and birds of prey.

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