

# Use of Topical Nicotine for Treatment of *Pediculus humanus capitis* (Anaplura: Pediculidae)

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**ABSTRACT** Head lice are caused by the host-specific, ectoparasitic insect *Pediculus humanus capitis* De Geer and remain a common human infestation. As a response to increasing resistance of head lice to present insecticidal agents, additional agents must be pursued. Inasmuch as nicotine has been used for controlling poultry lice, an in vitro study assessing its possible usage for human head lice was performed. Nicotine proved not to be an efficient insecticide, although it may facilitate removal of adult lice because it induces muscle twitches that may affect the insect's normal grip on hair follicles.

**KEY WORDS** *Pediculus humanus capitis*, head lice, nicotine

PEDICULOSIS CONTINUES TO be a major scourge in our society with over 6 million elementary children estimated to have been infested in 1998 (Smith 1998). Not only does this contagious condition cause considerable pruritus, but head louse, *Pediculus humanus capitis*, De Geer, is theoretically capable of being a vector for systemic diseases (Burkhart and Burkhart 1998). The search for alternative treatments continue because of the loss of susceptibility of lice populations to currently approved insecticides.

This study involves external application of nicotine to head lice. Nicotine is a highly toxic alkaloid that is both a stimulant and depressant to ganglionic function in humans. Additionally, it is an insecticide that interacts with nicotinic acetylcholine receptors of insects (Yamamoto 1965, Yamamoto et al. 1998). Nicotine has been used for controlling poultry lice by applying a tobacco extract containing 40% nicotine to perches in chickenhouses (Soulsby 1982, pp. 376–378). The fowl were exposed to this extract for 2 nights, and the warmth of their bodies caused the nicotine to evaporate on their feathers, which eventually killed the lice.

To determine its effect on human parasites, various concentrations of nicotine were applied in vitro to human head lice.

## Materials and Methods

Head lice were obtained from patients from a pediculosis treatment clinic. Twenty-four adult lice were placed in groups of 4 into petri dishes and exposed to nicotine pilacrilix in methocel at 0.5, 1.0, 2.0, 3.0, 4.0,

and 5.0% concentrations for 1 h. They were then washed with distilled water and allowed to dry on filter paper. Lice were observed during this study by light microscopy.

## Results

Within 1 min of exposure to nicotine of each concentration, lice were noted to have some hyperactivity. The insects attempted to assume their immobile state during which their legs would uncharacteristically twitch periodically. This twitching was more marked with the higher concentrations of nicotine. For each concentration, lice began their immobilizing response within 30 min. After removing the nicotine with water, all of the lice regained normal movement within 1 h.

## Discussion

An appreciation of the immobilizing state of the louse is necessary when assessing any therapeutic agent. With such a knockdown effect, there is a combination of central and peripheral paralysis of the louse (Glickman and Casida 1982). Insects are less dependent than mammals on continuous nervous control of respiration and circulation, therefore, time of death is not readily defined. Thus, lice, after inundation with mayonnaise, petrolatum, insecticides, or nicotine assume a body shut-down during which they appear dead by microscopic observation (Glickman and Casida 1982). Although irreversible damage to the nervous system and death may occur after insecticide or chemical exposure, lice regain normal movement after being washed with water after exposure to mayonnaise, petrolatum, and nicotine (Meinking et al. 1999). Head lice have to be observed for 24 h to ensure that any agent is lethal.

This head lice research was approved by the St. Vincent Mercy Hospital Animal Welfare/ Human Use Research Committee from 1998 to the present; the approved protocol is on file in our office.

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This study has shown that nicotine is not an efficient insecticide for louse infestations. The only supposed benefit for using nicotine for head louse infestation would be to facilitate removal of adult lice from scalp hair. The louse, which instinctively grasps hair even in its immobilized state, would be more easily removed with combing, because the muscle twitches with nicotine may affect their normal grip.

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