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Short communication

A note on averting goats to a toxic but palatable plant, *Leucaena leucocephala*

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Abstract

Conditioned taste aversions are a useful tool to reduce livestock consumption of toxic plants. The forage legume *Leucaena leucocephala* (leucaena) is both toxic and palatable. The objective of this study was to determine if goats could be aversively conditioned to avoid leucaena. Adult and juvenile female goats, naïve to leucaena, were divided into control and averted groups. Animals were exposed to leucaena, and time(s) spent eating leucaena was measured. During initial conditioning with lithium chloride (LiCl), averted goats spent less time eating leucaena ($P < 0.05$) than did controls. The averted groups maintained their reduced consumption ($P < 0.05$) of leucaena compared to controls during open field tests when goats could chose between leucaena and sugar cane. In final tests (two tests per week), averted goats reduced ($P < 0.05$) the amount of time they spent eating leucaena compared to control animals, but the aversion eventually extinguished. Aversive conditioning was successful in greatly reducing, but not entirely eliminating goats' consumption of leucaena.

Keywords: Conditioned taste aversion; Diet selection; Poisonous plants

1. Introduction

Conditioned taste aversions are a useful behavioral tool to train livestock to avoid some toxic plants (Ralphs et al., 2001). Livestock losses to toxic plants in Brazil are a serious problem, with 5% of the cattle population and 10% of the goat and sheep populations affected (i.e., death,

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abortions, birth defects, etc.) throughout the country (Tokarnia et al., 2002). Many toxic plants in Brazil are both poisonous and palatable (e.g., *Palicourea*, *Ipomoea*; Tokarnia et al., 2002), thus making it more difficult to keep livestock from ingesting fatal or harmful quantities. *Leucaena leucocephala*, commonly known as leucaena, is a palatable forage legume grown in tropical and subtropical areas worldwide. The major toxin in leucaena is mimosine, a depilatory and potent goitrogen (Hammond, 1995). The purpose of this study was to examine aversive conditioning in goats as a means to reduce consumption of leucaena, thus using leucaena as a possible model for conditioning aversions to other palatable and toxic plants.

2. Materials and methods

The study was conducted at the University of São Paulo Experimental Station, Pirassununga, São Paulo state, Brazil (S21°58′, W47°27′). All animal care and handling was done by experienced individuals under veterinary supervision.

2.1. Experimental subjects

Adult female Oberhaslis goats were 11–12 months of age (35–45 kg), while juvenile goats were 4–6 months of age (15–25 kg). Animals were naïve to leucaena. The basal diet of the goats was signal grass (*Brachiaria brizantha*) offered *ad libitum* each day. Animals were divided into two control ($n = 6$ adults and $n = 7$ juveniles) and two treatment groups ($n = 6$ adults and $n = 7$ juveniles). Observations were taken after the animals had been fasted from 17:00 to 08:00 h; fasting increases the animals' motivation to eat (Greenwood and Demment, 1988; Newman et al., 1994), thus providing a more stringent test of aversion and food choice.

2.2. Trial 1: conditioning and first pen test

On the first 2 days of the 4-day trial, the treatment animals were conditioned to avoid leucaena. Leucaena was collected fresh and placed into a feed box in the center of a 12 m × 12 m pen. On the first day, animals in each group were placed individually in the pen for 8 min, and consumption of leucaena was monitored using time spent eating as an estimate of forage intake. Groups were observed in random order. If an animal in the aversion treatment ate leucaena, it was dosed immediately after the session by oral gavage with 130 mg/kg of lithium chloride (LiCl, 10 mL volume). LiCl causes rapid nausea (i.e., ∼60 min). Similarly, control animals that ate leucaena were dosed with the equivalent volume of saline (0.9% NaCl) solution.

This initial 8 min session and dosing regime was followed immediately by a 60-min session during which each treatment group was observed together; observers used stopwatches to record the amount of time each animal spent consuming leucaena. On the second day, animals were again offered leucaena in a 12 m × 12 m pen, and the same procedure was followed. The last two days of this trial was used to provide an initial test of the aversion; animals were offered leucaena as detailed above for 60 min, the time spent eating was monitored, and no LiCl or saline was dosed if animals ate the plant.

2.3. Trial 2: first open field test

A small, open field (96 m^2) of signal grass (*Brachiaria decumbens*) pasture was used to further test the aversion. The field was divided into two equal parts separated by a wooden fence that virtually eliminated visual or social interaction. Two feed boxes were placed into the center of each open field; one box was filled with freshly cut sugar cane (*Saccharum officinarum*) and the other was filled with freshly cut leucaena. At 08:00 h treatment animals were placed in one half of the field, and controls were placed in the other portion for 60 min. Hidden observers documented the amount of time that individual animals spent feeding on either leucaena or sugar cane. No attempt was made to document grass consumption, as goats eat little grass when