Quart. J. Crude Drug Res. 19 (1981), No. 1, pp. 31-35.

Catnip (*Nepeta cataria*): An Evaluation of the Cold Water and Acetone-Pretreated Hot Water Extracts

C. J. SHERRY, T. W. ROBINSON and K. POWELL

Department of Biology, Texas A&M University, College Station, Texas 77843

After a careful search of the scientific literature and inquiries to professional organizations dealing with herbs and/or herbal remedies (e.g., National Association of Naturopathic Physicians; The American Society of Pharmacognosy; Homeopathic Council for Research and Education; National Center for Homeopathy; National Institute of Medical Herbalists (England)), we were not able to find any information (statistical or otherwise) about the number of people who use herbal teas and/or remedies. We were also not able to find any information about how often these teas and/or remedies are used or under what conditions. However, indirect evidence, such as an increase in the number of herb and/or health food retail outlets (Murray, 1978), the appearance of new herb magazines (e.g., The Herbalist, Bestways, etc.), increased subscriptions to existing magazines (e.g., Prevention, Nature's Path, etc.), and an increase in orders for United States Department of Agriculture publications dealing with herbs (Duke, 1978), all suggest an increase in interest in herbs and/or herbal remedies.

Catnip (*Nepeta cataria* L.), based on indirect evidence (e.g., frequency of listing in various herbals and herb lists, anecdotal reports in herbals and herb magazines, etc.), is one of the most commonly used herbal teas and/or remedies. Catnip herb has appeared in the United States Pharmacopeia (1840-1870)* and it is currently listed in the naturopath dispensatory (Kuts-Cheraux, 1953). It is commonly recommended for gastric, respiratory, and nervous system problems.

Catnip is widely distributed in the wild in both the United States and Europe and it is commonly available from a wide variety of commercial sources (i.e., pet stores, supermarkets, herb stores, seed supply houses, etc.). There are apparently at least three different catnip preparations that have differing chemical constituents and pharmacological effects: (1) the essential oil of catnip (i.e., the steam distillate); (2) catnip tea (i.e., the hot water extract); and (3) catnip roots.

* Also in the National Formulary (US) (editions IV to IX) and in at least four other pharmacopeias (Ed.).

The essential oil of catnip contains a psychoactive agent, which has potent behavior-altering effects and/or functions as an apparent hallucinogen in both domestic and wild cats (Hatch, 1972; Leyhausen, 1973). The most likely candidate for the active agent is nepetalactone (Waller et al., 1969) and/or one of its close chemical relatives, epinepetalactone (Regnier et al., 1967) or dihydronepetalactone (Wolinsky and Eustace, 1972). In rodents, catnip oil and nepetalic acid, a constituent of the oil, significantly increased hexobarbital sleeping time and altered Sidman avoidance behavior (Harvey et al., 1978). Tolerance to the behavior-altering effects of catnip oil developed (Harvey et al., 1978). Catnip has a mixed reputation among human drug experimenters, some claim it is a mild cannabis-like hallucinogen (Young et al., 1977), while others claim it is without effect (Margolis, 1978). Catnip smoke (which probably contains the constituents of the essential oil) functions as a mild cannabis-like hallucinogen in humans (Jackson and Reed, 1969). One potential reason for the mixed reputation of catnip amoung humans might be a simple concentration effect. The essential oil makes up approximately 0.3% of the dry weight of catnip (McElvain et al., 1941), and this value decreased with improper drying and/or storage techniques (Sherry, 1978). The chemistry of the essential oil is reasonably well known (McElvain et al., 1941, 1942; McElvain and Eisenbraun, 1955; etc.).

We have not been able to locate any reports of the chemical constituents, potential active agents, and/or pharmacology of catnip roots in the literature. All data are from anecdotal sources (i.e., herbals, etc.) and suggest that catnip roots act as a stimulant and cause an increase in aggressive behavior (Hutchens, 1973). Pilot studies in our laboratory suggest that catnip roots do act as stimulant (Sherry, 1978).

Based on indirect evidence (see above), catnip tea has a long history of use as a herbal tea and/or remedy. The usual method of preparing herbal teas (i.e., steeping in hot water in a closed container for varying time periods and then filtering out the leaves) would minimize the presence of the constituents of the essential oil in the tea. We have not been able to locate any reports about the chemical constituents, potential active agents, and/or pharmacology (human) of catnip tea in the literature. In young (9 ± 5 days) and old (25 ± 7 days) chicks, intraperitoneal injections of 400, 800, or 1000 mg/kg of the hot water extract of catnip caused a significant increase in the average episode and average total duration of light sleep (Sherry and Koontz, 1979).

In an effort to further elucidate the basic pharmacology of the aqueous extract of catnip, we decided to evaluate the pharmacological properties of the cold water extract of catnip and the hot water extract of catnip that had been previously extracted with acetone. Since the young chick responds in a stereotyped manner to other catnip preparations (Sherry and Koontz, 1979; Sherry and Hunter, 1979), as well as to other hallucinogens (Sherry and Burnett, 1978), we decided to use young chicks for these experiments.

METHODS

Male white Leghorn chickens were obtained at 1 day of age from the Kazmeirer Hatchery (Bryan, Tx) and housed in temperature-controlled brooders, with food and water available ad libitum. The cold water extract of a commercial preparation of dried ground catnip (Meer Corp., North Bergen, N. J., Lot # 36-82220) was prepared by pouring room temperature water (350 ml) over the catnip (50 g) and the mixture was sonicated for 15 min and then was periodically shaken and allowed to steep in a close container for approximately 24 hours. The mixture was filtered under vacuum and the residue was re-extracted (2 times). The 3 samples of extract were combined and the solvent was evaporated using a Rotavapor. The acetone pretreated hot water extract was prepared by extracting the catnip 3 times with acetone and allowing the residue to dry and then extracting it by pouring boiling water (350 ml) over the catnip (approximately 50 g), sonicating for 15 min and then allowing the mixture to steep for approximately 24 hours in a closed container. This was repeated twice. The 3 samples of the extract were combined and the solvent was evaporated. Weighted samples (400, 600, 800, 1000, and 1200 mg) as well as 200 mg of cold water extract and 1400 mg of acetone-pretreated hot water extract of each solid residue left after the evaporation of the solvent was added to distilled water and the volume was adjusted to 10 ml. This allowed a dose level of 0.01 ml/g of body weight. All drugs were administered intraperitoneally. The control chicks were injected with the same volume of distilled water. Groups of 12 each were injected at each dose level and, immediately after injection, each chick was placed in a standard galvanized steel mouse cage, one animal per cage, and closely observed for 2 hours. During this time period, at one minute intervals, each chick was observed and placed in 1 of the following categories which best described the behavior of the chick: (1) light sleep (i.e., the chick sat or stood quietly, without peeping, with eyes closed and head up); (2) deep sleep (i.e., the chick sat down without moving or peeping, with eyes closed and head down); and (3) wakefulness (i.e., the chick stood or sat quietly or moved about and peeped). Since we lack the standard neurophysiological correlates of sleep, we are using these terms (i.e., light and deep sleep) for the convenience of discussion, to describe the overt behavior of the chick and not to define a specific physiological state.

All statistical evaluations utilized the Kruskall-Wallis one-way analysis of variance test and where appropriate, Nemenyi's procedure was used as the multiple comparisons test (Kirk, 1968). All comparisons were made at the 0.05 confidence level.

RESULTS

The average episode and total duration and the average number of episodes of light and deep sleep caused by the cold water and the acetone pretreated hot water extracts are shown in Tables 1 and 2, respectively. The overall Kruskall-Wallis one-way analysis of variance for the average episode duration, average total duration, and the number of episodes of light sleep for both extracts, as well as the average

Table 1. The effect of the cold water extract of catnip on the behavior of the young chick. The first number in each pair is the average duration of each behavior and the number immediately below it, its standard deviation. All times are expressed in minutes.

Catnip extract (mg/kg)	Average Episode Duration Light Sleep	Average Total Duration Light Sleep	Average Number of of Episodes of Sleep
Control	1.69	11.58	6.08
	0.83	9.80	4.38
400	1.52	8.67	1.75
	2.40	16.64	3.19
600	7.02	45.17	7.58
	7.09	32.23	4.76
800	3.62	18.33	5.50
	2.57	9.45	3.15
1000	5.60	26.58	4.17
	3.26	19.86	2.25
1200	5.49	25.58	3.67
	3.88	29.04	2.74
1400	4.08	31.58	8.50
	1.90	13.00	2.15

Table 2. The effect of the acetone-pretreated hot water extract of catnip on the behavior of the young chick. The numbers have the same meaning as in Table 1.

Catnip Extract (mg/kg)	Average Episode Duration		Average Total Duration		Average Number of Episodes	
	Light Sleep	Deep Sleep	Light Sleep	Deep Sleep	Light Sleep	Deep Sleep
Control	1.51	0	5.53	0	3.17	0
	1.11		4.80		3.19	
200	4.36	0	43.00	0	10.17	0
	2.58		23.67		1.83	
400	3.63	3.50	39.83	5.00	11.5	0.62
	2.02	4.04	18.73	7.04	3.99	0.82
500	9.43	4.03	75.17	6.50	9.33	1.00
	5.91	5.32	32.90	7.23	3.14	1.26
800	3.72	3.95	43.17	9.33	12.00	1.67
	1.84	3.16	30.20	8.66	7.38	1.63
1000	10.96	6.58	59.00	10.33	5.50	1.17
	4.08	6.32	22.02	8.14	1.38	0.98
1200	13.97	11.25	82.17	20.67	6.67	2.0
	6.61	5.08	14.50	8.62	2.07	0.89

episode duration, average total duration, and the number of episodes of deep sleep for the acetone pretreated hot water extract were statistically significant at less than the 0.05 confidence level. Deep sleep did not occur with the cold water extract. Due at least in part to the high variability, the control and the various dose levels did not differ significantly (Nemenyi's procedure).

DISCUSSION

It is clear that the cold water and acetone-pretreated hot water extracts possess some pharmacological activity, since they both cause a significant change in the behavior of the young chick. However, the activity is relatively weak, variable, and it is not dose-dependent. Since the hot water extract (Sherry and Koontz, 1979) and the cold water extract were extracted under identical conditions, except for temperature, and since the hot water extract caused a significant, dose-dependent alteration in behavior, it is apparent that the active agent is more soluble in hot than in cold water. The active agent is also apparently soluble in acetone, since the acetone-pretreated hot water extract is less active than the hot water extract. The solubility in acetone and hot water suggests that the active agent is a small organic molecule.

SUMMARY

Samples of the cold water extract (400-1400 mg/kg) and the acetone-pretreated hot water extract (200-1200 mg/kg) of catnip (*Nepeta cataria*) are pharmacologically active, but the activity is relatively weak, variable, and not dose-dependent.

REFERENCES

Duke, J. A. Chief Medical Plant Resources Laboratory, United States Department of Agriculture, personal communication.
Harvey, J. W., Barofsky, I. M. and Leary, J. D. (1978) Lloydia 41, 367-74.
Hatch, R. C. (1972) Amer. J. Vet. Res. 33, 143-155.
Hutchens, Alma R. (1973) Indian Herbology of North America. Merco, Ontario.
Jackson, B. and Reed, A. (1969) J. Amer. Med. Assoc. 207, 1349-50.
Kuts-Cheraud, A. W. (1953) Naturae Medicina and Naturopathic Dispensatory. Amer. Naturopathic Physicians and Surgeons Assoc., Des Moines, IA.
Leyhausen, P. (1973) Addictive Behavior in free ranging animals, in: Goldberg, L. and Hoffmeister, F. Psychic Dependence: Definition, Assessment in Animals and Man: Theoretical and Clinical Implications. Springer, New York.
Margolis, J. S. (1978) Complete Book of Recreational Drugs. Cliff House Books, Los Angeles, CA.
McElvain, S. M., Bright, R. D., and Johnson, P. R. (1941) J. Amer. Chem. Soc. 63, 1558-63.
McElvain, S. M. and Eisenbraun, E. J. (1955) J. Amer. Chem. Soc. 70, 1559-1605.
McElvain, S. M., Walters, P. M., and Bright, R. D. (1942) J. Amer. Chem. Soc. 64, 1828-31.
Murray, F., Editor, Health Food Retailing, personal communication.
Regnier, F. E., Eisenberg, E. J., and Waller, G. R. (1967) Phytochem. 6, 1271-80.
Sherry, C. J. and Burnett, R. E. (1978) Experientia 34, 492-3.
Sherry, C. J. and Hunter, P. S. (1979) Ibid 35, 237-8.
Sherry, C. J. and Koontz, J. A. (1979) Quart. J. Crude Drug Res. 17, 68-72.
Waller, G. R., Prince, G. H. and Mitchell, E. D. (1969) Science 164, 1281-2.
Wolinsky, J. and Eustace, E. J. (1972) J. Org. Chem. 37, 3376-8.
Young, L. A., Young Linda G., Klein, Marjorie M., Klein, D. M., and Beyer, Dorianna (1977) Recreational Drugs, Berkeley Pub. Co., N.Y.