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ACUTE ADVERSE HEALTH EFFECTS OF PESTICIDES SPRAYED ON KHAT TREES.

By

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ABSTRACT

Khat, Catha edulis is a plant of the family Celastraceae. The leaves of khat are chewed for their stimulating effects. Cathinone is the active substance in khat Khat is sprayed with pesticides for protection from pests. This is a prospective study which was conducted between February 1997 and September 1998. The aims of the study was to identify and evaluate the acute toxic effects of pesticides used on khat. The study included 614 farmers who use pesticides with ages ranged from 8 to 70 years. Acute adverse effects were seen in 196 (31.9%) of cases and skin lesions were the commonest, followed by ocular toxicity. Acute fatal poisoning by pesticides was reported in 5 cases, two of them were children under 11 years of age. Also the study indicated that 6.4% of pesticide applicators were children under 15 years of age. There was a decrease in the activity of serum acetylcolinestrase and the exposure index indicated a high chronic exposure level in pesticide exposed khat farmers. The results of this study indicated that the hazardous use of pesticides on khat is a serious health problem, with a short and long term adverse health effects on humans.

INTRODUCTION

Khat, *Catha edulis* is a plant of the family Celastraceae and was first named and decsribed by the Swedish Botanist Peter Forsskal. The plant grows in East Africa and Yemen. The leaves of khat are chewed extensively by inhabitants of some African countries and Yemen. Currently khat is transported by plants to countries faraway from the areas of its cultivation. It has been shown that Cathinone is the active substance in khat. Khat protection from different pests is widely practised to maintain fresh clean foliage. Increase the demand and consumption of khat resulted in increase in the use of Pesticides on khat by farmers who wish to increase their income.

Introduction of pesticide to Yemen Republic has started by importing Organochlorine pesticides, then followed by organophosphorus and carbamates Unfortunately, most of the chemicals that are used as pesticides on khat trees are not highly selective and are generally toxic to many non-target species including humans. It is estimated that 70% of pesticides in Yemen Republic are used on khat (Al=Ghashm and Mogahed, 1988).

The aims of the study was to identify the acute toxicity of pesticides on khat farmers and their families.

MATERIALS AND METHODS

We carried out a cross sectional study among farmers exposed occupationally to pesticides. The study included 614 males from different villages. Ages ranged from 8 to 70 years. They were recruited during usual visits to their houses and / or khat fields and their participation was voluntary. The study was conducted between February 1997 and September 1998. Farmers were asked to answer standardized questionnaire on medical history, type of pesticide(s), number of pesticide sprays, The time interval between the last spray and khat harvesting.

Other data collected were routes of exposure, methods of protection, cases of acute fatal poisoning and all acute toxic effects experienced by the applicators. The serum cholinesterase activity and the levels of chronic exposure to pesticides were measured in 25 khat farmers with acute poisoning by pesticides and group of 5 healthy adult persons not exposed to pesticides. Serum cholinesterase activity was neasured by the method of Ellman *et al* (1961). The exposure index that measured the relative levels of chronic occupational exposure to pesticides was derived as follows:

Chronic exposure level = Log 10 [{YxD/Age – 18} + 1] where Y is the number of years of occupational exposume to pesticides and D is the most recent estimate of the number of days of usage of pesticides per year. Index values from 0.698 to 2.757 classed as high chronic exposure; those from 0.698 to 0.000 were classed as low chronic exposure (Korsak and Sato, 1977).

RESULTS AND DISCUSSION

Acute toxic effects of pesticides sprayed on khat were seen in 1996 of (31.9%) cases (Table 1). The commonest toxic effects were skin lesions (13.7%) followed by ocular toxicity (9.5%). Headache and convulsions were the commonest neurological symptoms. Acute fatal poisoning occurred in 5 cases. Two deaths were in children less than 11 years of age. The other 3 deaths were in adults. In one death, the poisoning was self inflected, when the farmer ingested the pesticide, to show others that it is harmless. 6.4% of pesticide applicators were children under 15 years of age. The majority of farmers 78.5% use mixture of pesticides (Table 2).

The number of pesticide applications per person on khat trees was found to be 59% weekely. The average period between the last application of pesticide and khat harvesting was 7 days. The results in Table (4) indicate the activity of (AchE) was reduced to 72.69%. Also, a high chronic exposure was found in pesticide-exposed Farmers. Safety measures (Table 4) in handling pesticides from selection to application and preharvesting safety period are not followed by the applicators. The disturbing fact is that some of the globally banned pesticides are used in

Yemen such as DDT, Lindane and Parathion. In addition, some of the extremely hazardous compounds according to WHO classifications of pesticides under group IA or IB are used heavily on khat for example, compounds such as monocratophos and methomyl which are not permitted on edible crops such as khat.

Table (1) : Acute adverse effects of pesticides sprayed on khat Trees in 169 cases

Adverse effect	No.	%
Skin lesions	84	13.7
• Ltching		
• Erythema		
• Rash		
Eye toxicity	58	9.5
• Reddness		
• Itching		
• Blurred vision		
Digestive system	27	4.4
• Headache		
• Convulsions		
• Vertigo		
Nervous system	16	2.6
• Diarrhoea		
• Abdominal pain		
• Nausea\ vomiting		
Miscellaneous	6	.98
• Bronchospasm		
• Sweating		
• Nasal allergy		
Fatal poisoning	5	31.9
Total	196	31.9

Table (2): Pesticides Used in mixtures On khat, Catha edulis Trees In Sana'a Governorate

Common Names	Trade	Type of Action
Dimethoate +	Prefekthion +	Insecticide
Trichlorfon +	Dipterex +	Insecticide
Penconazole	Topas	Fungicide
Methidathion +	Supracide	Insecticide
Fenarimol +	Rubigan	Fungicide
D.D.T or Lindane	D.D.T, Lindane	Insecticide
Methidathion	Supracide	Insecticide
Penconazole	Topas	Fungicide
Fenarimol	Rubigan	Fungicide
Dust	Dust	Fungicide
Iron Fetilizer	Iron Fetilizer	Fungicide
Dimethoate	Prefekthion	Insecticide
D.D.T	D.D.T	Insecticide
Trichlorfon	Dipterex	Insecticide
Penconazole	Topaz	Fungicide

Table (3) : Exposure Index and Acetylcholinesterase (AchE) Activity In Controls and khat Farmers.

Parameters	Controls	Exposed khat Farmers
Exposure Index	0	1.466 0.08 (a)
Colinesterase Activity %	100	72.69

(a) High Chronic Exposuure

Table (4) : The features of pesticides application on khat Trees

Surveyed Villages	No. of Farmers	Pesticides Applications Mixtures of single application				Number of Application during Season			Time Interval After Last Spray and Harvesting (Days)		
		Single	Two	Three	Four	Weakly	Monthly	Yearly	1-7	7-14	14-28
I	50	9	17	11	13	35	6	9	25	18	7
II	50	7	20	8	15	30	16	4	31	13	6
III	50	4	12	14	20	29	14	7	26	20	4
V	50	23	7	9	11	24	18	8	17	21	12
Total	200	43	56	42	59	118	54	28	99	72	29

The data in Table (4) shows that the surveyed villages were five villages in Sana'a Governorattes. \The total number of surveyed farmers were 200 who gave the information concerned with pesticide application.

This is the first study which evaluated the acute adverse effects of pesticides on humans in Yemen Republic. The review showed that 31.9% of pesticide applicators, suffered acute toxicity, which included 5 fatal poisonings. This figure gives an idea about the size and seriousness of the problem. Also, we believe that accidental deaths reported in this review are under-estimated. This might be explained by absence of death records in Yemen. The study showed that children are the victims of a high percentage of accidental fatal poisoning cases (two of five).

Reich *et al* (1968) reported that 27% of fatal poisoning occurred in children. In this paper, the toxic effects of pesticides on the eye and skin were the most common, while the adverse effects on the digestive and respiratory systems were relatively uncommon. This might be explained by the fact that some pesticide applicators in Yemen use protective clothing "Al-Shat" or "Al-Samatah" [1] (Piece of cloth put on head or shoulder by the majority of Yemeni farmers. [1]) to cover their nose and mouth and the majority of cases in this review didn't protect their skin or eyes. Wolfe *et al* (1972) studied the direct exposure of agriculture spraymen to pesticides. Values for potential dermal, respiratory exposure and for total exposure in terms of fraction of toxic dose were determined for 11 different pesticides. They indicated that potential dermal exposure to each compound was mush greater than potential respiratory exposure.

The most useful and probably most accurate estimations or measurements on the precutaneous penetration of pesticides in man accomplished have been made by Maibach *et al* (1971). Using radiolabelled pesticides, they were able to determine the approximate fraction of an applied dose absorbed through the skin. The results indicated that the area of greatest absorption of parathion in man is the scrotum, where approximatelly 100% of an applied dose was absorbed. It also points out that the head and neck area should be given more attention. In this area absorption of parathion was found to be from 32.2% to 36.3% of the applied dose, much more than at other areas of the body studied.

The use of pesticides on khat trees is more dangerous than their use on fruits and vegetables, because the khat farmers are using these pesticides haphazardly, disregarding the scientific rules of applications,

and the safety period between the last application of pesticide and khat harvesting. In the course of khat harvesting the khat farmers are exposing parts of their bodies to parts of the khat trees which are sprayed by pesticides and they inhale air which contains hazardous vapors and surface residues of pesticides on the leaves. Organophosphorus compound can exert their toxic effects through repeated exposure, and low-level daily exposures can cause cholinesterase activity at a rate faster than the rate of enzyme inhibition of regenerated. Under these conditions, a critical level of inhibition can occur and overt illness can result. Hazards to farm workers and consumers were reported in several studies (Kaskypp and Gupta, 1971), (El-Sebae *et al*, 1978), (Wicker *et al*, 1979 a,b), (Muller and Undt, 1980), (Kraus *et al*, 1981), (Thabet, 1993 and El-Sebae, 1998). The review showed that internationably suspended or banned pesticides have been used on khat trees, in Yemen (Table 3). It is believed that these compounds entered illegally to the country. In another paper the authors discussed the indirect relation between some pesticides and cancers in Yemen Republic (Al-Hadrani, and Thabet, 1999).

Howerever, further studies are needed to assess the impact of pesticide residues on khat trees.

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الملخص العربى

التأثيرات الضارة الحادة للمبيدات المرشوشه على القات

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نبات القات Catha edulis احد نباتات العائله Celastraceae واوراق القات يتم مضغها لتأثيرها المنبه ومركب الكاثينون هو الماده الفعالة الرئيسية فى نبات القات. ويتم رش القات بالمبيدات فى الحقل لوقايته من الافات المختلفه.

وقد تم اجراء الدراسة الحالية فى الفترة من فبراير ١٩٩٧ حتى سبتمبر ١٩٩٨ وذلك بغرض التأثيرات الضاره الحاده التى تظهر على الانسان بعد مضغ القات الملوث ببقايا المبيدات.

وقد تم فحص ودراسة ٦١٤ من المزارعين الذين يستخدمون المبيدات وتتراوح اعمارهم من ٨–٧٠ سنة.

وقد تم رصد اعراض من الاضرار الحاده فى ١٩٦ حالة منهم اى بمعدل ٩ر٣١% من جملة العينة المفحوصه. وقد تم تسجيل حالات وفيات منها اثنين من الاطفال تحت عمر ١١ سنة. كما اوضحت الدراسة ان ٤ر٦% من عمال رش المبيدات من الاطفال حيث تقع اعمارهم اقل من ١٥ سنة. كما تم رصد خفض فى نشاط انزيم الكولين استريز فى سيرم الدم. كما تبين وجود تأثيرات ضارة مزمنه بين مزارعى القات الذين يتعرضون للمبيدات.

وتشير نتائج الدراسه الى المخاطر الصحيه لتعاطى اوراق نباتات القات خاصة المعامله بالمبيدات سواء فى اعراض السميه الحاده او السميه المزمنة نتيجه التعرض للقات الملوث بالمبيدات.