

## An Association between Chronic Khat Chewing and the Development of Type 2 Diabetes

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**Abstract:** Hypothesis: Chronic khat chewing might be one of main risky factors which causing or play a main role in the appearance of diabetes mellitus (type 2) among khat chewers for long period of administration. Aims: the main target from the present investigation was to study the relationship between some people's habit such as khat chewing in some Arabic countries and the appearance of diabetes mellitus disease (DM -type 2) chewing khat for long time. **Methods and Subjects:** Three hundred ninety two patients (224 men, 168 women) where entered into a prospective controlled study. Patients where divided into two groups: G1 (=205) chronic khat chewers, G2 (= 187) non-khat chewers. Medical history, clinical examination, and investigations were performed and recorded on all subjects. Fasting plasma glucose was used to diagnose diabetes employing American Diabetes Association criteria. **Results:** Diabetes mellitus was found in 65 (31.7%) khat chewers compared to 20 (10.7%) in non-chewer subjects. The P-value is 0.000 which indicates that the two groups are significantly different. The odds of exposure (diabetics) in cases are 0.46 and that in the control cases is 0.12, yielding that the odds ratio is 3.88. khat chewing increases the odds of having diabetic disease by 3.88 times among this population. Almost 100% of these diabetes cases were type 2 diabetes. **Conclusions:** The results of this study have shown for the first time that there is an association between chronic khat chewing and the development of type II diabetes. The abuse in Pesticides application on khat trees, the sedentary lifestyle and smoking might be an important risk factors in the development of type 2 diabetes among khat chewers. Further studies are needed.

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**Keywords:** khat, type 2 diabetes, pesticides

### 1. Introduction

Some peoples adapting themselves for administering of some plants as a habit or due to stimulants effects on the nervous system as in south of Arabian Peninsula and some neighboring countries. Khat plant is cultivated in Yemen (South of Arabian Peninsula), Somalia and Ethiopia (East Africa), the young leaves and stems of khat are chewed or masticated in the mouth for several hours for their stimulant action<sup>(1)</sup>. Some immigrants transfer this bad

habit to their countries and helping in spreading the khat chewing to another countries. Phytochemical analysis of khat, revealed that it contains many components such as the alkaloid cathinone which considered the main active component of khat plant. Cathinone, is similar to the amphetamine in its pharmacological action, where they posses a stimulant effects on the central nervous system as sympathomimetic<sup>(2-4)</sup>.

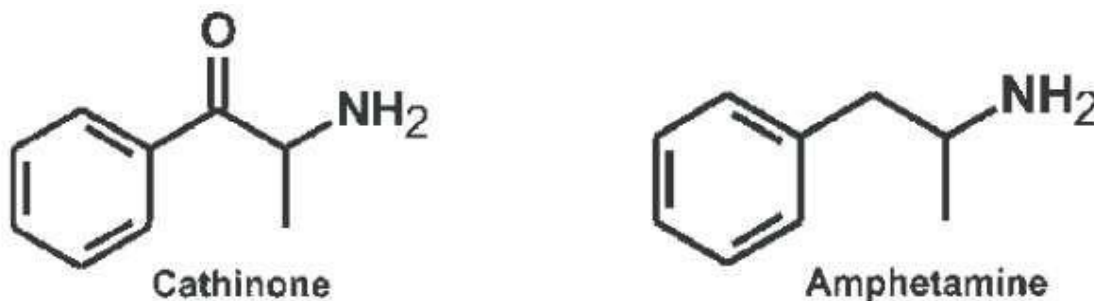


Figure (1): Chemical structure of cathinone and amphetamine.

It is estimated that approximately 95% of khat in Yemen is treated with pesticides. Pesticides are used on khat in Yemen, without safety precautions. Some pesticides are banned globally and smuggled to Yemen e.g. DDT and Lindane. Emerging evidence suggests that pesticides might participate in the pathogenesis of diabetes mellitus type 2<sup>(5-7)</sup>.

About 285 million of peoples around the world are suffering from diabetes, this number nominating for increase in the future and the probable numbers not less than 428 million at year 2030<sup>(8-10)</sup>. The Prevalence of diabetes is increasing in Yemen and Gulf Countries reaching up to 20-30% of Population<sup>(11,12)</sup>. Un controlled diabetes have various bad effects on body systems for example, such as renal failure, blindness, unhealed wounds, circulatory disordered and finally causing death. The disease of diabetes type 2 can be controlled through controlling of diets and life style improvement and physical activity as reported by many investigators<sup>(13,14)</sup>.

## 2, Methods and Subjects

This is a prospective controlled study which conducted in the Yemen Specialized Hospital, Three hundred and ninety two individuals were enrolled in the study, 224 men and 168 women whose ages ranged from 29 to 80 years. They were divided into 2 groups: group 1 was chronic khat chewers, group 2 were non-khat chewers (table 1).

Patients in the study group and controls were Yemenite who come from different sectors of the Yemeni Society. The controls were chosen from non-khat chewers who attended the outpatient clinic or admitted to the hospital with diseases other than diabetes. Medical history, clinical examination and investigations were performed on all subjects. Patients with fasting blood glucose > 126 mg/dl on two occasions were classified as diabetic. Patients with FPG of 100-125 mg/dl were not included in the study. Fasting plasma glucose levels were measured by RA-50 clinical chemistry analyzer. 100 khat farmers in

Sana'a governorate were questioned regarding use of pesticides on khat trees in their khat farms.

### Khat chewing sessions:

The khat chewer usually begins after lunch; each person consumes about 100-500 gm of the leaves. The young fresh leaves are picked from twigs, chewed and then stored in the check. The saliva and leaf extract are swallowed or spitted out. The active components of khat are absorbed from the buccal mucosa of the mouth and the intestine. Chewing sessions may last 3 to 6 hours. Data has been collected regarding chewing habits.

## 3. Results

Type 2 diabetes mellitus was found in 65 (31.7%) khat chewers compared to 20 (10.7%) non-chewer subjects (Table 1). Almost 100% of these diabetes cases were type 2 diabetes.

**Table 1. Type 2 diabetes in khat chewers and non-khat chewers**

	Khat chewers	Controls	Total
No	140	167	307
Diabetics	65(31.7%)	20(10.7%)	85
Total	205	187	392
P-value (2-sided test)		0.000	

### Statistical analysis,

The Chi-square test yielded that the P-value is 0.000, which indicates that the two groups are significantly different. It is also clear that the odds of exposure (diabetics), in cases are 0.46 and that in the control cases is 0.12, yielding that the odds ratio is 3.88. Based on this, we conclude that the khat chewing increases the odds of having diabetic disease by 3.88 times among this population.

The study showed that approximately 95% of khat farmers reported using one or mixtures of Pesticides on khat trees and the remaining (5%) using sand (table 2).

**Table 2: Pesticides used on Khat trees in 100 khat farms in Sana'a Governorate:**

Common Names	Trade Name	Type of Action
Diamethoate +	Prefektion+	Insecticide
Trichlorfon+	Dipterex+	Insecticide
Penconazole Topas	Fungicide	
Carbaryl Seveen	Insecticide	
Methidathion+	Suprcide	Insecticide
Fenarimol+	Rubigan	Fungicide
D.D.T	D.D.T	Insecticide
Lindane Gamexane	Insecticide	

#### 4. Discussion

Nowadays, a hundreds of millions of inhabitants in some countries in Yemen, Sudan and Madagascar<sup>(15) (16)</sup> adapted themselves for shewing young leaves and stems of khat plant. Phytochemical screening of khat plant indicated that it comprised many of active ingredients as, tannins, alkaloids, flavanoids and other ingredients. Chewing of khat for long period may cause adverse physiological effects and possible pathological lesions. This work is considered the first research which deals with the habit of khat chewing for long period and its relation with the appearance of diabetes mellitus type two disease or symptoms among inhabitants. The obtained results revealed that there are a significant elevation in numbers of diabetic patients among chronically chewed khat.

The aetiopathogenesis of diabetes mellitus in chronic khat chewers might be attributed to the following factors: using of pesticides on khat trees. This study showed that 95% of khat trees are sprayed with one or mixtures of pesticides.

A survey of farmers from Canada showed that men work with insecticides had an increased risk of diabetes as compared to farmers who did not work<sup>(17)</sup>. Epidemiological evidence supported by cohort studies, case control studies and cross-sectional studies, suggests an association between exposure to organ chlorine pesticide and type 2 diabetes<sup>(18)</sup>. The pathogenesis of diabetes due to pesticides includes: i. inhibitory effects on protein kinases (which play role in normal cell metabolism), of insulin receptors<sup>(19)</sup>. ii. Disruption of beta cell function<sup>(20)</sup>. iii. Insulin resistance<sup>(21)</sup>.

Some khat chewers consume a higher dietary glycemic load and trans fat as drinks or in meals which are linked with augment of diabetes hazard, while it was reported that utilization of high amounts of unsaturated fats and cereal fiber is accompanied improvement in the health condition and decreased risk factor<sup>(13)</sup>. It is estimated that 17% to 70% of khat chewers are smokers<sup>(22,23)</sup>. This percentage varies according to culture, social class, education and age. Statistically, the present data revealed that there was a 45% elevation in the percentage of occurring of diabetes among smokers in comparison with non-smokers individuals<sup>(24)</sup>.

Some khat chewers spend several hours (3 to 6 hours) sitting in khat chewing and some chewers spend more than 8 hours in chewing and most of the remaining hours (8 to 10 hours) in sleep. Several studies reported that this sedentary life style is associated with increased risk of diabetes<sup>(25) (26)</sup>. Some peoples considered that the hard work is required for stimulation of the body for absorbing sugars and augment the release of insulin to regulate sugar level in sedentary condition, but this is considered an

additional stress factor on the cells secreting or manufacturing insulin<sup>(27)</sup>.

#### In conclusion:

The present finding found a strong relationship between the appearance of diabetes mellitus type 2 and khat chewing habit and suggested that pesticides sprayed on khat, sedentary lifestyle and smoking are the most important risk factors in the development of type 2 diabetes among khat chewers. Further studies are needed to address this association further.

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