

East African Medical Journal Vol: 93 No.7 July 2016

EFFECTS OF *CATHA EDULIS* ON KIDNEY AND LIVER FUNCTION AMONG CHEWING ADULTS IN MERU COUNTY, KENYA

C. M. Mworia, BSc, MLS, MMLS Clinical Chemistry, Department of Medical Laboratory Sciences, Jomo Kenyatta University of Agriculture and Technology, P. O. Box 62000- 00200, Nairobi, Kenya, W. Kinge, MSc, PhD, Department of Medical Laboratory Sciences, Mount Kenya University, P. O. Box 342-01000, Thika, Kenya, M. Kahato, MSc, PhD, Medical Entomology, Department of Medical Laboratory Sciences, Jomo Kenyatta University of Agriculture and Technology, P. O. Box 62000- 00200, Nairobi, Kenya, and J. Mwamisi, MSc, PhD, Medical Education, Kenya Methodist University, P. O. Box 267-60200 Meru, Kenya

Request for reprints to: C. M. Mworia, Department of Medical Laboratory Sciences, Jomo Kenyatta University of Agriculture and Technology, P. O. Box 62000- 00200, Nairobi, Kenya

EFFECTS OF *CATHA EDULIS* ON KIDNEY AND LIVER FUNCTION AMONG CHEWING ADULTS IN MERU COUNTY, KENYA

C. M. MWORIA, W. KINGE, M. KAHATO and J. MWAMISI

ABSTRACT

**Background:** *Catha edulis* chewing is common in Kenya and is a daily activity in Meru. According to the National Authority for the Campaign against Alcohol and Drug Abuse (NACADA) 2012 drug-use study, there are 1.6 million *Catha edulis* users in Kenya. The habit of khat chewing is widespread with a deep-rooted socio-cultural tradition in Kenya and as such poses a public health problem. Some studies have been done to investigate the effects of Khat on kidney and liver in animals. However, only a few of these studies have been conducted in human.

**Objective:** To investigate the possible effects of *Catha edulis* on the levels of various biochemical parameters to assess kidney and liver function.

**Design:** Cross sectional study.

**Setting:** Meru County, Kenya.

**Subjects:** Three hundred and ninety one (198 *C. edulis* chewers and 193 *C. edulis* non-chewers) were enrolled in the study.

**Results:** Total bilirubin, direct bilirubin and alkaline phosphatase activity was significantly increased in the serum of *Catha edulis* consumers than non-consumers. Total protein and creatinine concentration were significantly decreased in the serum of *Catha edulis* consumers as compared to non-consumers.

**Conclusion:** *Catha edulis* chewing is not associated with electrolyte imbalance hence no predisposing effect to renal disorders. Chewing *C. edulis* might not be responsible for kidney damage but might be responsible for liver damage.

INTRODUCTION

Chronic disease like kidney and liver diseases constitutes a fast increasing burden to society. The World Health Organization (WHO) estimates that 46% of global disease and 59% of mortality is due to chronic diseases. Thirty-five million individuals in the world die each year from chronic disease and the numbers are increasing steadily (1). According to the Office for National Statistics in the United Kingdom, liver disease is now the fifth most common cause of death after heart disease, stroke, chest disease and cancer. However, unlike other major causes of mortality, liver disease rates are increasing rather than declining (2). Chronic kidney disease (CKD), has an increased prevalence in sub-Saharan Africa (3). Factors such as hypertension, diabetes, cardiovascular diseases have been associated with kidney

problem and alcoholism has been associated with liver problem. *Catha edulis* has also been associated with liver and kidney disease. However evidence of effects of *Catha edulis* on liver and kidney is often based on limited numbers of case reports and animal studies. These studies show that *Catha edulis* interferes with normal body functions, which could lead to serious liver and kidney disorders in animals and even in humans (10-16).

Khat belongs to the kingdom Plantae, class Magnoliopsida, order Celastrales, family Celastraceae, genus *Catha* and species *edulis* (4). *Catha edulis* originated in Ethiopia and later spread to Somalia, Kenya, Uganda, Tanzania, Congo, Zambia, Zimbabwe, Afghanistan, Yemen and Madagascar (5). According to National Authority for the Campaign against Alcohol and Drug Abuse (NACADA) 2012, drug-use study in the country, there are 1.6 million

*Catha edulis* users in Kenya.

The prevalence use of *C. edulis* in Kenya is 5.5% (6). The use is high among urban as opposed to rural. In terms of regions, highest use is reported in North Eastern (28%) followed by Nairobi (7.2%), Coast (6.2%) and Eastern (5.4%). Lowest current use is recorded in Western Kenya (7).

Chewing of *Catha edulis* (miraa) is a social habit in Kenya (7). The cultivation and consumption of the stimulant leaves and back of the stem of *Catha edulis* is widespread in several countries of East Africa and the Arabian Peninsula. The leaves come from a small evergreen shrub that can grow to tree size (8). The regular consumption of *Catha edulis* is associated with a variety of health problems affecting the consumers (8). Currently, *Catha edulis* is illegal in the USA, Canada, and many European countries (9).

Some studies have been done to investigate the effects of Khat on kidney and liver in animals (17-19). However, only a few of these studies have been conducted in human and these studies have been carried out in the Middle East countries.

## MATERIALS AND METHODS

The study was conducted under ethic number KNH-ERC/A/370 that was approved by the Kenyatta National Hospital/University of Nairobi – Ethical Review committee (KNH/UoN-ERC) through the ministry of health. The study was conducted on the *Catha edulis* consumers of Meru County in Kenya.

Meru County is located along the Eastern side of Mt Kenya. It borders Isiolo County to the North and North East, Tharaka County to the South West, Nyeri County to the South West and Laikipia County to the West. Meru is an agricultural county and miraa growing is one of the major economic activities carried out in the region. Meru County is the home of the Imenti, Tigania and Igembe sub-tribes of the Ameru (Meru) tribe. The sample (n=391) included 198 miraa chewers and 193 non-miraa chewers. Convenient-consecutive sampling method was used to recruit participants who gave a history of khat chewing. All participants were male and female Khat chewers, aged 18-60 years with a history of chewing *Catha edulis*. Individuals with diabetes, cardiovascular diseases, renal problems, hepatitis, hypertension, glomerulonephritis and pregnant women were excluded from the study. All the participants were interviewed by the researcher and questionnaire was completed to cover the personal history of Khat chewing (amount of Khat per day, number of hours per day, number of days per week and number of years), diabetes, cardio-vascular diseases, renal problems, hepatitis, hypertension, glomerulonephritis, pregnant women and any family history of liver or renal problem.

Those healthy participants who had no exposure of *Catha edulis* chewing (non-*Catha edulis* users) and alcohol drinking in their life time and have no family history of liver and renal problem were used as a control. Written consent was taken from all the participants after explanation of the aim of the study. Blood samples were collected into plain vacutainer tubes and allowed to clot. The clot samples were centrifuged immediately for 10 min at 3000 rpm. After centrifugation, the serum was separated and transferred to a clean tube with the help of pipette. The tubes containing serum were transported to Biochemistry laboratory, Nyeri provincial hospital to analyze the biochemical parameters. Classical laboratory procedures were used on the Humastar 200 automated chemistry analyzer and i-smart 30 electrolyte analyzer for electrolytes.

The Humastar 200 automated chemistry analyzer directly determined the values for total protein, albumin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase, creatinine total bilirubin, direct bilirubin. Sodium, potassium and chloride were determined using i-smart 30 electrolyte analyzer. The concentration of various biochemical parameters was examined in serum samples collected from *Catha edulis* users and non-users.

*Data analysis:* The results were computed statistically with SPSS software package version 21 using student independent t-test for mean difference between groups and cross tabulation for percentage count. A probability value (*p*-value) less than 0.05 was considered statistically significant.

## RESULTS

*Participants Catha edulis chewing habit:* Majority 92(46.5%) of the chewers were in age group 18 -30 years. In terms of the bundles chewed per week majority 92(46.5%) of the participants chewed one bundle per week and age group 18-30 years had majority 92(46.5%) of the participants chewing one bundle per week (Table 1).

With reference to frequency majority 140(70.7%) chewed *C. edulis* for more than three days in a week and age group 18-30years had the majority 63(31.8%) of the participants chewing *C. edulis* for more than three days in a week (Table 1).

Referring to the duration majority 67(33.8%) of the participants have chewed for more than ten years and age group 31- 40years had the majority 29(14.6%) of the participants who have chewed *C. edulis* for more than ten years (Table 1).

*Participants alcohol drinking habit:* Eighty seven (43.9%) of the participants reported drinking alcohol and 111(56.1%) not drinking. Majority 37(42.5%) who consumed alcohol, consumed less than 5 bottles per day (Table 2).

**Table 1**  
Participants *C.edulis* chewing habit (n = 198)

Bundles of <i>c. edulis</i> chewed per day	Age group of participants n and % count		
	18-30 years	31- 40 years	41 years & above
1	45(22.7%)	31(15.7%)	16(8.1%)
2	32(16.2%)	20(10.1%)	18(9.1%)
3	14(7.1%)	9(4.5%)	10(5.1%)
>5	1(0.5%)	1(0.5%)	1(0.5%)
Frequency of <i>C. edulis</i> chewing			
>3days	63(31.8%)	42(21.2%)	35(17.7%)
< 3 days	29(14.6%)	19(9.6%)	10(5.1%)
Duration of <i>C. edulis</i> chewing			
< 1 year	6(3.0%)	8(4.0%)	5(2.5%)
1-2 years	16(8.1%)	6(3.0%)	7(3.5%)
3-5 years	21(10.6%)	6(3.0%)	6(3.0%)
5-10 years	30(15.2%)	12(6.1%)	8(4.0%)
>10 years	19(9.6%)	29(14.6%)	19(9.6%)

N=sample size, %= percentage

**Table 2**  
Participant alcohol drinking habit (n=198)

Characteristic	Sample size		
	No.	Percentage (%)	
Drink alcohol			
Yes	87	43.9	
No	111	56.1	
Quantity of alcohol drunk per day			
< 5 bottles	37	42.5	
5-10 bottles	27	31.03	
>10 bottles	23	26.4	

No = Number, % = Percentage

*Liver and kidney biochemical parameters:* The *Catha edulis* chewing group (N=198) was associated with numerically smaller direct bilirubin, creatine and total protein mean and a higher alkaline phosphatase as compared to the non-*Catha edulis* chewing counterparts (N= 193), (Table 3). To test the hypothesis that the *Catha edulis* chewing has no effect on the biochemical parameters of the kidney and liver, an independent t-test was performed. The independent t test was associated with a statistically significant effect for alkaline phosphatase, total protein, total bilirubin, direct bilirubin and statistically nonsignificant effect on urea, ALA and ASA. Thus the *Catha edulis* chewing has no effect on ALA, ASA, urea, sodium ion, potassium ion, and chloride ion, but it has effect on direct bilirubin, total protein, alkaline phosphatase and creatinine (Table 3).





- of *Catha edulis* (qat) inferred from morphological characters and nuclear and plastid genes. *Mol Phylogenet Evol*. 2008 ;48(2):745–57.
5. Fitzgerald AJ. Khat : a literature review. 2009;(March).
  6. Report of the National Alcohol and Drug Abuse Conference 2012 held at the Kenya Institute of Administration eme :Towards a society free from Alcohol and Drug Abuse 2012.
  7. Authority N, The For, Against C, Abuse D. Rapid Situation Assessment Of The Status Of Drug And Substance Abuse 2012.
  8. Report T. WHO expert committee on drug dependence. World Health Organ Tech Rep Ser. 2012 ;(973):1–26.
  9. Roelandt P, George C, Heygere F, Aerts R, Monbaliu D, Laleman W, *et al*. Acute Liver Failure Secondary to Khat ( *Catha edulis* ) Induced Necrotic Hepatitis Requiring Liver Transplantation: Case Report. Elsevier Inc.; 2011;43(9):3493–5.
  10. Galal W, Khaled S, Elmahmoudy A, Naji S. Cardiac Electrical Abnormalities in Qat Chewers. 2013.
  11. Douglas H, Boyle M, Lintzeris N. The health impacts of khat: a qualitative study among Somali-Australians. *Med J*. 2011;195(11):666–9.
  12. Al-Motarreb A, Baker K, Broadley KJ. Khat: pharmacological and medical aspects and its social use in Yemen. *Phytother Res*. 2002 Aug;16(5):403–13.
  13. Masoud A, Al-assar A, Abu-zeed H, Albem S, Al-hubaishi S. Chewing *Catha Edulis* with Amphetamine-Like Effect Alters Liver and Kidney Functions of Female Chewers. *IJPS Inven*. 3:34–9.
  14. Al-habori M. The potential adverse effects of habitual use of *Catha edulis* (khat). 2005;1129–38.
  15. Cox G. Adverse effects of khat: a review. *Adv Psychiatr Treat*. 2003;9(6):456–63.
  16. Aden a, Dimba E a O, Ndolo UM, Chindia ML. Socio-economic effects of khat chewing in north eastern Kenya. *East Afri Med J*. 2006;83(3):69–73.
  17. Al-Habori M, Al-Aghbari a, Al-Mamary M, Baker M. Toxicological evaluation of *Catha edulis* leaves: a long term feeding experiment in animals. *J E*. 2002;83(3):209–17.
  18. Al-Hashem, Ismaeel Bin-Jaliah, Mohammad A Dallak MA-K. *Catha edulis* ). Khat (*Catha edulis*) Extr Increases Oxidative Stress Parameters Impair Ren Hepatic Funct Rats. 2011;33(1):1–9.
  19. Alsalahi A, Abdulla MA, Al-Mamary M, Noordin MI, Abdelwahab SI, Alabsi A. M., *et al*. Toxicological Features of *Catha edulis* (Khat) on Livers and Kidneys of Male and Female Sprague-Dawley Rats: A Subchronic Study. *Evid Based Complement Alternat Med*. 2012 ;2012:829401.
  20. M. Shabbir Alam, Ahmad Ali Bin Jerah, Gowhar Nabi & Qayyum Husain. Effect Of Khat (*Catha Edulis*) Consumption On The Functions Of Liver, Kidney And Lipid Profile In Male Population Of Jazan Region Of Kingdom Of Saudi Arabia. 2014.
  21. Rania Hussien Al-Ashwal, Maher Ali Al.Maqtari, Khalid Mohammed Naji, Nawal Ali Alwsabai, Sadeq M. Al Hazmy. Potential health effects of daily khat leaves chewing: Study on the biochemical blood constituents changes among adults in Sana'a city, Yemen. 2013.
  22. Anwar Masoud, Ahlam Al-Assar, Hana'a Abu-zeed, Samah Albem and Shadia Al-Hubaishi. Chewing *Catha Edulis* with Amphetamine-Like Effect Alters Liver and Kidney Functions of Female Chewers 2014.