

<http://www.pjbs.org>

PJBS

ISSN 1028-8880

**Pakistan
Journal of Biological Sciences**

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan



Research Article

Impact of Khat (*Catha edulis*) Chewing on Carotid Intima-media Thickness

¹Moawia Gameraddin, ²Bushra Abdalmalik, ³Mohamed Ibrahim, ⁴Mustafa Mahmoud and ¹Sultan A. Alshoabi

¹Department of Diagnostic Radiologic Technology, College of Applied Medical Sciences, Taibah University, Kingdom of Saudi Arabia

²Department of Diagnostic Radiology, Faculty of Medical Applied Science, University of Hail, Kingdom of Saudi Arabia

³Faculty of Medicine, University of Hargeisa, Hargeisa, Somaliland

⁴Department of Radiology and Medical Imaging, Prince Sattam Bin Abdulaziz University, Kingdom of Saudi Arabia

Abstract

Background and Objective: Khat has severe adverse socio-economic consequences. It causes serious cardiovascular, neurological and psychiatric problems. The study aimed to evaluate the effect of chewing khat on intima-media thickness (IMT) of the common carotid arteries. **Materials and Methods:** This was a descriptive case-control cross-sectional study. A total of 50 participants of chronic regular khat chewers were investigated. B-mode ultrasound 7-10 MHz linear transducers used for assessment of common carotid arteries according to the standard carotid sonography protocol. The IMT was measured and the presence of plaques was assessed. **Results:** The carotid IMT was significantly increased in regular khat chewers more than the controls (p -value = 0.016). The common carotid IMT increased in smokers more than non-smokers among khat chewers (0.6710 ± 0.20687 vs. 0.5789 ± 0.16859 mm). Significant correlations existed between the duration of chewing khat and age with the presence of plaque (p -values = 0.013 and 0.002, respectively). **Conclusion:** There is a significant correlation between carotid plaque and longtime khat chewing. Khat is a contributory factor for increasing carotid intima-media thickness and formation of carotid plaques. A combination of khat and smoking produce more thickening of carotid intima-media.

Key words: Psychiatric problems, carotid, intima-media thickness, carotid arteries, khat chewing, plaque

Citation: Moawia Gameraddin, Bushra Abdalmalik, Mohamed Ibrahim, Mustafa Mahmoud and Sultan A. Alshoabi, 2019. Impact of khat (*Catha edulis*) chewing on carotid intima-media thickness. Pak. J. Biol. Sci., 22: 226-230.

Corresponding Author: Moawia Gameraddin, Department of Diagnostic Radiologic Technology, College of Applied Medical Sciences, Taibah University, Kingdom of Saudi Arabia Tel: 00966534821130

Copyright: © 2019 Moawia Gameraddin *et al.* This is an open access article distributed under the terms of the creative commons attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Khat (*Catha edulis*) is referred to the leaves of the *Catha edulis* plant which is an evergreen shrub that can grow to a tree size¹. Figure 1 showed the khat tree. Chewing khat is a widespread social habit in Yemen, Somalia, Ethiopia and many other East African communities. It reported that khat-chewing in most of these countries had reached serious epidemic proportions². It has been established that the khat leaves contain an active substance known as cathinone that has a stimulant effect on the central nervous system (CNS) like amphetamine³. Several studies reported that khat chewing was significantly associated with ischemic heart disease and stroke⁴.

Khat-chewing has been studied to increase the prevalence of acute cerebral infarction⁵. This is probably due to the substantially higher blood pressure among the khat-chewer peoples in comparison with the non-chewers^{4,6}. However, there is a lack of definitive studies demonstrated a causal relationship between khat chewing and cerebrovascular accidents. For these reasons, the CCA is vital to be assessed as a part of the cardiovascular system (CVS) which influenced by cathinone and cathine which are responsible for their effects on the CNS and CVS⁴.

Ultrasonography is an ideal and reliable imaging modality for studying changes in the carotid artery morphology and sub-clinical atherosclerosis. Carotid intima-media thickness (CIMT) is significantly increased in patients with plaque and represents a marker of organ damage⁷. It was reported that,



Fig. 1: Khat tree

there was an association between CIMT and established risk factors⁸. Furthermore, the effect of khat on IMT of the CCAs is not yet determined. Now-a-days, khat plants are considered as a severe health and biological problem. Khat agriculture consumes an excessive amount of water because of other economic useful crops.

The study aimed to explore the impact of chewing khat on intima-media thickness (IMT) of the CCAs. To date, few articles demonstrated the effect of khat use on CIMT among khat chewers.

MATERIALS AND METHODS

The design of the study was a case-control descriptive survey to deal with the effect of khat (*Catha edulis*) on IMT of the CCAs. The study was conducted at Kaah Community Hospital in Hargeisa, Somaliland, during the time from August-December, 2017. The participants consisted of 50 subjects, who are regularly chewing khat and categorized into two groups; 31 were khat chewers and smokers and 19 were periodically khat chewers without smoking. They were selected using simple and convenient systematic sampling. Exactly 48 of them were men and only two were women. Chewer's age ranged from 20-64 years old. Structured data collection sheet was used to collect the demographic data and clinical history of the participants, status of chewing khat, the number of years they have been chewing khat and other habits that may affect the carotid artery like smoking. Participants with diabetes, cardiac and renal diseases were excluded from the study to maintain the effect of smoking among khat chewers. The participants were divided into groups; smokers and non-smokers and compared together to study the IMT changes.

All examinations were performed using a DCN3 Mindray ultrasound machine with linear multi-frequency transducer. The B-mode settings were adjusted to optimize the quality of the gray-scale images and the pulse repetition frequency (PRF).

Sonographic procedure for assessment of carotid-IMT:

The IMT of both CCAs was examined using B-mode ultrasonography. The subject was lying on a comfortable examination table in a supine position with a small pillow under his head. The subject's head was turned slightly away from the side to be examined. Both the right and left common carotid arteries were scanned with gray-scale to evaluate the CCA for their intima-media thickness (IMT) and to determine the presence or absence of atherosclerotic plaque.

A carotid artery plaque was defined as a localized protrusion of the vessel wall, which extended into the lumen ≥ 1.5 mm or had a thickness exceeding the intima-media thickness (IMT) of the adjacent portion of the vessel wall by $>50\%$. The characteristics of the plaques were described following the modified classification and plaque morphology was defined regarding its echogenicity⁹.

Statistical analysis: The SPSS 16.0 (IBM, Cary, north Carolina) was used to analyze the findings. Independent student t-test was used to calculate the statistical values for comparison between khat chewers and non-khat chewers and to compare between controls and study groups for identifying IMT changes. Pearson correlation was used to find a correlation of duration of chewing khat and age with the presence of plaque. The $p < 0.05$ were regarded as significant.

RESULTS

Out of the 50 individuals examined in this study, 48 (96%) participants were male and only 2 (4%) were female. Table 1 summarizes the characteristics of the participants; a total of 31 (62%) were khat chewers with smoking and 19 (38%) were khat chewers without smoking. The mean age

was 39.7 ± 12 years and the duration of khat chewing was 14.74 ± 8 years as summarized in Table 2. Data in Table 3 summarized the comparison of carotid IMT (CIMT) in control and regular khat chewers. The IMT increase of the right CCA was more significant among khat chewers than in control (0.6360 vs. 0.544 mm, p -value = 0.016). The increase of IMT of left CCAs was not significant (0.642 vs. 0.606 mm, p = 0.07). The results in Table 4 revealed the insignificant relationship in IMT of CCAs in khat chewers with smoking and khat chewers without smoking (p = 0.109 and 0.111, respectively). A significant correlation found between the duration of chewing khat and age with the presence of plaque (p = 0.013 and 0.002, respectively) as shown in Table 5.

DISCUSSION

The CIMT is an independent predictor of cardiovascular and cerebrovascular events. Several studies reported that associations existed between CIMT and established risk factors. However, in the existing literature, the current concepts of the risk factors of CIMT are not unified¹⁰. It was reported that the risk factors of CIMT included smoking, age, sex, alcohol consumption, blood pressure (BP), blood fat, blood sugar and lifestyle habits¹⁰.

Table 1: Characteristics of participants and the presence of plaque among the khat chewers

Variables	Frequency	Percentage
Gender		
Male	48	96
Female	2	4
Khat chewers with smoking	31	62
Khat chewers without tobacco	19	38
Presence of plaque		
Yes	6	12
No	44	88

Table 2: Distribution of duration of chewing khat

Duration (years)	Frequency	Percentage	Mean of duration (years)	Mean of age (years)
<5	8	16.0	14.74±8	39.7±12
5-10	8	16.0		
11-15	12	24.0		
16-20	9	18.0		
21-25	7	14.0		
26-30	4	8.0		
31-35	2	4.0		
Total	50	100.0		

Table 3: Comparison of carotid-IMT in control and regular khat chewers

Parameters	Control (mm) (Mean±SD)	Khat chewers (mm) (Mean±SD)	p-value
IMT of right CCA	0.5440±0.12961	0.6360±0.19667	0.016*
IMT of left CCA	0.6060±0.12022	0.6420±0.23655	0.07

* $p < 0.05$ is significant

Table 4: Comparison of carotid-IMT of regular khat chewers with smoking and non-smoking

Parameters	IMT of right CCA (mm)	p-value	IMT of left CCA (mm)	p-value
Khat chewers with smoking	0.6710±0.20687	0.109	0.6839±0.26089	0.111
Khat chewers without tobacco	0.5789±0.16859		0.5737±0.17589	

$p < 0.05$ is significant

Table 5: Correlation of the presence of plaque with age and duration of khat chewers

Variables	Correlation coefficient	p-value
Duration of chewing khat	-0.35*	0.013*
Age	-0.37*	0.002*

*Correlation is significant at 0.01 level (2-tailed). * $p < 0.05$ are significant

In the present study, it was observed that the IMT of the CCAs was significantly increased in khat chewers more than the control, significantly the IMT of the right CCA. This finding agreed with a previous study which demonstrated the immediate effect of khat on hemodynamics of CCAs and reported that the CIMT was significantly increased after chewing khat¹¹. Despite this agreement with the previously cited study, this study demonstrated the impact of khat for an extended period while the other one studied the immediate effect of chewing khat for hours (before and after chewing). However; all previous studies have not included khat as a risk factor for CIMT. There were a lack of studies which demonstrated the effect of khat on CIMT. The present study revealed that the IMT of right and left CCAs increased in smokers more than non-smokers among khat chewers. The effect of smoking on CIMT was much demonstrated in the literature¹²⁻¹⁶. It was observed that the combination of khat chewing and smoking produced more increase in thickening of CIMT among khat chewers. However, no ever studies were demonstrated the impact of khat on CIMT.

In the current study, it was found that duration of chewing khat has a significant influence on the formation of the atherosclerotic plaque in the carotid artery in addition to the other habits like smoking which is usually used along with khat. The study showed that there was a statistically significant association between chewing khat and the presence of carotid plaques ($p=0.013$). This suggested that as the duration of chewing khat increases, the risk of plaque formation will also increase. A previous study found a significant increase in CIMT among participants who chewed khat for few hours¹¹. An available previous study in Yemen reported that khat chewing was an independent risk factor for stroke and in-hospital mortality¹⁷. Another study in India suggested that khat chewing was a strong contender as the cause of stroke¹⁸.

In this study, the results revealed a lousier effect of khat on CIMT when combined with smoking. This result is consistent with a previous study which reported that concurrent use of khat and tobacco was associated with increased adverse effect¹⁹.

In addition, studies assessed the effect of khat on cardiovascular are scarce, most of the available studies reported an adverse impact of khat on the cardiovascular outcome. Recent reviews in Yemen stated the presence of an association of khat with acute myocardial infarction and heart failure²⁰. All of the mentioned studies have not demonstrated the effect of khat on CIMT as smoking did. In this study, khat is suggested to be a significant risk factor for carotid

atherosclerosis. Identifying khat with increased CIMT will be helpful for the prevention and treatment of early atherosclerosis.

It was a single-center study and the sample size was not large enough and no similar study is available, secondly, it was difficult to find a khat chewer without smoking since the majority of chewers were smokers. Large samples are recommended for further studies to confirm the initial results of this study.

CONCLUSION

There is a significant correlation between carotid plaque and longtime khat chewing. Khat is a contributory factor for increasing carotid intima-media thickness and formation of carotid plaques. It is suggested to be a contributory factor of formation atherosclerosis.

SIGNIFICANCE STATEMENT

This study discovered the chewing of khat produced a considerable effect on carotid IMT that can be beneficial for the community to avoid the potential risks of regular khat use. This study will help the researchers to study suspected neurovascular changes leading to stroke that must be considered in future researches.

ACKNOWLEDGMENTS

I would like to thank the Department of Radiology in Hargeisa hospital in Somaliland, who helped us to perform the study and Dr. Abdalasad Mohammed Salih (Radiology Department, Faculty of Radiological Sciences and Medical Imaging in Alzaiem Alazhari University, Sudan) for the valuable suggestions and correction of the manuscript.

REFERENCES

1. Al-Juhaishi, T., S. Al-Kindi and A. Gehani, 2013. Khat: A widely used drug of abuse in the Horn of Africa and the Arabian Peninsula. Review of literature. Qatar Med. J., Vol. 2. 10.5339/qmj.2012.2.5.
2. NIDA., 2013. Drug facts: Khat. National Institute on Drug Abuse, USA.
3. Wabe, N.T., 2011. Chemistry, pharmacology and toxicology of khat (*Catha edulis* Forsk): A review. Addict. Health, 3: 137-149.
4. Kassa, A., E. Loha and A. Esaiyas, 2017. Prevalence of khat chewing and its effect on academic performance in Sidama zone, Southern Ethiopia. Afr. Health Sci., 17: 175-185.

5. Mega, T.A. and N.E. Dabe, 2017. Khat (*Catha edulis*) as a risk factor for cardiovascular disorders: Systematic review and meta-analysis. *Open Cardiovasc. Med. J.*, 11: 146-155.
6. Getahun, W., T. Gedif and F. Tesfaye, 2010. Regular Khat (*Catha edulis*) chewing is associated with elevated diastolic blood pressure among adults in Butajira, Ethiopia: A comparative study. *BMC Public Health*, Vol. 10. 10.1186/1471-2458-10-390.
7. Roxana, O.N.U.T., A.P.S. Balanescu, D. Constantinescu, L. Calmac, M. Marinescu and M. Dorobantu, 2012. Imaging atherosclerosis by carotid intima-media thickness *in vivo*: How to, where and in whom? *Maedica*, 7: 153-162.
8. Sabater-Lleal, M., A. Malarstig, L. Folkersen, M.S. Artigas and D. Baldassarre *et al.*, 2014. Common genetic determinants of lung function, subclinical atherosclerosis and risk of coronary artery disease. *Plos One*, Vol. 9. 10.1371/journal.pone.0104082.
9. Casadei, A., M. Floreani, R. Catalini, C. Serra, A.P. Assanti and P. Conci, 2012. Sonographic characteristics of carotid artery plaques: Implications for follow-up planning? *J. Ultrasound*, 15: 151-157.
10. Qu, B. and T. Qu, 2015. Causes of changes in carotid intima-media thickness: A literature review. *Cardiovasc. Ultrasound*, Vol. 13. 10.1186/s12947-015-0041-4.
11. Ibrahim, M., B.H.A. Malik and M. Gameraddin, 2017. Doppler assessment of the effect of chewing qat on hemodynamics of the common carotid arteries. *J. Med. Sci.*, 17: 95-101.
12. Zhang, P., R. Guo, Z. Li, D. Xiao, L. Ma, P. Huang and C. Wang, 2014. Effect of smoking on common carotid artery wall elasticity evaluated by echo tracking technique. *Ultrasound Med. Biol.*, 40: 643-649.
13. Andersson, E.M., B. Fagerberg, G. Sallsten, Y. Borne, B. Hedblad, G. Engstrom and L. Barregard, 2017. Partial mediation by cadmium exposure of the association between tobacco smoking and atherosclerotic plaques in the carotid artery. *Am. J. Epidemiol.*, 187: 806-816.
14. Lankarani, K.B., F. Ghaffarpasand, M. Mahmoodi, M. Dehghankhalili and B. Honarvar *et al.*, 2015. Predictors of common carotid artery intima-media thickness and atherosclerosis in a sample of Iranian general population. *Shiraz E-Med. J.*, Vol. 16. 10.17795/semj27906.
15. Ebihara, A., A. Nagai, R. Hamanaka, N. Imamura, C. Yamada, T. Iwamoto and I. Kuwahira, 2014. Relationship between Early exposure to tobacco smoke and Intima Media Thickness (IMT) in COPD patients. *HEP.*, 41: 524-527.
16. Hansen, K., G. Ostling, M. Persson, P.M. Nilsson and O. Melander *et al.*, 2016. The effect of smoking on carotid intima-media thickness progression rate and rate of lumen diameter reduction. *Eur. J. Internal Med.*, 28: 74-79.
17. Ali, W.M., M. Zubaid, A. Al-Motarreb, R. Singh and S.Z. Al-Shereiqi *et al.*, 2010. Association of khat chewing with increased risk of stroke and death in patients presenting with acute coronary syndrome. *Mayo Clin. Proc.*, 85: 974-980.
18. Kulkarni, S.V., Y.A.A. Mughani, E.H.A. Onbol and P. Kempegowda, 2012. Khat and stroke. *Ann. Indian Acad. Neurol.*, 15: 139-140.
19. Al'Absi, M., M. Nakajima, A. Dokam, A. Sameai, M. Alsoofi, N.S. Khalil and M. Al Habori, 2014. Concurrent tobacco and khat use is associated with blunted cardiovascular stress response and enhanced negative mood: A cross sectional investigation. *Hum. Psychopharmacol.: Clin. Exp.*, 29: 307-315.
20. El-Menyar, A., A. Mekkodathil, H. Al-Thani and A. Al-Motarreb, 2015. Khat use: History and heart failure. *Oman Med. J.*, 30: 77-82.