

*Original Article*

# The Association Between Coronary Artery Disease and Hyperuricemia in Libyan Adults: A Cross-Sectional Study

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## ABSTRACT

**Background and objectives.** Hyperuricemia has been linked to coronary artery disease (CAD) development. We aimed in this study to examine the association between hyperuricemia and CAD among Libyan adults. **Methods.** This was a retrospective cross-sectional study of Libyan adults diagnosed with CAD and were divided into groups with high and normal serum uric acid. The data for patients were collected retrospectively from medical records. The likelihood occurrence of CAD in patients with hyperuricemia was determined by using the Bayesian one sample test. **Results.** In total, 97 patients with CAD were recruited in this study. 67 (69.1%) had CAD with high serum uric acid levels, while only 30 (30.1%) had CAD with normal serum uric acid levels. The mean age of patients at the start was  $60 \pm 11.89$  for all patients. 53 (54.6%) of patients were females, and 44 (45.4%) ( $p = 0.863$ ) were males, respectively. Hyperuricemia was significantly associated with the occurrence of CAD ( $p = 0.002$ ). **Conclusion.** Amongst a cohort of Libyan adults, there was a significant relationship between hyperuricemia and CAD.

**Keywords:** Hyperuricemia, CAD, Libyan adults.

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## INTRODUCTION

The serum level of Uric Acid (UA) is influenced by multiple factors, including exogenous ingestion (particularly with an animal protein-rich diet), endogenous production by the liver, and renal excretion [1]. UA is produced by the enzymatic activity of xanthine oxidase and is the final product of purine metabolism. Xanthine oxidase produces oxidants which can cause intracellular stress and

inflammation leading to endothelial injury. However, the association of high serum uric acid levels with cardiovascular disease may be due to the role of uric acid as an antioxidant [2,3].

Many epidemiological studies have suggested that increased serum uric acid is a risk factor for cardiovascular disease [4-10]. Increased serum uric acid levels are linked to obesity, dyslipidemia, and

hypertension (metabolic syndrome), which is associated with increased risk for cardiovascular disease [11-14].

The aim of this study was to establish the association between ischemic heart disease and hyperuricemia among Libyan patients.

## METHODS

### *Study design and settings*

We conducted a retrospective cross-sectional study to explore the relationship between CAD and uric acid levels in the blood. Patients in the study were recruited from the regular visit to the cardiac clinic at Al Wahda Teaching Hospital, Derna city. The data for patients were collected retrospectively from medical records.

We included males and females' patients aged  $\geq 30$  years old, with confirmed CAD. Also, we have gathered information regarding patients' uric acid levels in the blood. Because we specifically meant to explore the association between CAD and hyperuricemia, we divided patients into two groups as following: CAD with high serum uric acid group, and CAD with normal serum uric acid group. We defined hyperuricemia as a serum uric acid value of  $> 7.5$  mg/dl in males, and  $> 6.2$  mg/dl in females (15).

### *Statistical analysis*

All analysis was carried out using SPSS version 16. Demographic characteristics of patients were interpreted using descriptive statistics. We presented the nominal data as number and percentages, and the continuous data as mean and standard deviation.

We used Pearson's chi-square test to compare nominal data between the high and normal uric acid groups, and independent-sample t-test to compare the continuous data between the two groups.

Bayesian one sample test was used to predict the possibility of occurrence of CAD in the high and normal uric acid groups. We used binary logistic regression to predict the other possible risk factors for CAD such as gender and age.

## RESULTS

About 97 patients were eligible for this study. Of these, over two third [67 (69.1%)] had CAD with high serum uric acid levels, while about one third [30 (30.1%)] had CAD with normal serum uric acid levels. The mean age of patients at recruitment was  $60 \pm 11.89$  for all patients. 53 (54.6%) of patients were females, and 44 (45.4%) ( $p = 0.863$ ) were males, respectively (Table 1).

We have noticed that the possibility of occurrence of CAD was significantly higher in the hyperuricemic group than in the normal uric acid group at 67 (69%), and 30 (30.1%) for hyperuricemic and normal uric acid groups, respectively ( $p = 0.002$ ) (Table 1). This may give suggestion that maybe there is an association between the above normal levels of uric acid and the development of CAD.

Taking into consideration of the other possible risk factors for CAD in this study such as gender and age, we have noticed that the number of females and males in the hyperuricemic group were much higher than those in the normal uric acid group at 37 (38.1%), and 30 (30.9%) for females and males in hyperuricemic group against 16 (16.5%), and 14 (14.4%) for females and males in the normal uric acid group, respectively, but this difference was not statistically significant ( $p = 0.863$ ) (Table 1).

Additionally, although it was not statistically significant there was an increased risk of developing of CAD among males and females in the hyperuricemic group by an odds ratio of 1.079 [0.455 – 2.560] as compared to the normal uric acid group.

Similarly, the number of those who aged less than and more than 60 years old in the group of hyperuricemia was greater than those who were younger and older than 60 years old in the normal uric acid group at 38 (39.2%), and 29 (29.9%) for the <60 and > 60 years old in the hyperuricemic group as compared to 13 (13.4%), and 17 (17.5%) for the <60 and > 60 years old in the normal uric acid group ( $p = 0.222$ ), respectively (Table 1).

Moreover, there is an increased risk of development of CAD with increased age by and odds ratio of 1.714 [0.719 - 4.086], but this was not statistically significant.

**Table 1. Demographic patient characteristics and association between CAD and Hyperuricemia.**

Parameters	All patients	High uric acid group	Normal uric acid group	P-value
N (%)	97(100%)	67(69.1%)	30(30.1%)	-
Female	53(54.6%)	37(38.1%)	16(16.5%)	0.863
Male	44(45.4%)	30(30.9%)	14(14.4%)	
Age (years)	60±11.89	59.76±13.06	61.6±8.97	0.424
Age groups (years):				
<60 years old	51(52.6%)	38 (39.2%)	13(13.4%)	0.222
>60 years old	46(47.4%)	29 (29.9%)	17(17.5%)	
IHD	97(100%)	67(69.1%)	30(30.1%)	0.002*

Values are presented as mean ± SD for continuous variables. Comparisons between groups with continuous variables were made using independent samples *t* test.

Proportions with categorical variables were compared using Pearson's Chi-square test.

\*Denote that the P-value was reported from Bayesian one sample test.

N (%): Numbers and percentages, CAD: Coronary Artery Disease.

## DISCUSSION

We have shown that in a cohort of patients with established CAD, there was a significant association between the development of CAD and elevated serum uric acid. This finding is consistent with many previous studies on hyperuricemia as a risk factor for CAD. For example, in a large-scale, longitudinal cohort study asymptomatic hyperuricemia has been found to increase the incidence of CAD amongst patients older than 65 years old [16]. Moreover, in another study hyperuricemia was significantly related to CAD amongst female ≥ 80-year-old [17].

This study has a number of important limitations. Firstly, the retrospective nature of the study, therefore the future study would focus in a prospective design on the relationship between CAD and hyperuricemia possibly in the similar cohort of patients. Secondly, the smaller sample size and this makes the results of this study would not be generalized to the general population. Though, the significant outcomes of the study may add valuable and sufficient knowledge to the previous studies on hyperuricemia as an important risk factor for the development of CAD.

To conclude, the preliminary result of the current study has demonstrated that Hyperuricemia was significantly associated with the development of CAD in this particular cohort of patients with established CAD.

### Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

### Conflict of interest

We declare that they have no competing interests.

### Author contributions

All authors contribute equally in this manuscript.

### Abbreviations

CAD: Coronary Artery Disease; N (%): Numbers and percentages; SPSS: Statistical Package for the Social Sciences; UA: Uric Acid

### Data availability statement

The data can be made available upon request.

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