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Research article

Association of Chronic Kidney Disease and Coronary Heart Disease in A Series of Saudi Patients

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Abstract

Objectives: this study aimed to assess the association between CKD and coronary heart disease (CHD) in a series of Saudi patients. **Methods:** This study investigated 2700 Saudi volunteers during a cross-sectional survey conducted in Hai'l region. Participants were included based randomly regardless of age or gender. CKD stage was determined according to GFR estimation using creatinine level, age, and sex. **Results:** The risk of CHD associated with CKD, the relative risk (RR), and the 95% confidence interval was RR (95%CI) = 8.5045(4.5035 to 16.0602), P < 0.0001. The risk of CHD among patients above 41 years was statistically significant, with the RR (95%CI) = 5.6978 (2.3849 to 13.6126), P = 0.0001. The risk of CHD associated with FHRD was the RR (95%CI) = 5.2567 (2.5146 to 10.9891), P = 0.0001. **Conclusion:** There is a statistically significant association between CKD and CHD in a population with shared risk factors such as hypertension, diabetes, and obesity. A statistically significant positive association between CKD & CHD and Saudi rural inhabitants, family history of renal disease, and ex-smoking.

Keywords: Chronic Kidney Disease; Coronary Heart Disease; Saudi Arabi; GFR.

Introduction

Coronary heart disease (CHD) is a cardiovascular disease (CVD) mainly affecting the coronary arteries, which supply the heart with oxygenated blood. It is a significant cause of mortality and disability worldwide [1]. A high prevalence of coronary artery disease (CAD) is found in low- and middle-income countries. CAD is responsible for about seven million deaths and 129 million Disability Adjusted Life Years annually, representing a significant economic burden worldwide [2]. Cigarette smoking, High blood pressure, and high cholesterol are substantial causes of CHD [3].

Chronic Kidney disease (CKD) is a condition that results in progressive loss of renal function. It affects more than 10% of the general global population. It is common among older people, women, diabetic, and hypertensive individuals [4].

CKD is a significant risk factor for CVD. It was assumed that these two conditions have shared risk factors, such as hypertension, diabetes, oxidative stress, cerebral hypoperfusion, and cardiac structure (associated with dialysis-specific factors) [5]. CKD is a major modifiable risk for CAD, and they have parallel prevalence rates as they share similar risk factors such as hypertension and diabetes [6].

In recent years, Saudi Arabia has witnessed increasing CKD and CVDs due to the rising epidemiology of their risk factors, such

as hypertension, diabetes, and obesity [7-8]. Therefore, the present study aimed to assess the association between CKD and CHD in a series of Saudi patients.

Materials and Methods

This study investigated 2700 Saudi volunteers during a cross-sectional survey conducted in Hai'l region, which is inhibited by about 700,000 civilians. Participants were included based randomly regardless of age or gender. CKD stage was determined according to GFR estimation using creatinine level, age, and sex. GFR was calculated according to the National Kidney Foundation calculator available at: https://www.kidney.org/professionals/kdoqi/gfr_calculator

GFR was categorized into:

Stage I <90 - 60 mL/min), Stage II CKD (GFR = <60 - 30 mL/min), Stage III (GFR = <30 – 15 mL/min), Stage V (GFR = <15 mL/min).

Body mass index (BMI) was calculated by wt in kg

Height in m2 and categorized into:

Under weight (BMI < 18.5 Kg/m2). Normal weight (BMI 18.5- <25 Kg/m2). Obese (BMI 25- <30 Kg/m2). Morbid obese (BMI 25- <30 Kg/m2).

Ethical consent

The proposal of this study, including its informed ethical consent, was approved by the ethical committee Research board at the College of Medicine, University of Hai'l, Hai'l, Saudi Arabia. Each participant was consented and asked to sign a written ethical consent.

Statistical analysis

Data were entered into SPSS software and analyzed to obtain frequencies, cross-tabulations, relative risk (RR), and Pearson Chi-square test for statistical significance (P-value). Statistically significant was considered when P- value <0.05 considering a 95% confidence interval (CI).

Results

Out of the 2700 participants in the present study, 1220/2700(45.2%) were males, and 1480/2700(54.8%) were females aged 15 to 100 years old with a mean age of 45 years. Out of the 2700 participants, CKD was ascertained in 214/2700(8%) (GFR < 60mL/min). CHD was identified in 37/2700(1.4%). Of the 37 CHD patients, 16/37(43.2%) were detected with CKD (GFR <60mL/min) including 9/16(56.3%) with GFR = 30-59 mL/min, 5/16(31.3%) with GFR =15-29 mL/min, and 2/16(15.4%) with GFR <15 mL/min, as indicated in (Table 1, Figure 1). The risk of CHD associated with CKD, the relative risk (RR), and the 95% confidence interval was RR (95%CI) = 8.5045(4.5035 to 16.0602), P < 0.0001.

Of the 37 CHD patients, 20/37(54%) were females, and 17/37(46%) were males. Most CHD patients were seen in the age group 41-55 years, followed by < 70 years and 56-70 years, constituting 14/37(38%), 10/37(27%), and 7/37(19%), respectively. The risk of CHD among patients above 41 years was statistically significant, with the RR (95%CI) = 5.6978 (2.3849 to 13.6126), P = 0.0001.

Most CHD patients were rural inhabitants 27/37(73%) vs. 10/37(27%) urban. The risk of CHD associated with rural population was, the RR (95%CI) = 1.5782 (0.7671 to 3.2466), P = 0.02151, z statistics = 1.240.

Category	Variable	CHD		
		Yes	**No**	**Total**
CKD				
	GFR≥ 90 mL/min	7	1507	1514
	60-89	14	950	964
	30-59	9	183	192
	29-15	5	12	17
	≤14	2	11	13
	Total	**37**	**2663**	**2700**
Gender				
	Males	17	1203	1220
	Females	20	1460	1480
	Total	**37**	**2663**	**2700**
Age				
	<25 years	1	660	661
	26-40	5	750	755
	41-55	14	540	554
	56-70	7	410	417
	>70	10	303	313
	Total	**37**	**2663**	**2700**
Residence				
	Urban	10	986	996
	Rural	27	1677	1704
	Total	**37**	**2663**	**2700**

Table 1: Distribution of the CHD status by study subjects' characteristics

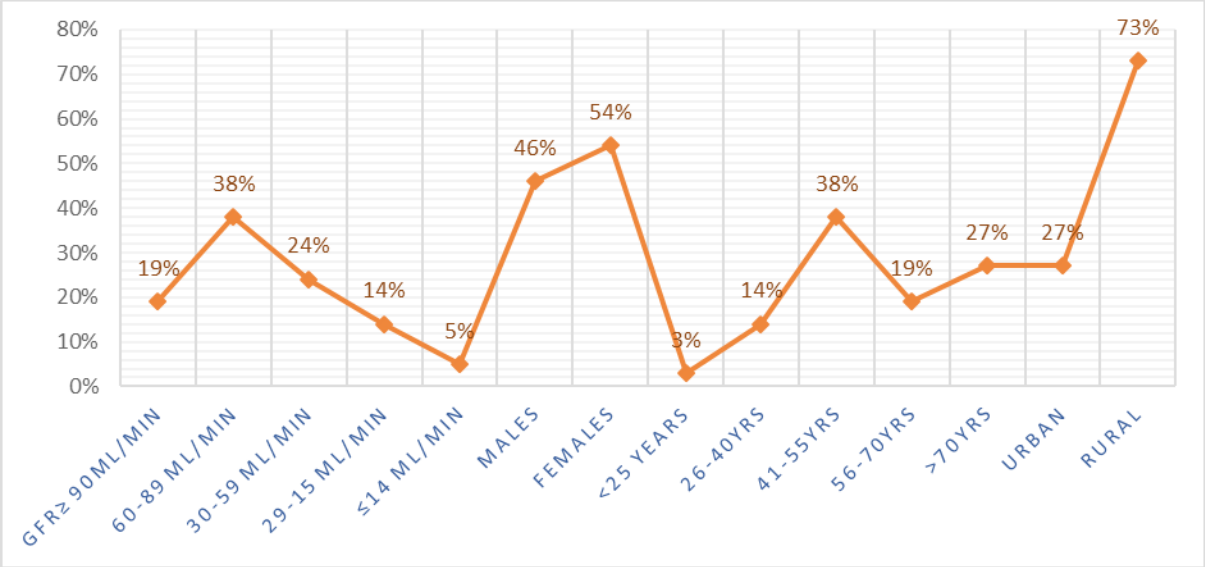

Figure 1: Description of the study population by proportions of CHD in different participants' characteristics

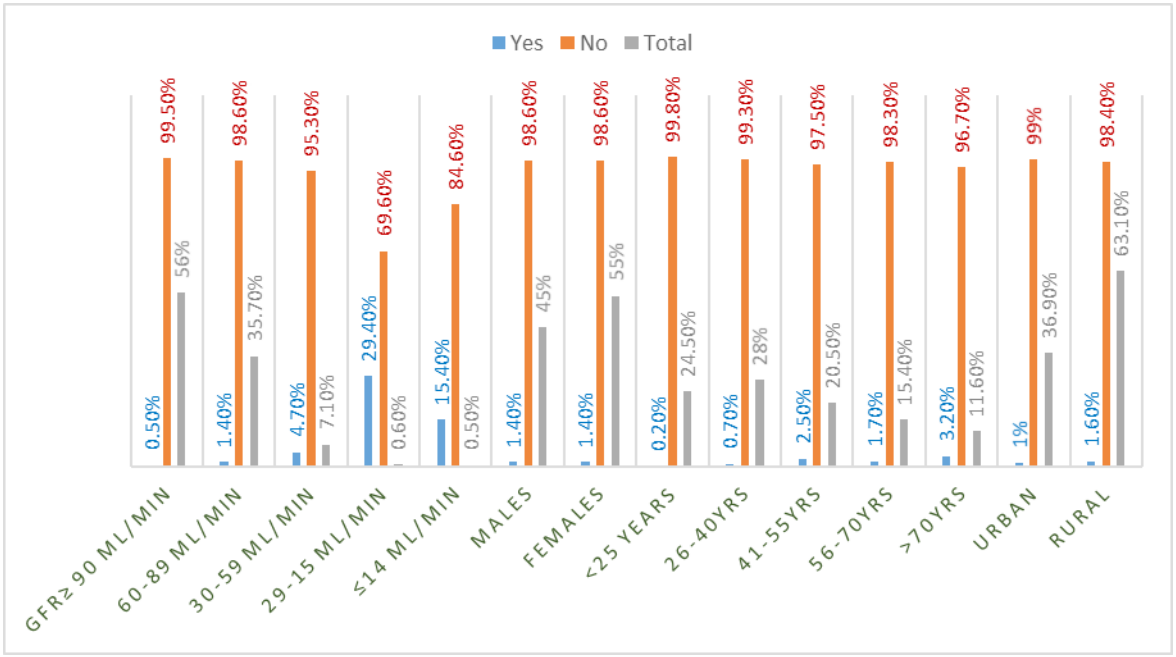

Figure 2: Description of the study population by proportions of CHD within entire participants' characteristics

A family history of renal disease (FHRD) was identified in 9/36(25%) of the CHD patients. The risk of CHD associated with FHRD was the RR (95%CI) = 5.2567 (2.5146 to 10.9891), P = 0.0001. About 18/31(58%) of the CHD patients were categorized as overweight, 9/31(29%) were obese, and 4/31(13%) were with normal body weight. The risk of CHD associated with obesity was, the RR (95%CI) = 1.0503 (0.4859 to 2.2705), P = 0.9007, z statistic = 0.125. Most CHD cases were associated with 25/33(76%) ex-smoking. The risk of CHD associated with ex-smoking was the RR (95%CI) = 2.6148 (1.1837 to 5.7761), P = 0.0175 shown in (Table 2, Figure 3).

Category	Variable	CHD		
		Yes	**No**	**Total**
Family history of renal disease				
	Yes	9	152	161
	No	27	2512	2539
	Total	**36**	**2664**	**2700**
Body Mass Index (BMI)				
	Low weight	0	28	28
	Normal weight	4	875	879
	Overweight	18	1026	1044
	Obese	5	420	425
	Morbid obese	4	320	324
	Total	**31**	**2669**	**2700**
Smoking				
	never smoked	6	1022	1028
	ex-smoker	25	1445	1470
	current smoker	2	200	202
	Total	**33**	**2667**	**2700**

Table 2: Distribution of the study subjects by CHD and Some CHD risk factors

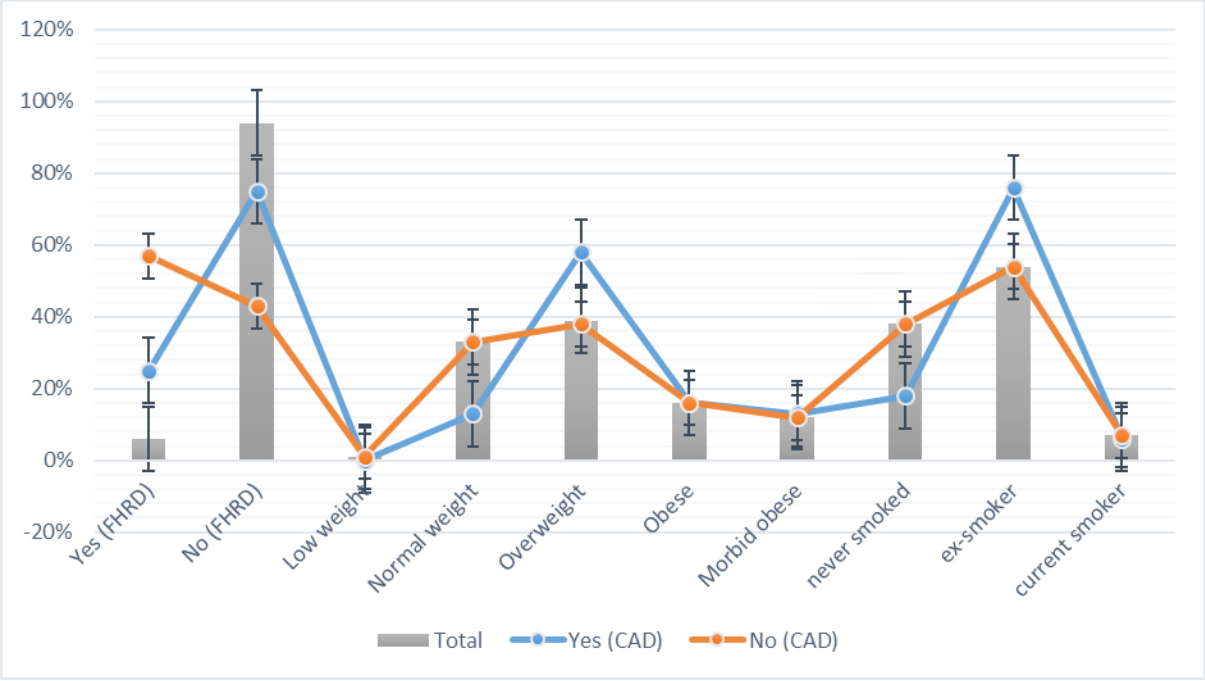

Figure 3: Description of the CHD by proportions of Some CHD risk factors

Discussion

Both CKD and CHD are health problems in Saudi Arabia due to the rising modifiable risk factors, including hypertension, diabetes, and obesity. In the present study, the prevalence of CKD was 8%. Previous studies from Saudi Arabia reported variable prevalence rates ranging from 5.7% to 9.4% [9-12], with a paucity of data in recent years. Globally the prevalence of CKD was reported to be 13.4% [13]. Moreover, the current study's findings have revealed a prevalence rate of 1.4% for CHD with a statistically significant positive association between CKD and CHD. Although there is a lack of data regarding the prevalence estimates of CHD from Saudi Arabia, available literature assumed that the prevalence rates might be among the higher country since Saudi Arabia is regarded among the top countries in the prevalence of the CHD associated risk factors, such as diabetes, hypertension, and obesity [10-11,14]. A study that assessed the coronary calcium score (CCS) to estimate coronary artery calcification (CAC) in asymptomatic Saudi participants revealed massive CAC, predominantly among males (3.1%) compared to females (1.6%) [15].

The current study results indicated that both diseases (CKD and CHD) were prevalent among the older population, and similar findings were previously reported in the country [16].

The current study's findings show a statistically significant association between CKD and CHD. However, cardiovascular diseases in patients with CKD attempt to be influenced by serval factors, including sex and age. Such factors may reveal cardiovascular diseases such as CAD, congestive heart failure, arrhythmias, and CKD-associated cardiovascular mortality [17]. A recent study found that higher CAC scores were associated with increased CVD risk in CKD patients, indicating a relationship between CAC score and CKD progression. Such results propose that a high CAC score correlates significantly with a risk of unfavourable kidney consequences and CKD progression [18]. With the absence of a model for predicting the outcomes for CHD patients with CKD after percutaneous coronary intervention (PCI), a recent study validated a model that included predictors, such as a positive family history of CHD, a history of revascularization, the number of diseased vessels, ST-segment changes, anaemia, hyponatremia, coronary collateral circulation, trans radial intervention, and contrast media >200 ml [19].

Most CHD patients were rural inhabitants. Studies from the area have shown that CKD and CHD risk factors such as hypertension, diabetes, and hypercholesterolemia are more frequent in Saudi rural areas than in urban [20-22].

In the present study, the risk of CHD was significantly associated with the risk of FHRD. Such a relationship was previously reported [23]. The risk of CHD is associated with ex-smoking in the current study. Moreover, the risk of CHD was higher among obese individuals. Cigarette smoking is a well-proven lifestyle modifiable risk for CHD and stroke. Smoking intensifies the positive relationship between increased body mass index and CHD [24].

Conclusion

There is a statistically significant association between CKD and CHD in a population with shared risk factors such as hypertension, diabetes, and obesity. A statistically significant positive association between CKD & CHD and Saudi rural inhabitants, family history of renal disease, and ex-smoking.

Acknowledgement

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Conflict of interest

Authors declare no conflict of interest.

Data Availability

Derived data supporting the findings of this study are available from the corresponding author (Ahmed HG).

Authors contributions

A.H.A and A.A.A conceived of the presented idea. H.G.A developed the theory and performed the computations. M.R.A, A.A.A and S.H.A verified the analytical methods and inspired other authors to investigate and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

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