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Research Article

Obese First Degree Relatives of Hemodialysis Patients Are at Higher Risk for Developing Kidney Diseases: In a Cross-sectional Study

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Abstract

Background: Previously, it has been demonstrated that obesity is one of the strongest risk factors for incident chronic kidney diseases (CKDs). Currently, we examine the association between Body mass index (BMI) and CKD in first degree relatives (FDRs) of renal failure patients on hemodialysis.

Materials and methods: In a cross-sectional study, 135 FDRs of end-stage renal disease (ESRD) patients on hemodialysis were included. Serum creatinine, uric acid, calcium, phosphate, and alkaline phosphatase were measured. Glomerular filtration rate (e-GFR) and albumin to creatinine ratio (ACR) were estimated. The height in Cm, weight in Kg was measured, and the BMI was calculated.

Results: Females 64% were found to have a higher frequency than males 36%. The frequency of BMI categories was found to be 26.7% obese, 26.7% overweight, and 46.6. % normal weight. The mean BMI was (26.0 ± 6.62). The prevalence of CKDs is 19.3% among relatives. CKDs were more frequent 42.3 % in obese, followed by 30.8 % in overweight and 26.9% in normal-weight relatives. Obese and overweight relatives have significantly higher ACR than normal weight (P= 0.012). GFR found to be significantly higher in obese and overweight relatives than normal weight (P = 0.000). GFR was negatively correlated with BMI (R = - 0.430, P = 0.000).

Conclusion: Obese and overweight RF relatives had higher ACR and lower eGFR. Therefore, obese and overweight members are at higher risk of developing CKD.

Keywords: CKDs, Family members, BMI, Obesity, ACR, eGFR.

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1. Introduction

Chronic kidney disease (CKD) is a global public health problem [1], increasing rapidly worldwide and is gaining much attention in both the developed as well as developing countries [2]. It is found in 10% of the global population [3], and it affects 10-16% of the adult population in China, Asia, Australia, Europe, and the United States [4]. In Sudan, as Abu-Aisha et al. reported in their pilot study in 2009, the prevalence range was 7.7 - 11% [5]. CKD is considered as a health issue associated with increased morbidity, mortality, and health care costs [3, 4].

Beside CKD, Obesity is another global pandemic problem; it is associated with various metabolic disorders such as CKD and results in a shortened life span related to adverse health consequences. In Sudan, the high prevalence of obesity was observed, and it was found that it is associated with diabetes and hypertension [6]. Epidemiological studies have demonstrated that obesity, a family history of ESRD and high body mass index (BMI) are essential risk factors for incident CKD and increased risk of ESRD [7, 8], and associated with an increased risk of CKD development among adult individuals in the general population [9].

Several studies showed that; the FDRs of ESRD patients with a family history are at risk to develop CKD [10, 11]. Furthermore, increased BMI and obesity were found to be having direct impact on the development of CKD and ESRD [8], through a compensatory mechanism of hyperfiltration occurs to meet the heightened metabolic demands of the increased body weight and the increase in intraglomerular pressure which can damage the kidney structure and raise the risk of developing CKD in long term [8]. This study aims to find out the association between BMI and CKD among FDRS of Sudanese hemodialysis patients.

2. Materials and Methods

In a cross-sectional study, 135 randomly selected family members (first-degree relatives) of chronic end-stage renal failure on hemodialysis attending different centers in Khartoum State were included. Ages ranged between 17-60 years old. After informed consent, blood samples were collected, under the aseptic condition from relatives. Subject with diabetes mellitus, hypertension, cancer, thyroid dysfunction, glucocorticoids therapy, HIV, pregnancy, and hepatitis were excluded. The selection based on clinical history records. The demographic data were gathered using instructed questionnaire. The height in cm and weight in Kg were estimated, then BMI was calculated. ACR and e-GFR were measured. Elevated ACR (>30 mg/g) and/or reduced e-GFR (<60 ml/min/1.73m^2) considered as CKDs.

2.1. Ethical approval

The study was approval by the local ethical committee of Al-Neelain University and Ministry of Health. Written informed consent was obtained from all participants.

2.2. Estimation of ACR

Brief according to manufacturer Also, mid-stream single spot urine sample was collected. Albumin was measured by turbidimetry assay. Urine creatinine was estimated by Jaffe method Cobas C-311® fully automated analyzer. Albumin-creatinine ratio was calculated by Medical, Scy-med calculator, and expressed in mg/g. ACR >30mg/gm was considered as albuminuria.

2.3. Estimation of e-GFR

Estimated-GFR was calculated by MDRD and CKD-EPI equations (reduced GFR was detected when eGFR<60 ml/min/1.73m^2).

2.4. Statistical analysis

The Statistical Package for Social Sciences (SPSS), version 21.0 (SPSS Inc., Chicago, USA) was used for data analyses. Results were presented as frequencies, percentage, Mean ± SD and regression coefficient. The student's *t*-test was used to compare mean levels between groups. Chi-esquire was used for qualitative data. Person's correlation was employed to determine the association between continuous variables. *P*-value ≤ 0.05 was considered as the statistical significance.

3. Results

In this study, 135 family members were participated. Table 1 shows the demographic and characteristics data, table 2 shows the frequency and distribution of CKD and table 3 shows the mean levels of ACR and e-GFR according to BMI categories, while Figure 1 shows association of BMI with ACR and e-GFR. 64% were Females and 36% males. Their mean age was (32.3 ± 14.1). The frequency of BMI categories was found to be 26.7% obese, 26.7% overweight, 39.2% normal weight and 7.4% underweight. The mean BMI was (26.0 ± 6.62). The prevalence of CKDs is 19.3% among relatives. CKDs were more frequent 42.3 % in obese, followed by 30.8% in overweight and 26.9% in normal weight relatives. Obese and overweight relatives have significantly higher ACR than normal weight (*P*= 0.012). GFR found to be significantly higher in obese and overweight relatives than normal weight (*P* = 0.000). GFR was negatively correlated with BMI (R = -0.430, *P* = 0.000).

Table 1: Demographic and characteristic data among first degree relatives of hemodialysis patients (N = 135).

Characteristics	Frequency (%) or Mean ± SD	Variable	Frequency (%) or Mean ± SD
Gender: N (%)		**Age Groups: N (%)**	
Male	49 (36 %)	**≤ 20 years**	32 (23.7 %)
Female	86 (64 %)	**21 - 40 Years**	65 (48.1 %)
Age: (Mean ± SD)	(32.3 ± 14.1)	**> 40 Years**	38 (28.1 %)
BMI: (Mean ± SD)	(26.0 ± 6.62)	**ACR: N (%)**	
BMI Classification: N (%)		**>30 mg/gm.**	23 (17.0 %)
Normal weight	63 (46.6 %)	**≤ 30 mg/gm.**	112 (83.0 %)
Overweight	36 (26.7 %)	**GFR – MDRD: N (%)**	
Obese	36 (26.7 %)	**< 60 ml/min/1.73m^2**	9 (6.70 %)
		> 60 ml/min/1.73m^2	126 (93.3)

Table 2: Frequency of chronic kidney disease and its distribution based on BMI and age categories among first degree relatives of hemodialysis patients (N = 135).

Characteristics	Frequency (%)
Chronic kidney disease	26 (19.3 %)
BMI Categories	
Normal weight	7 (26.9 %)
Overweight	8 (30.8 %)
Obese	11 (42.3 %)
Total	26 (100 %)
Age group	
≤ 20 years	5 (19.2 %)
21 - 40 Years	9 (34.6 %)
> 40 Years	12 (46.2 %)
Total	26 (100 %)

Table 3: The mean levels of ACR and e-GFR based on BMI categories in total first-degree relatives.

Parameters	BMI categories	Mean ± SD	P- value
ACR (mg /gm.)	**Normal weight**	12.0 ± 6.60	0.012
	Overweight	16.5 ± 9.80	
	Obese	21.6 ± 8.90	
GFR - MDRD	**Normal weight**	90.7 ± 20.2	0.000
	Overweight	77.4 ± 21.6	
	Obese	77.7 ± 25.8	

4. Discussion

Concurrent with several previous studies that showed increased prevalence of CKDs [12], this study has demonstrated higher prevalence (19.3%) of CKDs among family

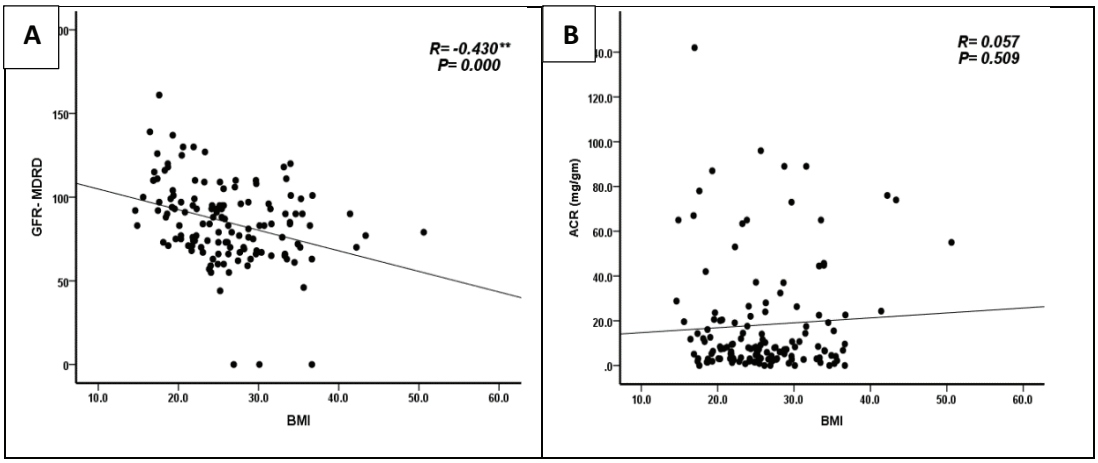

Figure 1: A: Correlation between BMI and estimated -GFR, B: Correlation between BMI and ACR.

members of renal failure patients. Moreover, the frequency data showed that, CKDs is more frequent in adults followed by adolescence and youngest. Meanwhile, in 135 of first-degree relatives, higher frequency of obesity was noted, followed by overweight and normal weight. Several previous studies have reported similar findings that, increased BMI was independent risk factor for CKDs in general population, diabetes and hypertension [13–16]. Indeed, obesity is known to affect hemodynamic, insulin resistance, adipokines changes, low grade inflammation, oxidative stress and endothelial dysfunction, therefore has been suggested to be a risk factor of CKDs. Previous studies have shown that, obesity lead to intraglomerular pressure, which damage the kidneys structure and raise the risk of developing CKD in long term [17, 18]. Whereas adiponectins from adipocyte are postulated to be involved in the pathogenesis and progression of CKD [19].

In contrast, few studies demonstrated an insignificant association between increased BMI and CKD [20, 21]. This contradiction attributed to obesity paradox, which suggested to have a protective effect against CKD progression and mortality [22].

Comparison analysis revealed that, obese and overweight relatives had significantly higher ACR and lower e-GFR levels than normal weight, therefore, have been suggested as potential risk factors of CKDs among family members. These findings similar from those reported that, albumin excretion rate is increased in obese subjects, also obese non diabetic subjects had a greater risk for microalbuminuria [23–25]. Since the obesity increases renal plasma flow, hyperfiltration and promote renal injury, consequently proteinuria [26–29]. On the other hand, the reduced level of e-GFR among individuals with increased BMI, in addition some data in support of this finding that, the BMI of 30 kg/m^2 or more is associated with rapid loss of kidney function in patients with eGFR of at least 60 mL/min /1·73 m^2 [30, 31].

In the present study, the comparison analysis was further reinforced by Person's correlation of eGFR and BMI that, eGFR positively associated with BMI. In fact, the association of obesity with an increased ACR-based CKD risk was previously reported [32]. In contrast, our results differ from those demonstrated that, the BMI is independent factor of CKD [33].

5. Conclusion

In conclusion, the prevalence of CKDs is 19.3% among relatives. Obese and overweight relatives had higher ACR and lower eGFR. Meanwhile, BMI inversely associated with eGFR. Therefore, obese and overweight chronic renal failure relatives are at increased risk for developing CKDs.

6. Limitations of the Study

Limited number of relatives, the diagnosis of albuminuria based on single laboratory measurement.

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Conflict of Interest

The authors declare no conflict of interest.

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