Original article

ASSOCIATION BETWEEN CENTRAL OBESITY AND CHRONIC KIDNEY DISEASE

Md Rezwanul Kabir [1], Fahmida Akter [2], Syeda Ruquia Murshed [3], Monzur Al Murshed Chowdhury [4], Nur Jahan Simi[5]

ABSTRACT

Background: Chronic kidney disease (CKD) is increasingly recognized as a global public health concern which is one of the leading cause of death and disability. Central obesity increases the risk of developing major risk factors for chronic kidney disease like diabetes and hypertension.

Methods: This case-control study was conducted between January and December, 2019. Fifty-five cases and fifty-five age and sex matched controls were interviewed by a pretested semi-structured questionnaire. Medical records of the respondents were reviewed and a checklist was used to document after measuring height, weight, waist circumference and blood pressure.

Results: The study showed that hypertension and diabetes mellitus were present in significantly higher proportions among the CKD respondents compared to the non-CKD respondents ($P < 0.001$). Cases were 11.5 times (OR 11.425; 95% CI 4.575-28.528) more likely to be hypertensive than controls. Cases were also 8.5 times (OR 8.469; 95% CI 3.119-23.000) more likely to be diabetic than controls. Among the all respondents, the proportion of central obesity was 40.9% while comparatively higher proportions were found in cases (45.5%) than in controls (36.4%). No significant association was found statistically between central obesity and chronic kidney disease. But diabetes mellitus and BMI were significantly associated with central obesity ($P < 0.05$). Centrally obese respondents were 2.5 times (OR 2.436; 95% CI 1.066-5.566) more likely to be diabetic than non-obese respondents. Lifestyle related risk factors such as consumption of tobacco both cigarette smoking and smokeless tobacco, alcohol consumption and body mass index (BMI) were also not associated with chronic kidney disease.

Conclusion: As central obesity was associated with major risk factors of chronic kidney disease, so weight loss should be encouraged in obese subjects to decrease the risk of CKD.

JOPSOM 2023; 42(1): 7-13
https://doi.org/10.3329/jopsom.v42i1.73040

Key words: Chronic kidney Disease; Central Obesity

---

1. *Lecturer, Dept. of Community Medicine, Mymensingh Medical College.*
2. *Associate Professor, Department of Epidemiology, National Institute of Preventive and Social Medicine (NIPSOM), Mohakhali, Dhaka-1212.*
3. *Major, Bangladesh Army, Graded Specialist (Obs.& Gynae), CMH, Mymensingh.*
4. *Deputy Program Manager, National Nutrition Services (NNS), Mohakhali, Dhaka-1212, Chairman, Muktijuddha Abdur Rahim Chowdhury Foundation (MARC Foundation).*
5. *Lecturer, Anwer Khan Modern Medical College, Dhanmondi, Dhaka & Treasurer, Muktijoddha Abdur Rahim Chowdhury Foundation (MARC Foundation).*

Corresponding author: *Dr. Md. Rezwanul Kabir, E-mail: kabir_500@yahoo.com*

INTRODUCTION

Non-communicable diseases (NCDs) present a significant global health challenge in the current century and have replaced communicable diseases as the most common causes of morbidity and premature mortality worldwide [1]. Initially, four NCDs (cardiovascular disease, cancers, chronic respiratory diseases and diabetes) were prioritized in the Global NCD Action Plan endorsed by the World Health Assembly in 2008 but systematic reviews of various population based studies have now revealed the significance of chronic kidney disease as a separate entity requiring emphasis on prevention, early detection and treatment [2].

Chronic kidney disease (CKD) is increasingly recognized as a global public health concern and an important contributor to morbidity and mortality [3]. The Global Burden of Disease study in 2015 showed that around 1.2 million people were known to have died of CKD [3], and over 2 million people died in 2010 because they had no access to dialysis [4]. Prevalence is estimated to be 8–16% worldwide [5] and the prevalence of CKD in Asia varies from 10-18%, which is not much different from other parts of the world. However, due to paucity of data in most Asian countries, the exact burden and cost associated with disease is still not clear. This incidence has doubled over the past decade and is expected to continue to rise by 5-8% [6].

Obesity is one of the major public health concern and worldwide health threat of the twenty first century because of its alarming upward trend in both developed and developing countries. Over the last 3 decades, the prevalence of obesity and socio-economic burden has increased worldwide substantially. Obesity is already among the top 10 risks to human health worldwide [7]. Obesity is already among the top 10 risks to human health worldwide [8]. According to the WHO report, one in three of the world's adult population is overweight and almost one in 10 is obese [9].

Central obesity, is a potent risk factor for the development of kidney disease. It increases the risk of developing major risk factors for chronic kidney disease (CKD), like diabetes and hypertension and has also direct impact on the development of CKD and end-stage renal disease (ESRD). Obesity has reached epidemic proportions worldwide including Bangladesh. A population based study in Bangladesh showed the prevalence of central obesity 39.8% (males 24.3%, females 48.7%) using the IDF definition [10].

METHODS

Study design & setting: This was a case control study was conducted at Dhaka Medical College and Hospital (DMCH) from January 2019 to December 2019 among fifty-five cases (diagnosed CKD patients) and fifty-five age and sex matched controls (non-CKD individuals). The study was conducted among age group 30 to 65 years.

Data collection and analysis: Data were collected through face-to-face interview using a pre-tested data collection sheet. Before preceding the data collection, the detail of the study was explained to each eligible respondent. Then written consent from the respondents were obtained. The relevant socio-demographic data along with anthropometric data of the respondents were collected and recorded. Computer based statistical analysis were carried out with appropriate techniques and systems. Descriptive statistics were computed for socio-demographic variables both for cases and controls. Chi-square and Fisher's exact test was carried out to assess association of qualitative data. To assess strength of associations, Odds Ratio (OR) and their corresponding 95% confidence interval (CI) were calculated. Statistical significance was defined as $p < 0.05$. Analyzed data were presented through tables. Medical records of the respondents were reviewed and a checklist was used to document after measuring height, weight, waist circumference and blood pressure. Quantitative data were expressed as mean and standard deviation and qualitative data were expressed as frequency distribution and percentage. Statistical analysis was performed by using Statistical Packages for Social Sciences (SPSS version 25). For nutritional assessment, "BMI classification for Asians" was performed. The patient was then assigned a rating of underweight (BMI<18.5), normal weight (BMI 18.5-24.9), overweight (BMI 25-29.9.5), obese (BMI≥30). Waist circumference was measured to assess central obesity.

Ethical considerations: Ethical clearance of the study was obtained from the Institutional review board of NIPSOM, Bangladesh. Informed written consent was obtained from the respondents after describing the objectives and procedure of the study and ensuring that there was no chance of any physical, mental, social and economic harm to them. Each participant voluntarily took part in the study. Privacy and confidentiality was maintained strictly. Participants had the liberty to refuse to participate at any point of the study. Anonymity of data was maintained and access to data was restricted to the Principal Investigator.

RESULTS

Socio-demographic characteristics of the respondents:

Majority of the respondents were from the age group 50-59 years both in cases and controls and the proportion of the respondents was higher in cases (45.5%) than in controls (36.4%). Chi-square test revealed no significant association between age of the respondents and chronic kidney disease ($p > 0.05$) [Table-1].

JOPSOM 2023; 42(1): 7-13 https://doi.org/10.3329/jopsom.v42i1.73040

Table-1: Age of the respondents and chronic kidney disease

Age (in years)	**Case**	**Control**	**Statistics**
	n (%)	**n (%)**	
< 40	6 (10.9)	10 (18.2)	χ^2=2.556
40-49	12 (21.8)	16 (29.1)	df =3, p=0.465
50-59	25 (45.5)	20 (36.4)	
≥ 60	12 (21.8)	9 (16.4)	

Majority of the respondents were from urban both in cases (56.4%) and controls (52.7%). No significant association was revealed between residence of the respondents and chronic kidney disease ($p > 0.05$) [Table-2].

Table 2: Residence of the respondents and chronic kidney disease

Residence	**Case**	**Control**	**Statistics**
	n (%)	**n (%)**	
Rural	24 (43.6)	26 (47.3)	χ^2=0.147
Urban	31 (56.4)	29 (52.7)	df =1, p=0.702

Most of the respondents both in cases and controls were Muslims with comparatively slightly higher proportion in cases (92.7%) than in controls (89.1%). Fisher's exact test revealed no significant association between religion of the respondents and chronic kidney disease ($p > 0.05$) [Table-3].

Table-3: Religion of the respondents and chronic kidney disease

Religion	**Case**	**Control**	**Statistics**
	n (%)	**n (%)**	
Islam	51 (92.7)	49 (89.1)	Calculated value = 0.54
Shanatan	3 (5.5)	5 (9.1)	df =2, p=0.857
Christianity	1 (1.8)	1 (1.8)	Fisher's exact test

The higher proportions of married respondents were found both in cases (100%) and controls (94.5%). The difference was not statistically significant by Fisher's exact test ($p > 0.05$) [Table-4].

Table-4: Marital status of the respondents and chronic kidney disease:

Marital Status	**Case**	**Control**	**Statistics**
	n (%)	**n (%)**	
Unmarried	0 (0)	3 (5.5)	Calculated value = 3.084
Married	55 (100%)	52 (94.5)	df =1, p=0.243*
			Fisher's exact test

The higher proportions of the respondents were below secondary educational level both in cases (40.0%) and controls (38.2%). Only 10.9% of the respondents both in cases and controls were graduate and above. No significant association was found between educational status of the respondents and chronic kidney disease ($p > 0.05$) [Table-5].

Table-5: Educational status of the respondents and chronic kidney disease

Level of Education	**Case**	**Control**	**Statistics**
	n (%)	**n (%)**	
Illiterate & Can sign only	13 (23.6)	10 (18.2)	χ^2=0.915
Below secondary	22 (40.0)	21 (38.2)	df=3
Secondary & Higher secondary	14 (25.5)	18 (32.7)	p=0.822
Graduate & Post graduate	6 (10.9)	6 (10.9)	

Majority of cases (40.0%) and controls (38.2%) were housewife. The proportion of service was comparatively higher in controls (21.8%) than in cases (12.7%). These differences in proportions were not found statistically significant ($p > 0.05$) [Table 6].

Table-6: Occupational status of the respondents and chronic kidney disease

Occupation	Case	Control	Statistics
	n (%)	n (%)	
Unemployed & Retired	8 (14.5)	5 (9.1)	$\chi 2$=2.231
Service	7 (12.7)	12 (21.8)	df=4
Business	15(27.3)	15 (27.3)	p=0.693
Housewife	22 (40.0)	21 (38.2)	
Farmer	3 (5.5)	2 (3.6)	

Monthly income ≤ 20000 taka were comparatively more common both in cases (58.2%) and controls (50.9%). Fisher's exact test revealed no significant association between household income of the respondents and chronic kidney disease ($p > 0.05$) [Table 7].

Table-7: Household income of the respondents and chronic kidney disease

Household Income (taka/month)	Case	Control	Statistics
	n (%)	n (%)	
≤ 20000	32 (58.2)	28 (50.9)	$\chi 2$=2.143
20001-40000	20 (36.4)	23 (41.8)	df=3, p=0.569
40001-60000	2 (3.6)	4 (7.3)	Fisher's exact test
>60000	1 (1.8)	0 (0)	

Cases and controls were mostly never smokers with higher proportion in controls (74.5%) than in cases (67.3%). Only 7.3% in controls and 5.5% in cases were current smokers. No significant association was found between consumption of smoking and chronic kidney disease ($p > 0.05$) [Table 8].

Cases and controls were mostly never take smokeless tobacco with higher proportion in cases (70.9%) than in controls (60.0%). Chi-square test revealed no significant association between consumption of smokeless tobacco and chronic kidney disease ($p > 0.05$) [Table 8].

Table-8: Consumption of smoking and chronic kidney disease

Smoking	Case	Control	Statistics
	n (%)	n (%)	
Never	37 (67.3)	41 (74.5)	1.348
Ex or Occasional	15 (27.2)	10 (18.2)	df= 2, p=0.581
Current	3 (5.5)	4 (7.3)	Fisher's exact test
Smokeless Tobacco			$\chi^{2=}$ 1.447
Never	39 (70.9)	33 (60.0)	df=1, p=0.229
Ever	16 (29.1)	22 (40.0)	

Majority of the respondents, both in cases (47.3%) and controls (56.4%) had normal weight according to BMI classification for Asians. The proportion of obese respondents were slightly higher in cases (21.8%) than in controls (18.2%). No significant association was found statistically between body mass index (BMI) and chronic kidney disease ($p > 0.05$) [Table 9].

Table-9: Body mass index (BMI) and chronic kidney disease

BMI	Case n (%)	Control n (%)	Statistics
Underweight	6 (10.9)	2 (3.6)	χ^2 = 2.664
Normal	26 (47.3)	31 (56.4)	df= 3
Overweight	11 (20.0)	12 (21.8)	p= 0.446
Obese	12 (21.8)	10 (18.2)	

JOPSOM 2023; 42(1): 7-13 https://doi.org/10.3329/jopsom.v42i1.73040

Majority of the cases (69.1%) had hypertension and majority of the controls (83.6%) had no hypertension. Chi-square test revealed significant association between hypertension and chronic kidney disease ($p < 0.05$). Cases were 11.5 times (OR 11.425; 95% CI 4.575-28.528) more likely to be hypertensive than controls [Table 10].

Table-10: Hypertension and chronic kidney disease

HTN	Case n (%)	Control n (%)	Statistics	OR (95% CI)
No	17 (30.9)	46 (83.6)	χ^2=31.243	11.425
Yes	38 (69.1)	9 (16.4)	df= 1, p=0.000	(4.575-28.528)

Among cases, 50.9% were diabetic while majority of the controls were non-diabetic (89.1%). Chi-square test revealed significant association between diabetes mellitus and chronic kidney disease ($p < 0.05$). Cases were 8.5 times (OR 8.469; 95% CI 3.119-23.000) more likely to be diabetic than controls [Table 11].

Table-11: Diabetes mellitus and chronic kidney disease

DM	Case n (%)	Control n (%)	Statistics	OR (95% CI)
No	27 (49.1)	49 (89.1)	χ**2**=20.604	8.469
Yes	28 (50.9)	6 (10.9)	df=1, p=0.000	(3.119-23.000)

Among the centrally non-obese respondents, 72.4% had normal BMI. According to BMI classification, 46.7% obese respondents who had also central obesity. Significant association was found statistically between body mass index (BMI) and central obesity ($p < 0.05$) [Table-12].

Table-12: Body mass index (BMI) and central obesity

BMI	Central Obesity		Statistics
	Non obese n (%)	Obese n (%)	
Underweight	8 (12.3)	0 (0)	χ**2**=49.279
Normal	47 (72.4)	10 (22.2)	df=3, p=0.000
Overweight	9 (13.8)	14 (31.1)	
Obese	1 (1.5)	21 (46.7)	

DISCUSSION

This case-control study was carried out to assess association between central obesity and chronic kidney disease. In the current study the cases (51.58±8.78 years) were on average, 2 years older than the controls (49.15±9.93 years), majority were male (58.2%). Highest proportion of CKD was 50-59-year age group in the study, while highest proportion was reported for 46 years and above age group, the age range was between 18 and 70 years (mean ± SD, 37 ± 11) and most of the participants (88.3%) were males in another study [11].

In this study, 10.9% were underweight, 47.3% were normal, 20% were overweight and 21.8% were obese among the cases. No significant association was found of educational status, occupation and income of the respondents with chronic kidney disease. A study conducted in Bangladesh where 57.5% of the participants were normal, 21.8% underweight, 17.4% overweight, 3% obese, and 0.3% morbidly obese. The association of sociodemographic factors with CKD was not significant except age more than 40 years and marital status [12].

The current study also found no significant association between central obesity and chronic kidney disease (CKD). A community- based study conducted in China also found association between central obesity and chronic kidney disease but that was not highly significant (*P = 0.045*) [13]. In Southeast Asian cohort study followed for 12 years, WC was not significantly associated with risk of incident CKD [14].

No significant association of consumption of tobacco and alcohol with chronic kidney disease were also not found in the current study. A study conducted in Bangladesh also found no association of smoking with CKD [15,11], while using of smokeless tobacco was associated with higher odds of CKD among women in the study [15].

In this study, chi-square test revealed significant association between diabetes mellitus and central obesity ($p< 0.05$). Central obesity is a risk factor for developing type 2 diabetes (T2DM) and hypertension (HTN) [16, 17] which are well known risk factors for CKD and cardiovascular mortality.

CONCLUSION

This case-control study was carried out to assess association between central obesity and chronic kidney disease (CKD). It can be concluded from the study that central obesity is not associated with chronic kidney disease. Although not significant by itself, the presence of central obesity might increase the risk of CKD in the presence of other risk factors. Central obesity was significantly associated with diabetes mellitus and body mass index (BMI). Respondents with diabetes mellitus were about two and half times more likely to be centrally obese.

REFERENCES

1. World Health Organization, Public Health Agency of Canada. Preventing chronic diseases: a vital investment. World Health Organization; 2005 Sep 28.
2. Couser WG, Remuzzi G, Mendis S, Tonelli M. The contribution of chronic kidney disease to the global burden of major noncommunicable diseases. Kidney international. 2011 Dec 2;80(12):1258-70.
3. Wang H, Naghavi M, Allen C, Barber RM, Carter A, Casey DC, Charlson FJ, Chen AZ, Coates MM, Coggeshall M, Dandona L. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980â 2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet. 2016;388(10053):1459-544.
4. Crews DC, Bello AK, Saadi G. 2019 World Kidney Day Editorial-burden, access, and disparities in kidney disease. Brazilian Journal of Nephrology. 2019 Feb 28;41:1-09.
5. Jha, V., Garcia-Garcia, G., Iseki, K., Li, Z., Naicker, S., Plattner, B., Saran, R., Wang, A. Y.-M. & Yang, C.-W. 2013. Chronic kidney disease: global dimension and perspectives. The lancet, 382**,** 260-272.
6. Hamer RA, El Nahas AM. The burden of chronic kidney disease. Bmj. 2006 Mar 9;332(7541):563-4.
7. Mutangadura, G. B. 2004. World health report 2002: reducing risks, promoting healthy life: world health organization, Geneva, 2002, 250 pages, US $13.50, ISBN 9-2415-6207-2. Agricultural Economics, 30**,** 170-172.
8. World Health Organization. The world health report 2002: reducing risks, promoting healthy life. World Health Organization; 2002.
9. WHO I Obesity and overweight. http:// www.who.int/mediacentre/factsheets/fs311/en/ index.html.
10. Siddiquee, T., Bhowmik, B., Moreira, N. C. D. V., Mujumder, A., Mahtab, H., Khan, A. A. & Hussain, A. 2015. Prevalence of obesity in a rural Asian Indian (Bangladeshi) population and its determinants. BMC public health, 15**,** 860.
11. Fatema K, Abedin Z, Mansur A, Rahman F, Khatun T, Sumi N, Kobura K, Akter S, Ali L. Screening for chronic kidney diseases among an adult population. Saudi Journal of Kidney Diseases and Transplantation. 2013 May 1;24(3):534-41.
12. Huda MN, Alam KS. Prevalence of chronic kidney disease and its association with risk factors in disadvantageous population. International journal of nephrology. 2012 Oct;2012.
13. Chen N, Wang W, Huang Y, Shen P, Pei D, Yu H, Shi H, Zhang Q, Xu J, Lv Y, Fan Q. Community-based study on CKD subjects and the associated risk factors. Nephrology Dialysis Transplantation. 2009 Jul 1;24(7):2117-23.
14. Kitiyakara C, Yamwong S, Cheepudomwit S, Domrongkitchaiporn S, Unkurapinun N, Pakpeankitvatana V, Sritara P. The metabolic syndrome and chronic kidney disease in a Southeast Asian cohort. Kidney international. 2007 Apr 1;71(7):693-700.
15. Anand, S., Khanam, M. A., Saquib, J., Saquib, N., Ahmed, T., Alam, D. S., Cullen, M. R., Barry, M. & Chertow, G. M. 2014. High prevalence of chronic kidney disease in a community survey of urban Bangladeshis: a cross-sectional study. Globalization and health, 10**,** 9.
16. Feng RN, Zhao C, Wang C, Niu YC, Li K, Guo FC, Li ST, Sun CH, Li Y. BMI is strongly

associated with hypertension, and waist circumference is strongly associated with type 2 diabetes and dyslipidemia, in northern Chinese adults. Journal of epidemiology. 2012 Jul 5;22(4):317-23.

17. Casanueva FF, Moreno B, Rodríguez-Azeredo R, Massien C, Conthe P, Formiguera X, Barrios V, Balkau B. Relationship of abdominal obesity with cardiovascular disease, diabetes and hyperlipidaemia in Spain. Clinical endocrinology. 2010 Jul;73(1):35-40.