

## Original Research Article

# A study on prevalence of chronic kidney disease and its risk factors among adults in selected slums of Chennai

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### ABSTRACT

**Background:** Chronic kidney disease (CKD) is a silent epidemic. The true prevalence of CKD with in a population are very difficult to estimate, since early to moderate CKD were usually asymptomatic. ESRD in the consequence of CKD is one of the most expensive diseases to treat. Only way is to prevent it and Hence this was conducted to estimate the prevalence of CKD and its associated risk factors among adults in selected slums of Chennai.

**Methods:** This is a cross sectional study done from May 2013 to June 2014 in selected slums of Chennai. The study population includes adult males and females. Multi stage sampling method used. Sample size covered was 400. A semi structured questionnaire used as tool. Based on the serum creatinine eGFR calculated using modified MDRD study equation and CKD prevalence was identified. The data was entered in MS excel and analyzed using SPSS version 21.

**Results:** Total of 400 participants involved. Females were predominant in the study. Among them, 67 (16.8%) were diagnosed as CKD patients and Stage 1, 4.0% had stage 2, 3.6% had stage 3, 1.3% had stage 4 and 0.5% had stage 5 at the time of diagnosis.

**Conclusions:** This study revealed prevalence of CKD among slum population was 16.8%. This study showed that old age, uncontrolled hypertension, uneducated, Diabetes with poor control, overuse of analgesics, H/o smoking, obesity, alcoholism, passive smoking, family H/o CKD and proteinuria were significant risk factor for CKD among study subjects. Slum population with risk factors should be regularly screened for CKD.

**Keywords:** CKD, Adults, Slum, Diabetes, Hypertension

### INTRODUCTION

Increasing affluence and sedentary lifestyle along with changing pattern of demographics has led to raising trend in non-communicable diseases worldwide, even in developing countries like India. Chronic kidney disease (CKD) is a silent epidemic. It is attributed by better nutrition, decreasing incidence of communicable diseases and improved life expectancy.<sup>1</sup> Different methodologies were used for studying the prevalence of CKD and this poses a difficulty in estimating the true prevalence.<sup>2</sup>

Formulae to calculate estimated glomerular filtration rate (eGFR), age related decrease in GFR and microalbuminuria these all can overinflate the overall CKD prevalence. Glomerular filtration rate is considered the best overall index of kidney. "SEEK (screening and early evaluation of kidney disease) India cohort" estimated CKD prevalence 17.2% using community and hospital based screening camp approach, modification of diet in renal disease (MDRD- 3) equation eGFR <60 ml/min/1.73 m<sup>2</sup> or urine protein ≥1+.<sup>3</sup> The true incidence and prevalence of CKD with in a population are very

difficult to estimate, since early to moderate CKD were usually asymptomatic. Non-availability of population based screening programs lead to delay in diagnosis of CKD.<sup>3</sup> End stage renal disease (ESRD) in the consequence of CKD is one of the most expensive diseases to treat currently.<sup>3</sup> Only way is to prevent it rather than try to treat it. Hence, this present study was designed and performed to estimate the prevalence of CKD and its risk factors in selected slums of Chennai.

### Objectives of the study

This study was conducted to estimate the prevalence of chronic kidney disease (CKD) and its associated risk factors among adults in selected slums of Chennai.

### METHODS

This is a community based cross sectional study done from May 2013 to June 2014 in selected slums of Chennai, Tamil Nadu, India. The study population includes adult males and female aged more than 18 years. After obtaining approval from the Commissioner, Corporation of Chennai and Institutional Ethics Committee, data collection started. After getting informed consent, relevant information collected by one to one interview using questionnaire in the local language at their homes. Those who are bed-ridden were excluded as they could not be mobilized for blood and urine examination, pregnant women; those who had any acute illness like diarrhea, fever, those who were taking drugs that affect serum creatinine were excluded. Sample size covered was 400 and the Calculated Sample size was 394.  $Z_{1-\alpha/2}=1.96$  at 95% confidence interval,  $p$ =prevalence of CKD 17.2%,  $q=100-17.2=82.8\%$ ,  $d$ =absolute precision of 5%, design effect of 1.5.

$$N = \frac{1.96 \times 1.96 \times 17.2 \times 82.8}{5^2} \times 1.5 = 328$$

Allowing a 20% non-response rate=66. The sample size is calculated by using prevalence of CKD 17.2% in SEEK India study.<sup>3</sup> First stage was a simple random sampling technique, followed by a cluster sampling. With the cluster size of 20, number of clusters needed= sample size/cluster size= 400/20= 20 clusters.

A pre-tested semi structured questionnaire adapted and modified from the SEEK study.<sup>3</sup> This contains 2 parts, First part includes socio demographic particulars and contact details and the second part consists history regarding exposure to risk factors. The questionnaire was pretested among 50 adults in a slum and based on the observations, necessary modifications were made. Following the interview of the participant with the questionnaire, measurements of height, weight, waist and hip circumference, blood pressure, blood samples and urine samples for glucose (random), serum creatinine and urine dipstick were made among the participants of the study.

Based on the serum creatinine eGFR calculated using modified MDRD study equation and CKD prevalence was identified. Throughout the study the privacy of the participants ensured. The interview was conducted and also measurements were taken in their own house.

The data was entered into a MS excel sheet and analyzed using SPSS version 21. Chi square tests and regression were used and  $p < 0.05$  was considered to be significant.

### RESULTS

This cross sectional study estimated the prevalence of chronic kidney disease and its risk factors among 400 study participants. Among them, as per Table 1, majority belongs to 20-29 yrs (32.5%) followed by 22.8% in 40-49 yrs, 21.3% in 30-39 yrs, 13.6% in 50-59 yrs, 9.8% >60 yrs. Females were predominant in the study with 63.2% compared to males (36.8%) and Hindus were 80.3%, Christians 17% and Muslims 2.7%.

**Table 1: Socio demographic details of the study participants.**

Socio demographic factors	Frequency	%	
<b>Gender</b>	Male	147	36.8
	Female	253	63.2
<b>Age</b>	<60 years	361	90.2
	≥60 years	39	9.8
<b>Religion</b>	Hindus	321	80.3
	Christmas	68	17
	Muslims	11	2.7
<b>Marital status</b>	Unmarried	46	11.5
	Married	284	71
	Divorced	2	0.5
	Widow/widower	68	17
<b>Educational status</b>	Illiterate	148	37
	1-5th std	60	15
	6-12th std	164	41
	Degree / Diploma	24	6
	PG Degree	3	0.8
	Others	1	0.2
<b>Occupation</b>	Laborer	62	15.5
	Self-employed	114	28.5
	Salaried employee	58	14.5
	Housewife	123	30.8
	Student	4	1
	Unemployed	28	7
	Retired	11	2.7
<b>SES</b>			
>5090	Class I	11	2.8
2545-5089	Class II	131	32.7
1527-2544	Class III	120	30.0
764-1526	Class IV	99	24.8
<764	Class V	39	9.7

Among study participants, 6th-12th std 41%, illiterate 36.5% followed by degree/diploma 6%, primary education (5%), and other (1.6%). Socioeconomic classification was done based on modified B.G. Prasad scale, 2.8% belonged to class I, 32.7% in class II, 30% in class III, 24.8% in class IV and 9.7% in class V.

**Table 2: Stage wise distribution of CKD among study participants.**

Stages of CKD	Number	Percentage (%)
Normal	333	83.2
Stage 1	30	7.5
Stage 2	16	4.0
Stage 3a	9	2.2
Stage 3b	5	1.3
Stage 4	5	1.3
Stage 5	2	0.5
Total	400	100

Among study participants, 67 (16.8%) were diagnosed as CKD patients. Table 2 shows that among all the newly

diagnosed CKD patients 7.5% had stage 1, 4.0% had stage 2, 3.6% had stage 3, 1.3% had stage 4 and 0.5% had stage 5 at the time of diagnosis.

In study population, 57 (14.3%) had proteinuria and about 50 (12.5%) had haematuria, 39 (9.8%) had leucocyturia with nitrate positivity (UTIs).

Prevalence of modifiable and non-modifiable factors risk factors was shown in Table 3. CKD prevalence also increases gradually i.e. from 6.2% among 20-29 years to 29.1% in 50-59 yrs, 25.6% among more than 60 years age group which was statistically significant. Among CKD patients, 50% (6) of the vegetarian and 15.7% (61) of the mixed diet had chronic kidney disease which was statistically significant. Among women those who not attained menopause 19 (12.1%) and who attained menopause 23 (24%) had CKD. The difference was statistically significant. Women who had attained menopause 2.288 times increased odds of getting CKD than menstruating females.

**Table 3: Distribution of CKD risk factors among study participants.**

Risk factors		Male		Female		Total	
		No	%	No	%	No	%
Diet	Veg	3	2	9	3.6	12	3
	Mixed	144	98	244	96.4	388	97
H/o smoking	Smoker	68	46.3	-	-	68	17
	Non-smoker	79	53.7	-	-	332	83
H/o alcohol	Yes	107	72.8	-	-	107	26.8
	No	40	27.2	253	100	293	73.2
H/o diabetes	Yes	12	8.2	43	17	55	13.8
	No	135	91.8	210	83	345	86.2
H/o HTN	Yes	19	12.9	52	20.6	17	17.7
	No	128	87.1	201	79.4	329	82.3
H/o over usage of NSAIDS	Yes	44	29.9	116	45.8	160	40
	No	103	70.1	137	54.2	240	60
H/o AYUSH medicines intake	Yes	4	2.7	8	3.2	12	3
	No	143	97.3	245	96.8	388	97
H/o high blood cholesterol	Yes	5	3.4	22	8.7	27	6.8
	No	142	96.6	231	91.3	373	93.2
H/o heart disease	Yes	15	10.2	13	5.1	28	7
	No	132	89.8	240	94.9	373	93
H/o past urinary problem	Yes	11	7.5	50	19.8	61	15.3
	No	136	92.5	203	80.2	339	84.7
H/o 1 <sup>st</sup> degree relatives with CKD	Yes	17	11.6	20	10.3	43	10.8
	No	130	88.4	227	89.7	357	89.2
Menopause (among females)	Menstruating			157	62.1		
	Attained menopause			96	37.9		

Among those having CKD, newly diagnosed hypertensives in screening were 52 (13%), 71 (17.8%) had history of (h/o) hypertension. Thus prevalence of hypertension was 30.8%. Among CKD proportion, 25.4% of known hypertensives had CKD when compared with

newly diagnosed hypertensives (14.9%). The association is statistically significant. Known hypertensives 1.941 times higher chance of getting CKD than others. Among 400 study participants 71 (17.8%) had h/o hypertension of which 27 (38%) had under control, 44 (62%) had

uncontrolled BP. About 36.4% of uncontrolled hypertension patients developed CKD and the association is statistically significant. Those who had uncontrolled BP 3.417 times higher the chance of getting CKD than others.

Newly diagnosed cases of diabetes in screening were 20 (5.0%), 55 (13.8%) had history of diabetes. Thus prevalence of diabetes was 75 (18.8%). About 36.0% of diabetics developed CKD when compared with non-diabetics, among whom 13.3% developed CKD. The association was statistically significant. Those who had diabetes, 4.008 times higher chance of getting CKD than others. Among known diabetes 50.1% had good glycemic control.

About 44.4% of uncontrolled diabetics developed CKD when compared with those who had good glycemic control 14.7% developed CKD. The association was statistically significant.

About 46% of the males were current and ex-smokers. Among them 32.4% (22) were found to have CKD. The prevalence of CKD is high among smokers and 12.116 times higher the chance of getting CKD ( $p < 0.01$ ). There were 72.8% (107) subjects who consumed alcohol, among them 21.5% (23) were having CKD. Out of 40 (27.2%) who did not consume alcohol, 2 (5%) were found to have CKD. The difference was statistically significant.

**Table 4: Logistic regression analysis of the factors associated with CKD.**

CKD risk factors (significant in univariate analysis)	Category	Odds ratio	P value	Adjusted odds	95% CI	
					Lower limit	Upper limit
<b>Educational status</b>	Less than primary education	1.592	0.02	1.419	1.048	2.387
<b>Diet</b>	Vegetarian	5.361	0.002	2.375	1.209	4.668
<b>H/o alcoholism</b>	Alcoholics	5.202	0.018	0.626	0.218	1.796
<b>H/o diabetes</b>	Known diabetics			0.744	0.182	3.041
<b>H/o hypertension</b>	Hypertensives	1.427	0.202	0.307	0.065	1.445
<b>BMI</b>	obesity			0.701	0.398	1.234
<b>Diabetes (new and old cases)</b>	Diabetics	4.008	<0.01	4.567	1.504	13.863
<b>Poor glycemic control in old case of diabetics</b>	Poor glycemic control in known diabetics	4.625	<0.01	1.211	0.337	4.349
<b>Poor BP control in old case of hypertensives</b>	Poor BP control in known hypertensives	3.417	<0.01	8.267	1.548	44.143
<b>Waist hip ratio</b>	Obesity	2.544	0.02	2.711	0.934	7.874
<b>H/o smoking</b>	Smokers	12.116	<0.01	3.179	1.779	5.678

About 63.5% (254) were overweight. Among those who had over weight 51 (20.1%) had CKD. The difference was statistically significant. Out of 215 (53.7%) who were having normal waist circumference 12.1% (26) subjects were having CKD, whereas out of 185 (46.3%) subjects having Waist circumference >80 cm in female >90 cm in male; 41% (22.2) were having CKD which shows significant association between waist circumference and CKD. Those who had abdominal obesity 2.070 time higher the chance of getting CKD. Out of 87 (34.4%) who were having normal waist hip ratio 8 (9.2%) subjects were having CKD, whereas out of 166 (65.6%) subjects having Waist circumference >0.85 in female >0.90 in male; 34% (20.5) were having CKD which shows there was significant association between waist hip ratio and CKD. Those who had waist circumference >0.85 in female >0.90 in male, 2.544 times higher the chance of getting CKD.

Around 45.8% (116 females) and 29.9% (44males) of subjects have history of regular intake of analgesics, of whom 22.4% (26 females) and 15.9% (7 males) had CKD when compared with subjects who did not use any

analgesic drugs, among whom 11.7% of females and 17.5% of males developed CKD. The association was statistically significant for females. Those who had over use of NSAIDs among females 2.185 times higher chance of getting CKD.

Binary logistic regression analysis showed that, after adjusting for the risk factors which were significantly associated with CKD in univariate analysis, factors like Education (less than primary education), diabetes, uncontrolled hypertension, diet and H/o smoking were found to be significantly associated in multivariate analysis as shown in the Table 4.

## DISCUSSION

This study included 400 adults, 61 (16.8%) were identified as having CKD and 14.3% had proteinuria, of these 85% of CKD patients had proteinuria, which is almost similar study by Singh et al reported a similar prevalence of CKD 17.2% and proteinuria 13.7% by camp approach and similar definition for CKD used in this study.<sup>3</sup>



GFR declines by 1 ml/min/1.73m<sup>2</sup> after the age of 30 yrs in healthy person.<sup>4</sup> The decrease in kidney function might be due to the changes in the kidney structure associated with aging.<sup>5</sup> In this study, mean eGFR among males was significantly higher (100.45 ml/min/1.73 m<sup>2</sup>) than the mean eGFR of females (88.65 ml/min/1.73 m<sup>2</sup>). The mean eGFR is highest among 20-29 yrs (105.75 ml/min/1.73 m<sup>2</sup>), and gradually decreasing as the age advances (>60 yrs had 67.76 ml/min/1.73 m<sup>2</sup>). A study by Prem et al among 3398 healthy central govt. employees reported mean eGFR was 98+ 25.25 ml/min/1.73m<sup>2</sup> by using MDRD equation.<sup>6</sup> As per Singh et al, mean eGFR of 84.27±76.46 ml/min/1.73 m<sup>2</sup> among CKD group while non CKD group had 116.65 ml/min/1.73 m<sup>2</sup>.<sup>3</sup>

In another study the prevalence of early stages I, II, III of CKD was 15.04%. The criteria used for defining CKD was MDRD formula and microalbuminuria based on KDOQI guidelines.<sup>6</sup> In large US population based studies like NHANES II and III estimated the prevalence 10.03% and 13.07% in 1988-94 and 1999-2004 accordingly.<sup>7</sup> In a south Asian ethnic people of Britain were mostly 1st generation migrants from India showed 8.7% prevalence of microalbuminuria. In a study from Delhi and adjoining area by Singh et al shown prevalence of late stages of CKD (3,4&5) 4.2% using original MDRD equation.<sup>8</sup> In contrast the present study estimated 6.3% using modified MDRD equation. But the SEEK study showed 5.9% which was almost similar to the present study.<sup>3</sup> A study by Kidney help trust from Chennai by Mani et al showed the prevalence of eGFR <80 ml/min/1.73 m<sup>2</sup> 0.86-1.39% from 2 different rural population which is much lower than the present study, because they have subjected those who had abnormal urine findings to blood investigation (serum creatinine).<sup>9</sup>

Prevalence of CKD was highest among 60 years and above (25.6%) and lowest among 20–29 years (6.2%) in this study. It also observed that increasing age was significantly associated with CKD (p-value is <0.01). This finding is consistent with Singh et al showed old age was significantly associated with CKD (p=0.0001), Singh et al concluded that as the age increases median eGFR decrease and prevalence of low eGFR increase and Varma et al showed age >40 yrs with OR= 1.86 (CI 1.42-4.43) which was statistically significant (p-value-<0.001).<sup>3,6,8</sup> Though the younger age group had a lesser prevalence compared to older age it is of public health importance as the younger age will be continuously exposed to the risk factors.

This study shows higher prevalence of CKD among females than males (37.3% vs. 62.7%) similar to Singh et al and contrast to the SEEK study where males had higher

prevalence.<sup>2,8</sup> This study shows majority of the study population belongs to the middle income group as per BG Prasad scale- Class II, III, and IV (32.8%, 30% and 24.8%). This is due to change in trend from

communicable to non-communicable diseases in developing countries.

There were no female smokers and alcoholics in this study. There were 46.3% (68) subjects who are smoking, among them 32.4% (22) were found to have CKD. There is significant association between smoking and CKD, Singh et al showed similar result that current smoker has association with CKD i.e. OR=1.885, 95% CI-1.100-2.339 with significant p-value among both the sex.<sup>8</sup> Among 107 male who consumed alcohol, 23 (21.5%) had CKD. This study observed significant association between alcoholism and CKD similar to Singh et al study.<sup>8</sup>

In this study, among those who had diabetes (75), 36% (27) had CKD than non-diabetics (13.3%). This association is highly significant (p-value=0.000). This is very similar to SEEK study by Singh et al and Singh et al.<sup>3,8</sup> Hypertension is a most important predictor of kidney damage and promotes rapid decline of GFR. Among 71 known hypertensive patients 18 patients (25.4%) had CKD than 14.9% among not a known hypertensive. Known hypertensives and uncontrolled hypertensives had significant association with CKD (p<0.05) in the present study. Singh et al, Varma et al and Singh et al showed similar results among hypertensives (p<0.05).<sup>3,6,8</sup>

Obesity is a risk factor for hypertension and diabetes, which is leading causes for CKD. This study shows, 42.8% had a normal BMI while 29.5% of the patients were pre-obese and 21.3% were obese. In the US and most of the developed nations, the obesity epidemic was considerably major threat to the health outcome progress made in the past several decades.<sup>3</sup> In a recent study confirmed that there is a 3 times increased risk of developing CKD among people with obesity.<sup>10</sup> Among 67 CKD patients, 85.1% (57) had proteinuria than those do not had proteinuria (10) 2.9% which was statistically significant (p=0.00). Singh et al study revealed that 79.6% which is slightly lower than the present study (85.1%).<sup>3</sup> Singh et al study revealed OR= 6.806 (95% CI=3.632-12.754) with significant p value.<sup>8</sup>

Those who attained menopause had higher prevalence (24%) than menstruating women (12.1%) which is statistically significant (p=0.01). Salve, Mahajan et al concluded in their study that post-menopausal groups are high risk groups.<sup>11</sup> Educational status, diet, marital status and abdominal obesity has significant association with CKD (<0.05). Among females, analgesic intake, H/o heart disease and h/o high blood cholesterol has significant association.

## CONCLUSION

This study revealed that the prevalence of CKD among slum population was 16.8%. Risk factors studied were hypertension, diabetic, h/o heart disease, h/o high blood

cholesterol, proteinuria (dipstick >1+), smoking habit, alcoholics, obesity and history of overuse of NSAIDs. Other risk factors like diet, alcoholism among males, passive smoking, and proteinuria had significant association with CKD. Slum population with risk factors (like hypertension, diabetes, smoking, alcoholism) should be regularly screened for chronic kidney disease. Prevalence of CKD was found out using serum creatinine and urine dipstick for protein. But they are not subjected to detailed clinical and laboratory examination due to economic constraints. Since this study included only slum population, these results could not be generalized to the whole population. The cut off level for eGFR and urine protein levels were basically derived from US and Europe based studies. This may not be approximate to different racial, geographic or ethnic group of people and for all age groups. Hence further large scale and multicentric studies needed.

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