International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Prevalence Estimates of Chronic Kidney Disease in Hail Region, KSA: in a Comprehensive Survey

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Short Title: Prevalence of CKD in Hail

Abstract: Objective: Chronic kidney disease (CKD) reside clinically quiet and consequently undetected until an advanced stage is reached. Therefore, the objective of this study was to estimate the prevalence of CKD in a primary health care setting in Hail Region, KSA. **Methodology**: A multi-center cross sectional survey included 5000 Saudi selected from 30 primary health care centers (PHCs) in Hail Region. CKD prevalence was assessed using CKD-EPI creatinine equations and proteinurea**. Results**: Prevalence [95% confidence interval (CI)] of all stages CKD was 9.4%. The GFR estimation was available for 2,946 individuals, among whom, 278/2946 (9.4%) were found with impaired kidney function). Of the 278 persons with CKD, 11/2946(0.4%), 16/2946(0.5%), 229/2946(7.8%) and 22/2946 (0.6%) were estimated for GFR rates of stage V, Stage IV, stage III and stage IV, respectively. **Conclusion**: CKD prevalence is high in Hail; therefore, preventive interventions are highly recommended, since, CKD prevalence is likely to rise over the next decades due to increase of its risk factors.

Key words: CKD, Hail, Saudi Arabia, GFR

1. Introduction

Chronic kidney disease (CKD), defined as renal damage with persistent and usually progressive deterioration of ultra filtration, is a worldwide public health problem [1]. CKD is a common condition that irrespective of aetiology results in a wide range of complications including hypertension, hyperparathyroidism, anaemia, vascular calcification and accelerated cardiovascular disease [2,3]. The symptoms associated with CKD are vague and are often attributed to age-related frailty; as a result CKD often remains undiagnosed until the condition is advanced [4]. The ageing of population and the generally increasing rates of obesity, hypertension, and diabetes worldwide suggest that the incidence and prevalence of CKD will rise over the next decades [5,6].

CKD is defined by Glomerular filtration rate (GFR) less than 60 ml/min per 1.73 m^2 and/or kidney damage for three or more months. The presence of albuminuria is most commonly used to define kidney damage, while GFR is usually estimated using equations that include a filtration marker, such as serum creatinine, in conjunction with demographic characteristics that account for factors that affect creatinine generation. The most common creatinine-based equation currently in use is the 4-variable MDRD Study equation, although a newer equation, the CKD-EPI equation, is more accurate, particularly at higher levels of eGFR [7].

One of the biggest issues in CKD prevention is actually disease awareness. As with other causes of chronic disease, social and economic deprivation has been shown to influence the development and progression of CKD, in individual subjects and in residential communities [8].

One of the first steps to improve CKD management is knowledge about CKD prevalence. To date there has been no population based estimates of the prevalence of CKD in Saudi Arabia. We therefore, conducted this representative cross-sectional survey of the Saudi population in Hail Region in order: to estimate the prevalence of CKD to provide data for health services for better patient's management.

2. Materials and Methods

This is a multi-center cross sectional survey included data from 5000 Saudi from general population during period from October 2012 to December 2013. Participants were selected from 30/105 PHCs by simple random method. A team of professionals and volunteers assisted in collection of data from 30 PHCs in Hail Region, KSA, during a comprehensive survey for CKD. Participants were recruited to the local PHC in each area before one week of the campaign.

Before CKD screening campaign, the professionals were given instructions by the chief of the team in order to standardize data collection and procedures. Data were collected by the doctors of the team utilizing a standard questionnaire, which included demographic information, previously diagnosed diseases (hypertension, kidney and cardiovascular diseases, diabetes and others) and familial history of hypertension, diabetes, kidney, kidney stones, urinary tract infection, cardiovascular diseases, analgesic abuse and herbal use.

After, the questionnaire, each participant underwent a physical examination with the measurement of height and weight for counting the body mass index (BMI).

Blood and urine specimens' were collected from each respondent. The results of diagnostic tests performed at that time (urine dipstick, capillary blood glucose) as well as blood pressure levels were also registered in this form.

Whether urinary abnormalities were detected or risk factors for CKD were identified, people with such conditions were referred to PHC.

A dipstick test (ChoiceLine 10; Roche Diagnostics Ltd, UK) was performed to check the presence of albumin and erythrocytes/haemoglobin in the urine samples. This procedure was performed immediately after the urine sample was brought by each participant. Dipstick was read manually by a group of professionals trained for this purpose, and final result of each reagent strip was confirmed by two of them, as they worked in pairs. They followed a standardized procedure, according to the instructions provided by the manufacturer, including the use of a stopwatch with countdown timer. In addition, traces of proteinuria were not considered as an abnormal result for this study purpose, and a supervisor was available whenever there was any doubt. In fact, proteinuria and haematuria were defined by a reading of 1+ or more of protein or blood on dipstick.

GFR was calculated using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) creatinine equation [7]. CKD was indicated based on the presence of protein urea and level of GFR. All individuals with a glomerular filtration rate (GFR) <60 mL/min/1.73 m^2, were regarded as having KCD. CKD stages were categorized according to the following:

Stage I: Kidney with normal GFR (90 ml/min/1.73m^2or above).
Stage II: Kidney with mild decrease in GFR (60 to 89 ml/min/1.73m^2).
Stage III: Kidney with moderate decrease in GFR (30 to 59 ml/min/1.73m^2).
Stage IV: Kidney with severe reduction in GFR (15 to 29 ml/min/1.73m^2).
Stage V: Kidney failure (GFR less than 15 ml/min/1.73m^2).

Ethical consent: The protocol of the project was approved by Research Committee, College of Medicine, and University of Hail. Each participant was informed before the interview about the purpose of the survey, and informed consent was obtained from each subject.

3. Results

This study estimated the overall prevalence of stages of chronic kidney disease in Hail Region, KSA, through a comprehensive epidemiologic survey. The age range for the study population was from 15 to 101 years with a mean age of 43 years. Male female ration was 1.03: 1.0. The GFR estimation was available for 2,946 individuals, among whom, 278/2946 (9.4%) were found with impaired kidney function). Of the 278 persons with CKD, 11/2946(0.4%), 16/2946(0.5%), 229/2946(7.8%) and 22/2946 (0.6%) were estimated for GFR rates of stage V, Stage IV, stage III and stage IV, respectively, as indicated in fig.1.

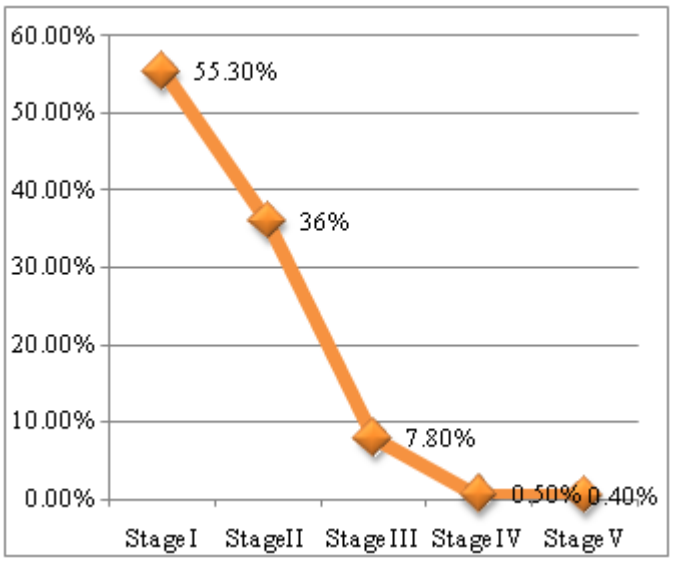

Figure 1: Distribution of general population different stages of Kidney functions

In regard to gender and CKD, the ratio of male female was 1.0: 1.15. Of the 119 men, 9/119 (7.6%), 11/119(9.2%) and 99/119(83.2%) were identified with stage V, stage IV and stage III, respectively, since, for female 2/137 (1.5%), 5/137(3.5%) and 130/137(95%) were identified with stage V, stage IV and stage III, respectively, as indicated in Fig.2. The risk for severe stages of CKD is more among males than females and this was found to be statistically significant (P > 0.0001).

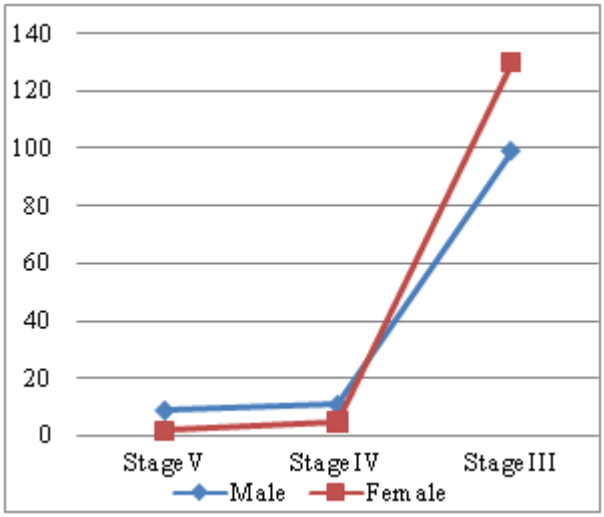

Figure 2: Description of CKD stage with gender

Table 1: Distribution of GFR levels by age

Age	>+90	60-89	30-59	15-29	<15	Total
<25 years	547	94	8	0	2	651
26-40	532	246	20	3	4	805
41-55	353	322	54	3	2	734
56-70	171	303	90	7	1	572
71+	27	95	57	3	2	184
Total	1630	1060	229	16	11	2946

Table 1 summarizes the distribution of age by levels GFR. The levels of GFR decrease with the increase of age and this

was found to be statistically significant (P < 0.001), as indicated in Fig 3.

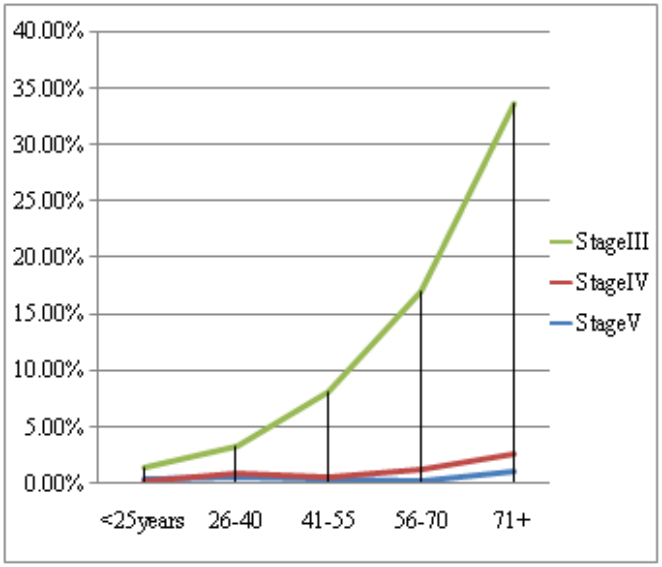

Figure 3: Description of the study population by age and levels of GFR

4. Discussion

This study shows that CKD prevalence and/or renal function impairment in the general Saudi population is considerably high, since there is close homology within Saudi population in different regions. One of the first steps to improve CKD management is knowledge about CKD prevalence. To the best of our knowledge this is the first study that screened a large section of population, which was preceded by fruitful pilot study [9,10]. Consequently, there is a lack of data about the prevalence of CKD and its risk factors in the general population of the kingdom of Saudi Arabia. Of the few studies in this context; there was pilot study conducted in Riyadh comprised 491 (49.9% were males) adults Saudi nationals. The over-all prevalence of CKD was 5.7% and 5.3% using the MDRD-3 and CKD-EPI glomerular filtration equations, respectively [11].

There has been a marked rise in the prevalence and incidence of end stage chronic kidney disease (CKD) in Saudi Arabia over the last 3 decades. This rise exceeds those reported from many countries. The enormous and rapid changes in lifestyle, high population growth, and fast increase in life expectancy, and massive urbanization that has occurred over the last 3 decades combined to make the current CKD status different to what it was. The two major factors that influence the CKD status are the very high rate of diabetic nephropathy and shift in age demographics [12].

Hail is a province of Saudi Arabia, located in the north of the country. It has an area of 103,887 km² and a population of 527,033 (2004) census). Its capital is Ha'il. The prevalence of different stages of CKD is high in Hail, which is relatively similar to those of the western countries with high prevalence of CKD. In a Swiss cross-sectional study, About 10% of the patients had a substantially reduced eGFR of <60 ml/min/1.73 m^2[13]. The prevalence of CKD in the United States adult population was 11% (19.2 million). By stage, an estimated 5.9 million individuals (3.3%) had stage 1 (persistent albuminuria with a normal GFR), 5.3 million (3.0%) had stage 2 (persistent albuminuria with a GFR of 60 to 89 mL/min/1.73 m^2), 7.6 million (4.3%) had stage 3 (GFR, 30 to 59 mL/min/1.73 m^2), 400,000 individuals (0.2%) had stage 4 (GFR, 15 to 29 mL/min/1.73 m^2), and 300,000 individuals (0.2%) had stage 5, or kidney failure [14]. These similarities in prevalence of CKD between Saudi population and Western population are attributed to acute adoption of Western style. The Western-style diet is characterized by its highly processed and refined foods and high contents of sugars, salt, and fat and protein from red meat. It has been recognized as the major contributor to metabolic disturbances and the development of obesity-related diseases including type 2 diabetes, hypertension, and cardiovascular disease. Also, the Western-style diet has been associated with an increased incidence of chronic kidney disease (CKD). A combination of dietary factors contributes to the impairment of renal vascularization, steatosis and inflammation, hypertension, and impaired renal hormonal regulation [15].

In the current study the risk for severe stages of CKD is more among males than females and this was found to be statistically significant (P > 0.0001). Similar findings were previously reported, female gender was associated with slower decline in GFR and better patient and renal survival. [16,17]. The incidence of end-stage renal disease is especially high in men, and some studies indicated that smoking is a risk factor for men only[18]. Nevertheless, Obesity, smoking, and physical inactivity were associated significantly with CKD. Men were not more susceptible to these risk factors than women.

In the present study age was found to be a risk factor in the development of CKD. Chronic kidney disease (CKD) is common among the elderly {19}. However, little is known about how the clinical implications of CKD vary with age. In a study explored the effect of ageing on renal function with general population without vascular disease or diabetes, the median for plasma cystatin C was 0.93 mg/l (60-69 years old), 1.04 (70-79 years old) and 1.24 (80+ years old). The difference in mg/l between the 5th and 95th percentile was 0.46, 0.62 and 0.90 for these age groups. Male sex increased the age effect on plasma cystatin C levels with 0.004 mg/l/year (P = 0.03), adjusted for vascular risk factors. 54.7% (CKD-EPI creatinine) to 73.9% (CKD-EPI cystatin C) of the 80+ had an eGFR < 60 ml/min/1.73 m2 [20].

However, this study has some limitations, of which is the cross-sectional setting and the fact that most of the respondents were older age and those with diabetes and hypertension. Moreover, the estimation of GFR was based on creatinine only, which is not enough as a marker for renal function in older people.

5. Future Scope

The prevalence of CKD is high in all stages. What's interesting is that this is a first prevalence from a considerable survey from KSA. Nevertheless, the prevalence of end-stage renal disease is going up very significantly in

Saudi, as well as, some risk factors for CKD, such as hypertension and diabetes, as reported by several studies. What does that mean? It may mean that many factors are required to be assessed in these patients. Therefore, it may be much more complicated than what is indicated in this study. This means that the future scope and focus should be on various factors that have possible link with overall management of CKD, including; prevention, early identification criteria, treatment, follow up and assessment of risk factors, such as hypertension, diabetes and others.

In conclusion; A comprehensive strategies to address the burden of kidney disease in Hail Region are urgently needed. The most efficient way to reduce the burden of CKD is to prevent and treat its risk factors. Screening individuals at high risk for CKD including those with a history of diabetes mellitus, hypertension, cardiovascular disease; as well as older people may prevent or delay kidney failure. Therapeutic treatments can slow progression of kidney disease as well as manage its complications. Screening projects are urgently needed in other part of KSA to evaluate the prevalence of CKD.

6. Acknowledgement

Authors would like to express their special appreciation and thanks to his Excellency Prof. (Dr.) Nasir Alrasheed for funding this project. Authors appreciate the assistant from Medical college's staff and Medical students (University of Hail), Health Authority in Hail, the Saudi community leaders and participants.

7. Funding

This work was supported by grants from His Excellency Prof. Dr. Nasser Elrasheed Chair for Renal Diseases Research.

References

[1] Eknoyan G, Lameire N, Barsoum R, Eckardt KU, Levin A, et al. The burden of kidney disease: improving global outcomes. Kidney international 2004;66: 1310–1314.
[2] Astor BC, et al.: Association of kidney functions with anemia: the Third National Health and Nutrition Examination Survey (1988–1994). Arch Intern Med 2002, 162(12):1401.
[3] Pitts TO, Piraino BH, Mitro R, Chen TAIC, Segre GV, Greenberg A, et al.: Hyperparathyroidism and 1, 25-dihydroxyvitamin D deficiency in mild, moderate, and severe renal failure. J Clin Endocrinol Metab 1988, 67(5):876.
[4] Gemma M Browne, Joseph A Eustace, Anthony P Fitzgerald, Jennifer E Lutomski and Ivan J Perry. Prevalence of diminished kidney function in a representative sample of middle and older age adults in the Irish population. BMC Nephrology 2012, 13:144.
[5] Ting SM, Nair H, Ching I, Taheri S, Dasgupta I. Overweight, obesity and chronic kidney disease. Nephron2009; 112: c121–127; discussion c127.
[6] Stevens LA, Viswanathan G, Weiner DE. Chronic kidney disease and end-stage renal disease in the elderly population: current prevalence, future projections, and clinical significance. Advances in chronic kidney disease 2010; 17(4): 293–301.
[7] Levey AS, et al. A new equation to estimate glomerular filtration rate. Ann Intern Med. 2009;150(9):604–12.
[8] Shoham DA, Vupputuri S, Kaufman JS, Kshirsaqar AV, Diez Roux AV, Coresh J: Kidney disease and the cumulative burden of life course socioeconomic conditions: The Atherosclerosis Risk in Communities (ARIC) Study. Soc Sci Med 2008, 67(8):1311-1320
[9] Ibrahim Abdelmajeed GINAWI, Hussain Gadelkarim Gadelkarim AHMED, Ibraheem M. ASHANKYTY, Tahani ALTAMIMI, Mohamed ALMOGBEL, Abdelkareem ALSUEDAA, Daad AKBAR, Fatma ALBELADI, Ahmed ALRASHDAN, S. D. JASTANIAH, Awdah M. AL-HAZIMI1. A survey for potential risk factors for susceptibility to Chronic Kidney Disease in Hail Region, KSA. Management in Health, Vol 17, No 2 (2013).
[10] Ibrahim Abdelmajeed Ginawi, Abulbaset alAsbali, Hussain Gadelkarim Ahmed, Tahani Altamimi, Awdah M. Al-hazimi. Population Screening for CKD and its associated risk factors: a survey in Hail Region, KSA. J of public health and epidemiology 2013;5(7):285-290.
[11] Alsuwaida AO, Farag YM, Al Sayyari AA, Mousa D, Alhejaili F, Al-Harbi A, et al. Epidemiology of chronic kidney disease in the Kingdom of Saudi Arabia (SEEK-Saudi investigators) - a pilot study. Saudi J Kidney Dis Transpl. 2010 Nov;21(6):1066-72.
[12] Al-Sayyari AA, Shaheen FA. End stage chronic kidney disease in Saudi Arabia. A rapidly changing scene. Saudi Med J. 2011 Apr;32(4):339-46.
[13] Tomonaga Y, Risch L, Szucs TD, Ambuehl PM. The prevalence of chronic kidney disease in a primary care setting: a Swiss cross-sectional study. PLoS One 2013 Jul 3;8(7):e67848.
[14] Josef Coresh, Brad C. Astor, Tom Greene, Garabed Eknoyan, Andrew S. Levey. Prevalence of chronic kidney disease and decreased kidney function in the adult US population: Third national health and nutrition examination survey. American Journal of Kidney Diseases 2003;41(1):1-12.
[15] Odermatt A. The Western-style diet: a major risk factor for impaired kidney function and chronic kidney disease. Am J Physiol Renal Physiol. 2011 Nov;301(5):F919-31.
[16] Eriksen B O and Ingebretsen O C. The progression of chronic kidney disease: A 10-year population-based study of the effects of gender and age. Kidney International 2006; 69, 375–382.
[17] Fussner LA, Charlton MR, Heimbach JK, Fan C, Dierkhising R, Coss E, Watt KD. The impact of gender and NASH on chronic kidney disease before and after liver transplantation. Liver Int. 2013 Nov 5. doi: 10.1111/liv.12381. [Epub ahead of print].
[18] Stein Hallan, Renée de Mutsert, Sven Carlsen, Friedo W. Dekker, Knut Aasarød, Jostein Holmen. Obesity, Smoking, and Physical Inactivity as Risk Factors for CKD: Are Men More Vulnerable?. American Journal of Kidney Diseases 2006; 47(3): 396–405.

[19] Davison R, Sheerin NS. Prognosis and management of chronic kidney disease (CKD) at the end of life. Postgrad Med J. 2013 Dec 6. doi: 10.1136/postgradmedj-2013-132195. [Epub ahead of print]
[20] Werner KB, Elmståhl S, Christensson A, Pihlsgård M. Male sex and vascular risk factors affect cystatin C-derived renal function in older people without diabetes or overt vascular disease. Age Ageing. 2013 Dec 8. [Epub ahead of print]

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