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Diabetes Risk Factors for Chronic Kidney Patients

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Abstract

Diabetes Mellitus (DM), Chronic Kidney Disease (CKD), and Coronary Heart Disease (CHD) are in practice a complex medical status which are closely associated and generally coexist. This article focuses the diabetes risk factors of the CKD patients, and examines the association between DM, CKD and CHD, based on the data set in Apollo Hospitals, Managiri, Tamil nadu, India. The risk factors of DM, and its association with CKD and CHD are discussed for the awareness of the healthy individuals, diabetes, kidney, cardiac patients, and medical practitioners.

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Diabetes Risk Factors for CKD Patients

The disease DM is considered a world-wide epidemic and major chronic health problem. DM is a chronic progressive disease, and is a well recognized risk factor for CHD & CKD[1,2]. In recent years, the prevalence of diabetes, has significantly increased over the world, and this has in turn impacted on the incidence of associated of many complications, including heart failure. It is well known that the DM is one of the main risk factors for developing many diseases to human being. Diabetes is recognized as a silent disease, and in 70% of patients with type 2 diabetes, cardiovascular problem and coronary disease are the main cause of death[3-7]. The relationship between DM and CHD is well described in[1]. The risk factors for Type 2 diabetes is also described in[2]. In 1995, the estimated prevalence of DM in adults, over the whole world was 4%. It was predicted to increase to 5.4% by 2025, which amount to about 300 million adults. Many statistical analyses of randomized studies have located that a significant number HF patients suffer from diabetes[8].

We seek answers to the following questions: What are the causal factors of DM of CKD patients? Is there any association between DM, CHD & CKD? What are the effects of the risk factors on DM? These answers are examined based on the data set of 25 factors/ variables on 150 non-missing subjects. This data has been collected under the supervision of Dr. P. Soundarapandian, in Apollo Hospitals, Managiri, Madurai, Tamilnadu, India, and created by L. Jerlin Rubini, Alagappa University (E:-mail: jel.jerlin@gmail.com). The variables/ factors of this study are 1. Age (years) (coded as AGE), 2. Blood pressure (mmHg) (coded as BP), 3. Specific gravity (nominal) (coded as SG), 4. Albumin (nominal) (coded as AL), 5. Sugar (nominal) (coded as SU), 6. Red Blood Cells (nominal) (abnormal = 1, normal = 2) (coded as RBC), 7. Pus Cell (nominal) (abnormal = 1, normal = 2) (coded as PC), 8. Pus Cell clumps (nominal) (not present = 1, present = 2) (coded as PCC), 9. Bacteria (nominal) (not present = 1, present = 2) (coded as BA), 10. Blood Glucose Random (numerical) (mgs/dl) (coded as BGR), 11. Blood Urea (numerical) (mgs/dl) (coded as BU), 12. Serum Creatinine (numerical) (mgs/dl) (coded as SC), 13. Sodium (numerical) (mEq/L) (coded as SOD), 14. Potassium (numerical) (mEq/L) (coded as POT), 15. Hemoglobin (numerical) (gms) (coded as HEMO), 16. Packed Cell Volume (numerical) (coded as PCV), 17. White Blood Cell Count (numerical) (cells/cumm) (coded as WBCC), 18. Red Blood Cell Count (numerical) (millions/cmm) (coded as RBCC), 19. Hypertension (nominal) (no = 1, yes = 2) (coded as HTN), 20. Diabetes Mellitus (nominal) (no = 1, yes = 2) (coded

as DM), 21. Coronary Artery Disease (nominal) (no = 1, yes = 2) (coded as CAD), 22. Appetite (nominal) (good = 1, poor = 2) (coded as APPET), 23. Pedal Edema (nominal) (no=1, yes = 2) (coded as PED), 24. Anemia (nominal) (no = 1, yes = 2) (coded as ANE), 25. Class (nominal) (ckd = 1, notckd = 2) (coded as CLASS). This data set has been analyzed by both the joint Log-normal & Gamma models[9]. It is observed that the Log-normal fit gives better results. There is only one marker of DM is BGR. So, the results of Log-normal fit of blood glucose random (BGR) are shortly presented. The risk factors of the BGR are as follows.

The blood glucose random (BGR) has been modeled based on the remaining other variables/ factors by joint Log-normal models. The results of the analysis are as follows. The mean BGR is separately negatively associated with SU ($P < 0.001$), RBC ($P < 0.001$), BA ($P < 0.001$), PCV ($P < 0.001$), WBCC ($P < 0.001$), RBCC ($P < 0.001$), APPET ($P < 0.001$), ANE ($P < 0.001$). In the data set, SU values are nominal (0,1,2,3,4,5). The mean BGR is negatively associated with the nominal values of SU, indicating that the BGR is high at lower nominal value of SU. As RBC is negatively associated with the BGR, so BGR is high of the kidney patients with abnormal RBC. Indicating that the chronic kidney patients with diabetes may have abnormal RBC. BA is negatively associated with the BGR. It implies that the kidney patients with no BA have high BGR. As PCV is negatively associated with the BGR, so, BGR is high at lower values of PCV. It indicates that the kidney patients with diabetes have lower value of PCV. Again, WBCC and RBCC are negatively associated with the BGR, indicating that the kidney patients with diabetes have lower count of WBCC or RBCC. APPET is negatively associated with the mean BGR, indicating that the kidney patients with high BGR have good APPET. Also, ANE is negatively associated with the mean BGR, indicating that the kidney patients with high BGR have no ANE.

The mean BGR is separately positively associated with AGE ($P < 0.001$), AL ($P < 0.001$), PC ($P < 0.001$), PCC ($P < 0.001$), SC ($P < 0.001$), CAD ($P < 0.001$), PED ($P < 0.001$). The mean BGR of the kidney patients will be high at older age, as BGR is directly associated with the AGE. AL values are nominal (0,1,2,3,4,5). The BGR of the kidney patients will be higher at higher nominal values of AL. The kidney patients with normal PC have higher BGR. Also, the kidney patients with PCC have higher BGR. SC is directly associated with the mean BGR. So, the BGR will be high, if the patient SC is high. The kidney patients with higher BGR have CAD or PED, as CAD or PED is directly associated with the mean BGR. Therefore, the diabetic (higher BGR) kidney patients may have coronary artery disease and also pedal edema.

The variance of BGR is separately negatively associated AL ($P < 0.001$) and RBC ($P < 0.001$). AL values are nominal. If the nominal values of AL are decreasing, the BGR variance is increasing. The BGR variance is higher for the patients with abnormal RBC. Again, the BGR variance is separately positively associated BP ($P = 0.030$), PC ($P < 0.001$), BA ($P < 0.001$), PCV ($P = 0.079$), CAD ($P < 0.001$), PED ($P < 0.001$). Therefore, the kidney patients with high BP or normal PC or with BA have higher BGR variance. The BGR variance is high for the kidney patients who have high PCV or CAD or PED.

All the above results are summarized in Table 1. The above results are derived based on the joint Log-normal models[9]. Here the mean and variance parameters of the response BGR are very shortly discussed. All the derivations along with other models will be discussed in the full research paper. The complete research paper will be submitted very soon. This data set contains nominal values for many continuous variables. For example, specific gravity, albumin and sugar have only some nominal values. Original numerical values give better results. This data set does not contain the values of HbA1c, height, weight, body mass index, blood cholesterol, HDL, LDL, systolic BP, diastolic BP, heart rate, peak heart rate, history of diabetes and CHD, etc. Future researchers are requested to consider these additional variables/ factors for better study. This data set contains many missing values. There are 400 subjects (with missing and non-missing) in this study. Only 150 non-missing subjects are considered in the present study. The above derived results are based on these 150 non-missing subjects.

Table 1: Determinants of Blood Glucose Random (BGR).

Response	Associated with	Association type	P-value
Mean of Blood Glucose Random (BGR)	Sugar (SU)	Negative	$P < 0.001$
	Red Blood Cells (RBC)	Negative	$P < 0.001$
	Bacteria (BA)	Negative	$P < 0.001$
	Packed Cell Volume (PCV)	Negative	$P < 0.001$
	White Blood Cell Count (WBCC)	Negative	$P < 0.001$
	Red Blood Cell Count (RBCC)	Negative	$P < 0.001$
	Appetite (APPET)	Negative	$P < 0.001$
	Anemia (ANE)	Negative	$P < 0.001$
	Age (AGE)	Positive	$P < 0.001$
	Albumin (AL)	Positive	$P < 0.001$
	Pus Cell (PC)	Positive	$P < 0.001$
	Pus Cell clumps (PCC)	Positive	$P < 0.001$
	Serum Creatinine (SC)	Positive	$P < 0.001$
	Coronary Artery Disease (CAD)	Positive	$P < 0.001$
	Pedal Edema (PED)	Positive	$P < 0.001$
Variance of Blood Glucose Random (BGR)	Albumin (AL)	Negative	$P < 0.001$
	Red Blood Cells (RBC)	Negative	$P < 0.001$
	Blood pressure (BP)	Positive	$P = 0.030$
	Pus Cell (PC)	Positive	$P < 0.001$
	Bacteria (BA)	Positive	$P < 0.001$
	Packed Cell Volume (PCV)	Positive	$P = 0.079$
	Coronary Artery Disease (CAD)	Positive	$P < 0.001$
	Pedal Edema (PED)	Positive	$P < 0.001$

The above mentioned diabetes risk factors are associated with kidney patients. This report recommends the following for all individuals. The kidney patients or healthy persons with older age may have the chance of diabetes. The kidney patients and their medical practitioners should care on coronary artery

disease of the patients. Medical practitioners should care on the patients BP, PCV, WBCC, RBCC, and PED. The kidney patients with high BGR may be attacked with other many diseases, as the WBCC decreases. It is identified here that the kidney patients with high BGR are highly associated with coronary artery disease and BP. For better medical treatment, the above results should be considered by the medical practitioners.

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