An Observational Case Control Study on Dietary Intake Pattern and its Relationship with Serum Creatinine for the Risk of Cardiovascular Diseases

Arpita Patra
Department of Dietetics & Nutrition
NSHM Knowledge Campus, Durgapur under MAKAUT University, S-186, Bidhannagar Housing Colony, Durgapur-713206, West Bengal, India

Dr. Anuradha Mukherjee
Department of Dietetics & Nutrition
NSHM Knowledge Campus, Durgapur under MAKAUT University, Natural heights block 2 flat no 2 b, padmapukur, Durgapur 713213, West Bengal, India

Dr. Soumit Roy
Department of Community Medicine
IQ City Medical College & Hospital, Flat GA JD2 Block IQCITY Durgapur PIN 713206, West Bengal, India

Abstract - Introduction: Elevated serum creatinine level was considered to be a marker for increased risk of cardiovascular disease. This study has been done to compare any association between serum creatinine with dietary intake pattern among patients of cardiovascular disease and other patients (without cardiovascular disease).

Method: Serum creatinine concentration was measured in patients with cardiovascular disease (case) and patients without cardiovascular disease (control) from IQ City Medical College & Hospital and collected data with the help of predesigned pretested questionnaire containing sociodemographic, clinical parameters and food frequency questionnaire.

Result: There was a significant difference of seram creatinine level and eGFR level between cases and control but there was no statistically significant difference of creatininogenic food intake between these two groups and there was no significant difference of correlation between these food intake and serum creatinine.

Conclusion: There was a significant difference in creatinine level and eGFR level between those with cardiovascular disease and those without cardiovascular disease and no such difference was found for dietary intake pattern.

Keywords: Serum creatinine, Cardiovascular disease, dietary intake pattern, eGFR

I. INTRODUCTION

A great number of studies shown that increased serum creatinine may be an predictor for cardiovascular disease **(S. Goya et al., 1997)**. These cardiovascular disease included, ischemic heart disease, myocardial infraction, atherosclerosis, hypertension etc **(Mehmet Akif Cakar et al., 2012; Kirstine L. et al.,2014; Rekhyiashvili A. et al., 2015)**. Previous studies showed that patients with the coronary artery disease had increased levels of serum creatinine and also it had showed a positive relationship between hypertension and elevated serum creatinine level **(Babak Bagheri et al., 2019)**. A study investigated the relationship between dietary protein intake and the changes in creatinine clearance and multiple regression analysis establish that dietary protein intake was independently corelated with creatinine clearance **(Toshikazu Wada et al., 2015)**.

Creatinine: Creatinine is the breakdown product of creatine, filtered through glomeruli and concentrated in tubules and it is neither reabsorbed nor metabolized by kidney **(Joris R. et al., 2011, Chatterjee CC, 2018)**.

II. PROPOSED ALGORITHM

In brief, we made a project proposal and consent letter in English, Bengali, Hindi and then after it was approved by Institutional Ethics Committee from IQ City Medical College & Hospital and then we start the data collection procedure. The study design is observational case control study and the study population is consisted of 40 subjects (case group: Admitted patient in IQ City Medical College & Hospital with cardiovascular disease, control group: Admitted patient in IQ City Medical College & Hospital with other diagnosis). The subjects were excluded from the study who were not willing to participate, who were seriously ill and unable to speak, who can not understand English, Bengali or Hindi. The sampling technique of this study is Non probability consecutive sampling. Independent variables are included age, gender, BMI, diagnosis, any known cardiovascular disease, and any type of comorbidity present or not, dietary intake pattern (frequency and amount of different creatininogenic food groups). Dependent variable is Serum creatinine level, eGFR using CKD-EPI Creatinine Equation.

Study tools which are used,

- A predesigned pretested questionnaire containing sociodemographic, clinical parameters and Food frequency questionnaire.
- Medical records.
- Weighing machine & Non-stretchable measuring tape.

III. EXPERIMENT AND RESULT

TABLE 1: Distribution of study participants according to age

Age (years)	**Case (n=20) Number (%)**	**Control (n=20) Number (%)**	**Total (n=40) Number (%)**	**P- value**
Young (≤ 40)	2 (10%)	6 (30%)	8 (20%)	0.105
Middle Age (41-60)	7 (35%)	9 (45%)	16 (40%)	
Elderly (>60)	11 (55%)	5 (25%)	16 (40%)	
Total	20 (100%)	20 (100%)	40 (100%)	

Chi Square Test

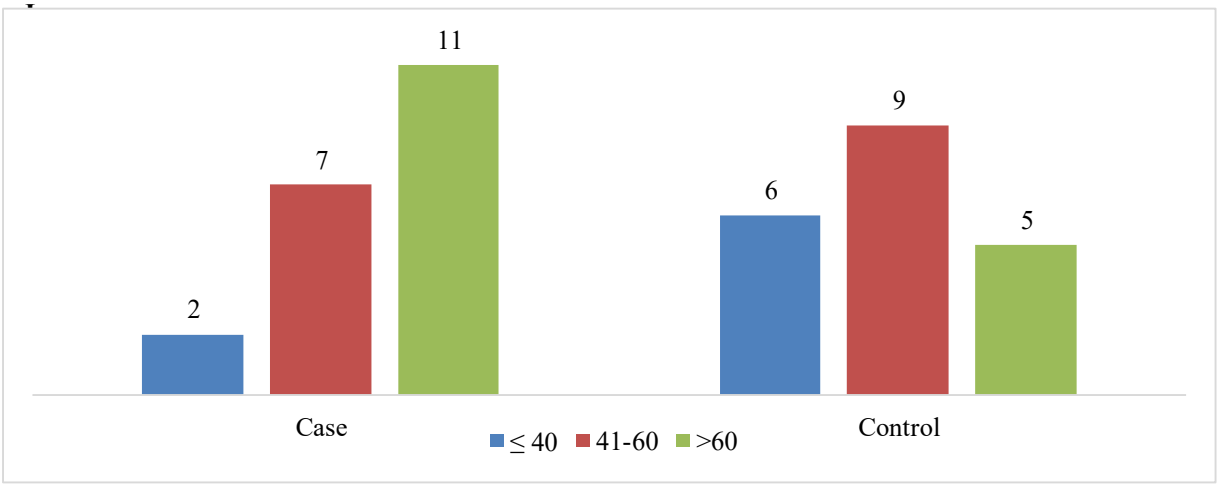


Figure 1: Distribution of study participants according to age

Interpretation: Nearly half (10, 50%) of the cases were elderly whereas nearly one fourth (5, 25%) of controls were elderly. Most (9, 45%) of the controls are aged 40 to 60 years. However, this differential pattern of age among cases and controls was not statistically significant.

TABLE 2: Distribution of study participants according to Gender

Gender	**Case (n=20) Number (%)**	**Control (n=20) Number (%)**	**Total (n=40) Number (%)**	**P- value**
Female	8 (40)	8 (40)	16 (40)	0.999
Male	12 (60)	12 (60)	24 (60)	
Total	20 (100%)	20 (100%)	40 (100%)	

Chi Square Test

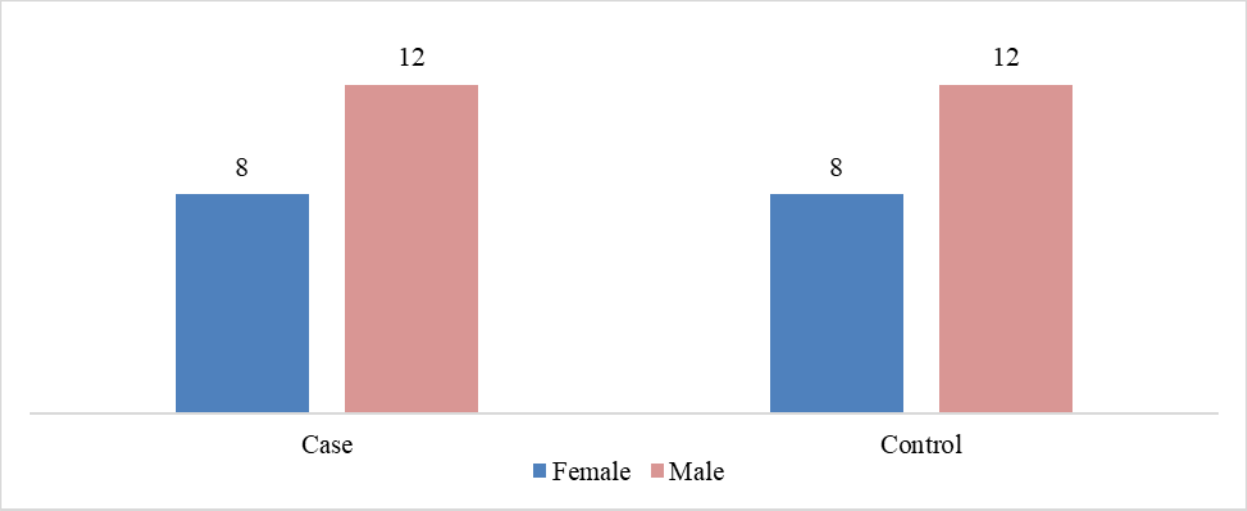


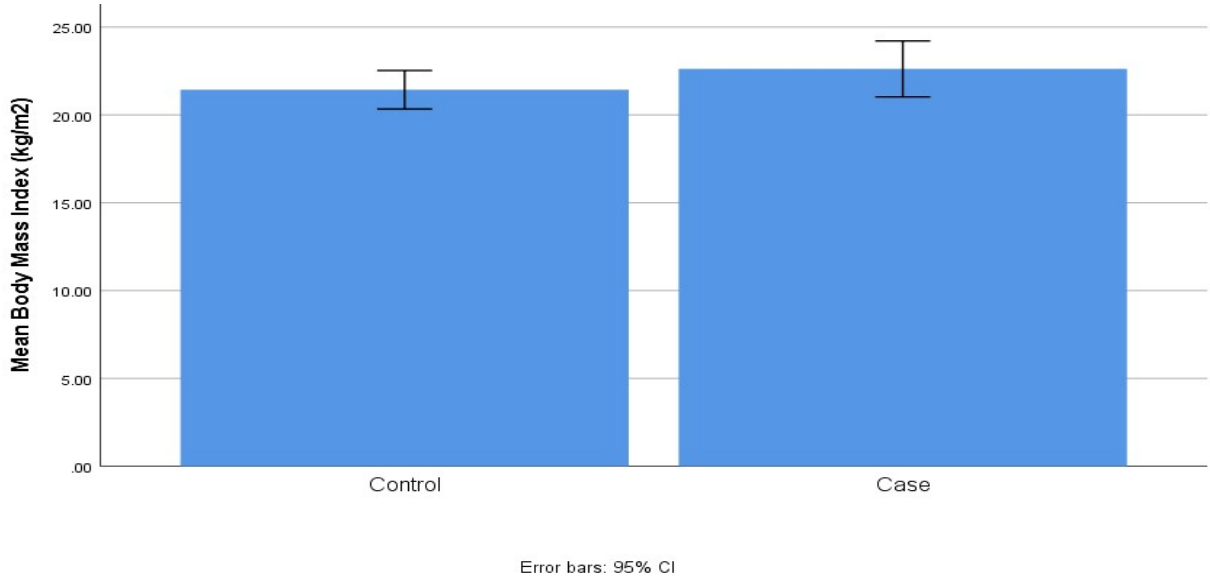
Figure 2: Distribution of study participants according to Gender

Interpretation: In both Case and Control group 60% patients are male rest are female. Thus no significant difference was noticed between them according to gender.

TABLE 3: Distribution of study participants according to Body Mass Index

BMI (kg/m^2)	**Case (n=20) Number (%)**	**Control (n=20) Number (%)**	**Total (n=40) Number (%)**	**P- value**
Underweight (<18.5)	2 (10)	2 (10)	4 (20)	–
Normal (18.5-24.9)	17 (85)	15 (75)	32 (80)	
Overweight (25.0-29.9)	1 (5)	2 (10)	3 (7.5)	
Obese (30)	0 (0)	1 (5)	1 (2.5)	
Total	20 (100%)	20 (100%)	40 (100%)	
Mean (SD) Median (IQR) Range	22.6 (3.4) 22.6 (21.3, 23.6) 16.7, 33.0	21.4 (2.3) 21.2 (20.5, 22.7) 17, 26.8	22.0 (2.9) 21.4 (21.0, 23.3) 16.7, 33.0	0. 114

Mann Whitney U Test



Mean (SD) BMI among controls were 21.4 (2.3) kg/m^2 ranged from 17.0 to 26.8 kg/m^2 with median of 21.4 kg/m^2. No statistically significant difference was noticed between these groups according to BMI.

TABLE 4a : Distribution of Cases according to Type of Cardiovascular Diseases (n=20)

Cardiovascular Disease *	**Number (%)**
Hypertension	17 (85)
Ischemic Heart Disease	4 (20)
Heart Failure	1 (5)
Stroke	3 (15)
Total	20 (100%)

* Multiple Response

TABLE 4b : Distribution of Cases according to Comorbidities (n=20)

Comorbidity *	**Number (%)**
Diabetes Mellitus	7 (35)
COPD	2 (10)
Fever	2 (10)
Foot Ulcer	2 (10)
Musculoskeletal Problems / Pain	2 (10)
Hypothyroidism	1 (5)
Hyperthyroidism	1 (5)
Fatty Liver	1 (5)
Total	20 (100%)

* Multiple Response

TABLE 4c : Distribution of Control according to Morbidity pattern (n=20)

Morbidity Pattern *	**Number (%)**
Diabetes Mellitus	3 (15)
Musculoskeletal Problems / Pain	4 (20)
Fever	8 (40)
Anaemia	4 (20)
Neck Swelling	2 (10)
Haemorrhoids	1 (5)
Asthma	1 (5)
Renal Stone	1 (5)
Total	20 (100%)

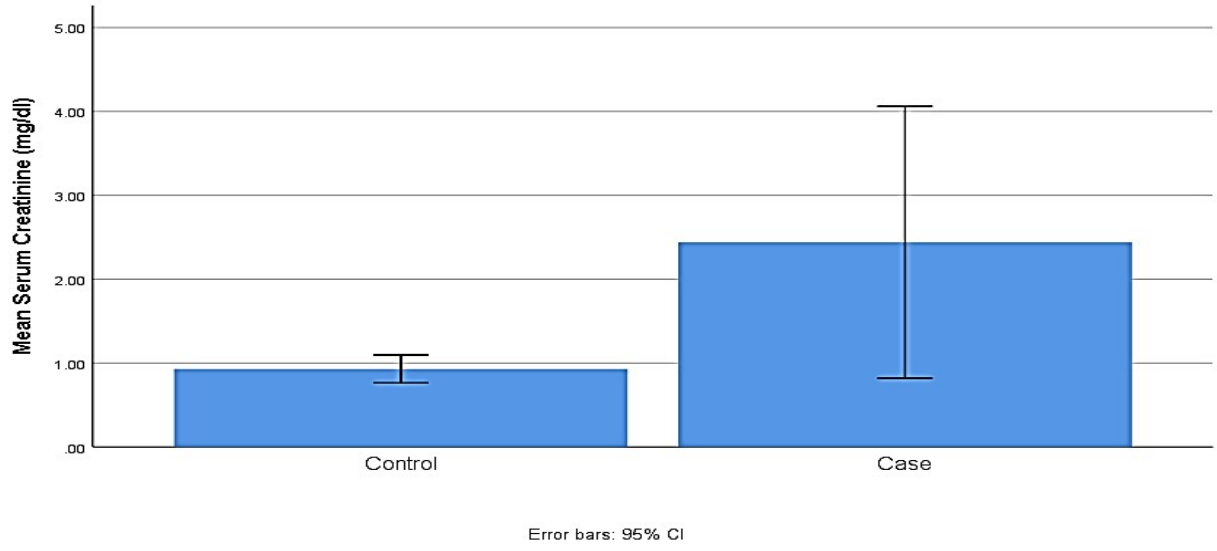
*** Multiple Response**

Interpretation: Commonest cardiovascular morbidity among cases was Hypertension (85%), followed by Ischemic Heart Disease (20%) and Stroke (15%). One case had heart failure. Commonest comorbidity among them was Diabetes Mellitus (35%). Among control commonest morbidity was fever (40%), followed by musculoskeletal problems (20%), anaemia (20%) and Diabetes Mellitus (15%).

TABLE 5: Distribution of study participants according to Serum Creatinine

Serum Creatinine mg/dl	**Case (n=20)**	**Control (n=20)**	**Total (n=40)**	**P- value**
Mean (SD)	2.44 (3.47)	0.93 (0.36)	1.68 (2.55)	
Median (IQR)	1.15 (0.95, 1.75)	0.85 (0.65, 1.10)	1.00 (0.8, 1.35)	**0.015***
Range	0.4 to 15.5	0.50 to 1.90	0.4 to 15.5	

Mann Whitney U Test *** Statistically Significant**



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controls were statistically significant.

TABLE 6: Distribution of study participants according to eGFR

eGFR (mL/min/1.73 m^2)	**Case (n=20) Number (%)**	**Control (n=20) Number (%)**	**Total (n=40) Number (%)**	**P- value**
G1 (≥90) Normal or high	3 (15)	10 (50)	13 (32.5)	–
G2 (60-89.9) Mild decreased	8 (40)	7 (35)	15 (37.5)	
G3a (45-59.9) Mild to moderate decreased	2 (10)	2 (10)	4 (10)	
G3b (30-44.9) Moderate to severe decreased	2 (10)	1 (5)	3 (7.5)	
G4 (15-29.9) Severe decreased	1 (5)	0 (0)	1 (2.5)	
G5 (<15) End stage renal disease	4 (20)	0 (0)	4 (10)	
Total	20 (100%)	20 (100%)	40 (100%)	
Mean (SD) Median (IQR) Range	55 (31) 63 (30, 81) 2, 96	89 (28) 90 (78, 103) 37, 154	72 (34) 78 (50, 94) 2, 154	**0.001***

Mann Whitney U Test *** Statistically Significant**

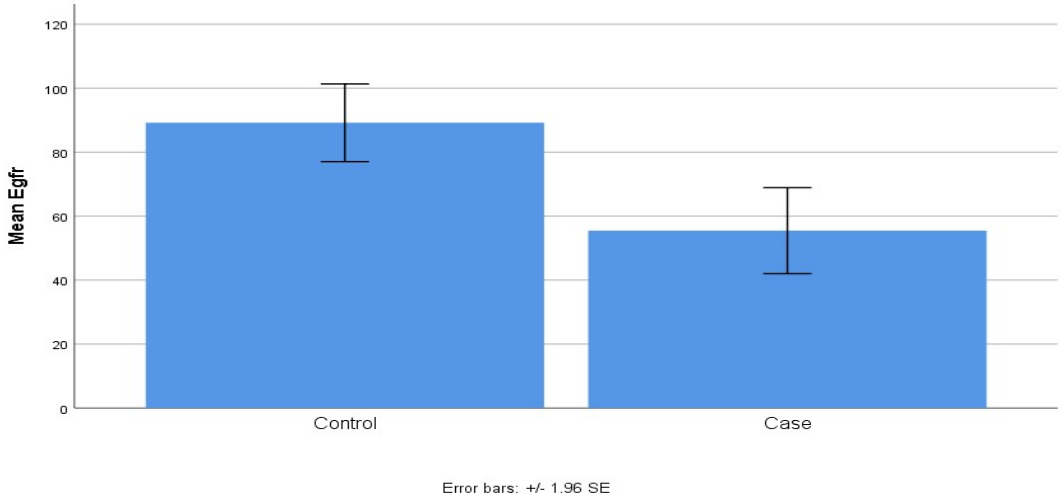


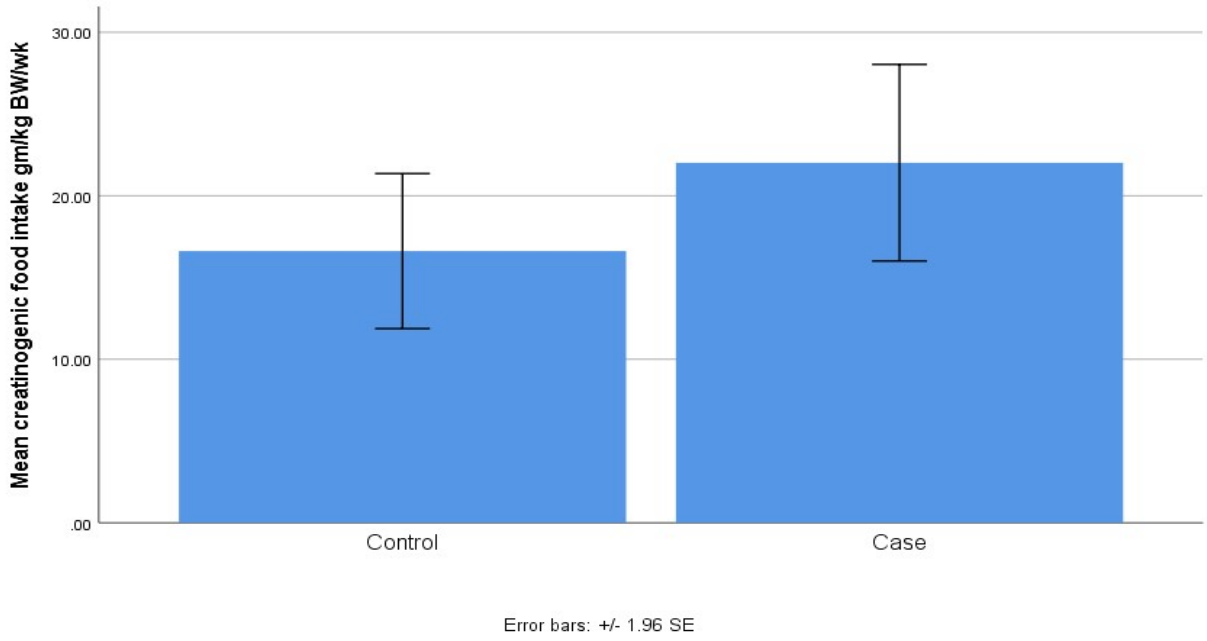
Figure 6: Distribution of study participants according to eGFR

Interpretation: Half (50%) of the controls had normal eGFR whereas only 15% cases had normal eGFR. Nearly one fourth cases had either severely reduced eGFR (5%) or end stage renal disease (5%). Mean (SD) eGFR among cases were 55 (31) mL/min/1.73 m2 ranged from 2 to 96 mL/min/1.73 m2 with median of 63 mL/min/1.73 m2. Mean (SD) eGFR among control were 89 (28) mL/min/1.73 m2 ranged from 37 to 154 mL/min/1.73 m2 with median of 90 mL/min/1.73 m2. This difference of eGFR among cases and controls were statistically significant.

TABLE 7: Distribution of study participants according to creatininogenic food intake

Creatininogenic food intake Gm/kg body wt./week	**Case (n=20)**	**Control (n=20)**	**Total (n=40)**	**P- value**
Mean (SD)	22.0 (13.7)	16.6 (10.8)	19.3 (12.5)	
Median (IQR)	18.9 (10.9, 29.8)	14.3 (9.5, 19.2)	16.6 (10.3, 26.4)	0.165
Range	6.9, 52.0	4.5, 52.6	4.5, 52.6	

Mann Whitney U Test



ranged from 6.9 to 52 gm/kg body wt/week with median of 18.9 gm/kg body wt/week. Mean (SD) creatininogenic food intake among controls were 16.6 (10.8) gm/kg body wt/week ranged from 4.2 to 52.6 gm/kg body wt/week with median of 14.3 gm/kg body wt/week. No statistically significant difference of creatininogenic food intake among cases and controls was noticed.

TABLE 8: Correlation of creatininogenic food intake with Serum Creatinine and eGFR

Variable		**Creatininogenic food intake**	
		Correlation Coefficient	**P Value**
Case (n=20)	**Serum Creatinine**	0.182	0.268
	eGFR	-0.196	0.229
Control (n=20)	**Serum Creatinine**	0.177	0.293
	eGFR	-0.223	0. 172
Total (n=40)	**Serum Creatinine**	0.103	0.361
	eGFR	-0.107	0.333

*** Kendall tau B Correlation Coefficient**

Interpretation: Positive but weak and statistically not significant correlation was noted between Serum creatinine and creatininogenic food intake in both case and control as well as combined groups. It means with

increase in creatininogenic food intake there was increase in serum creatinine level though this change was statistically insignificant. Negative but weak and statistically not significant correlation was noted between eGFR and creatininogenic food intake in both case and control as well as combined groups. It means with increase in creatininogenic food intake there was decrease in serum creatinine level though this change was statistically insignificant.

Discussion:

In this study this differential pattern of age among cases and controls was not statistically significant and according to gender and BMI there is no significant difference noticeable. But difference of serum creatinine level among cases and controls were statistically significant.

Half of the control group had normal eGFR whereas only 15% cases had normal eGFR. Nearly one fourth cases had either severely reduced eGFR or end stage renal disease.

With increase in creatininogenic food intake there was increase in serum creatinine level though this change was statistically insignificant and with increase in creatininogenic food intake there was decrease in serum creatinine level though this change was statistically insignificant.

Because we only collected data by questionnaire method and did not actually measure what they are eating and because of the small sample size and they may had some other disease while in the hospital so their diet may have been compromised. Although there is some relationship, it is not completely significant for all this reasons.

IV. CONCLUSION

There was a significant difference in creatinine level and eGFR level between those with cardiovascular disease and those without cardiovascular disease and no such difference was found for dietary pattern.

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