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Comparison of Plasma Zinc Level, Saliva Contents, and Taste Perception between Patients with and without Chronic Kidney Disease

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Dear Editor

Chronic kidney disease (CKD) is a global health issue that reduces lifespan by increasing the need for dialysis and the risk of cardiovascular events. The main clinical features of CKD are fluid imbalances, toxin accumulation, and metabolic disturbances. Food intake has a major effect on the development and course of CKD. Adequate taste perception is important, because it is correlated to appetite and supports an adequate nutrition intake. Good taste perception can prevent the consumption of unfavorable foods such as salty foods, substances with bitter taste that may be potentially toxic, etc. Impaired taste perception may be related to fluid imbalance, toxin accumulation, memory, and metabolic disorders, especially in the advanced stages (1, 2). Therefore, this study compared plasma zinc levels, saliva contents, and taste perception of subjects with and without CKD in Immanuel Hospital, Bandung, Indonesia.

Our findings showed that the majority age range for subjects was between 56 to 75 years (Table 1) because in aging, the amount of kidney tissue decreases and kidney function diminishes (3). Table 1 reveals that in CKD subjects, there were more males (57%) than females (43%) and gender difference was very important based on pathophysiology of the disease that was different among men and women. As complications of the disease was different, male or female patients needed various preventive and treatment measures (4). Other important variations in relation to gender were food intake, medication adherence, or treatment choice (5). The educational level of CKD subjects was lower than non-CKD subjects (Table 1) which shows the risk of low knowledge about health status. Majority of people with CKD did not work, so they were dependent on others for medical expenses.

Table 1: Comparison of profiles of CKD patients with Non-CKD ones.

Variable	CKD (%)	Non-CKD (%)
Patient's age (year)	56-75 (100)	56-75 (53.3)
Gender	Male (57)	Male (67)
Educational level	Elementary school (42.9)	High school (26.7)
	Middle school (21.1)	Middle school (25.3)
	High school (30.5)	High school (24.5)
	Academic level (4.5)	Academic level (23.5)
Profession	Not working (86)	Not working (46.7)
	Working (14)	Working (53.3)
Body Mass Index	3 Normal (42.9)	5 Normal (33.3)
	3 Obese 1 (42.9)	6 Overweight (40.0)
	1 Obese 2 (14.2)	4 Obese 1 (26.7)
Stage of CKD based on eGFR	3a (57.1)	1 (13%)
	4 (28.6)	2 (87%)
	5 (14.3)	

CKD: Chronic Kidney Disease, GFR: Estimated glomerular filtration rate.

Table 2: Comparison of plasma zinc level and salivary contents between CKD and Non-CKD patients.

Variable (Average)	CKD	Non-CKD
Plasma zinc level	Normal (100%)	Normal (86.7%)
Normal=(12-18 mcmol/L); Normal value: 60-130 µg/dL	Average: 73.71±3.41	Average: 74.13±5.39
Urea (mmol/L)	11.43±1.39	5.55±0.97
Potassium (mmol/L)	9.69±0.31	8.45±1.59
Natrium (mmol/L)	43.93±4.01	58.61±6.35

CKD: Chronic Kidney Disease.

The nutritional status of more than half of CKD sufferers was poor, while three people were categorized as grade 1 obesity and one person as grade 2 obesity (Table 1). So obesity could cause taste dysfunction and could affect excessive food intake (6). The zinc plasma level of both CKD and non-CKD subjects was normal. Zinc deficiency can cause arterial stiffness or loss of blood vessel flexibility, high blood pressure, and CKD, especially among hypertensive individuals (7). Elgenidy *et al.* stated that CKD and hemodialysis patients demonstrated lower zinc levels than normal subjects (8). Our study revealed no difference between CKD and non-CKD sufferers regarding zinc level that may be due to our small sample size. Also, the CKD patients did not show high stage, except stage 5 for 1 patient and no patient underwent hemodialysis (Table 2).

The average salivary urea level in CKD subjects was very high when compared to non-CKD ones. Salivary potassium level among CKD subjects was also higher than non-CKD individuals. The CKD patients' natrium (sodium) level was lower than those of non-CKD subjects. In the salivary analysis for urea and potassium level, there was a difference between CKD and non-CKD patients (Table 2). There was one subject of CKD stage 3a with an impaired perception of salty, sweet, and bitter tastes. There were one subject of CKD stage 3a and one CKD stage 4 with more severe bitter taste perception disorder, while both had a slight taste distortion. In non-CKD subjects, there was no impaired perception of salty, sweet, and bitter tastes, except one female subject who had a slight impaired taste perception of sweet taste who used to eat a lot of sweet foods (Table 3).

In three subjects with CKD, there was a slight decrease in taste perception at various concentrations that may be due to the subject's habit of too high or low sodium or salt intake in foods. Most people with CKD prepare their own food, in contrast to non-CKD subjects, while most of them are still working and buy food from restaurants; so foods purchased from outside can contain high sodium and sugar levels. It is not surprising that the salivary sodium of non-CKD subjects was higher than CKD ones (Table 2). In contrast to our research, Yusuf *et al.* showed the prevalence of taste dysfunction to be high in CKD patients and a significant relationship with CKD development; however, the stage of CKD was not associated with taste dysfunction (9). Several researchers reported reduced salt taste sensitivity in CKD sufferers, but with no differences in intensity or hedonic ratings (10). In our study, there was a relationship between saliva urea and potassium levels and presence of taste perception disorders. Noteworthy, sodium saliva profiles did not differ between CKD and non-CKD patients, but there was still a decrease in salt taste sensitivity among CKD

Table 3: Concentration drop test and saliva contents of 7 CKD patients.

Code	Stage CKD	Concentration 1	Concentration 2	Concentration 3	Concentration 4	Urea (mmol/L)	Potassium (mmol/L)	Na (mmol/L)
IK	3a	Sweet: ++++ Salty: ++ Bitter: +	Sweet: +++ Salty: +++ Bitter: -	Sweet: ++ Salty: + Bitter: -	Sweet: + Salty: ++ Bitter: -	2.64	3.79	35.44
II	3a	Sweet: ++++ Salty: ++++ Bitter: +++	Sweet: ++++ Salty: ++++ Bitter: +	Sweet: +++ Salty: +++ Bitter: ++	Sweet: ++ Salty: ++ Bitter: -	6.66	8.65	36.66
MS	4	Sweet: +++ Salty: +++ Bitter: ++++	Sweet: ++ Salty: ++ Bitter: +++	Sweet: + Salty: + Bitter: ++	Sweet: - Salty: - Bitter: -	22.3	14.9	61.57
AS	3a	Sweet: ++++ Salty: ++++ Bitter: ++++	Sweet: +++ Salty: ++++ Bitter: +++	Sweet: ++ Salty: +++ Bitter: -	Sweet: - Salty: ++ Bitter: -	28.45	16.29	44.92
ST	4	Sweet: ++++ Salty: ++++ Bitter: ++++	Sweet: +++ Salty: +++ Bitter: +++	Sweet: + Salty: ++ Bitter: ++	Sweet: - Salty: + Bitter: +	5.47	8.36	41.9
NL	4	Sweet: ++++ Salty: ++++ Bitter: ++++	Sweet: +++ Salty: +++ Bitter: +++	Sweet: ++ Salty: ++ Bitter: ++	Sweet: + Salty: + Bitter: +	3.05	6.26	43.9
CS	5	Sweet: ++++ Salty: ++++ Bitter: ++++	Sweet: +++ Salty: +++ Bitter: +++	Sweet: ++ Salty: ++ Bitter: ++	Sweet: + Salty: + Bitter: +	11.41	9.59	41.63
					Average	11.43	9.69	43.93

Sweet: Concentration of sucrose 0.05 g/mL (1); 0.005 g/mL (2); 0.0025 g/mL (3); 0.00125 g/mL (4). Salty: Concentration of salt 0.05 g/mL (1); 0.005 g/mL (2); 0.0025 g/mL (3); 0.00125 g/mL (4). Bitter: Concentration of quinine 0.01 g/mL (1); 0.004 g/mL (2); 0.002 g/mL (3); 0.001 g/mL (4). Range normal of urea saliva: 3-10 mmol/L. Range normal of potassium saliva: 2.6-18.3 mmol/L. Range normal of natrium saliva: 2-50 mmol/L. CKD: Chronic Kidney Disease.

subjects that may be due to sample size limitations or taste perception between salty, bitter, and sweet tastes, especially in elderly.

Due to sample size limitations in our study because of a pandemic situation, it was difficult to reach an accepted conclusion, but there are still several factors that can increase the knowledge about incidence of CKD and to find strategies to manage disease progression. There was no difference in the profile of zinc plasma level between CKD and non-CKD subjects, but there was a difference for salivary urea and potassium levels between CKD and non-CKD subjects, while the salivary urea and potassium levels among CKD subjects were higher. The salivary natrium (sodium) level was shown to be lower among CKD subjects compared to non-CKD ones, and it may due to the habits of CKD subjects who mostly prepared food by their cooking.

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Authors' Contribution

MH: Conceptualization, acquisition, interpretation of data, analysis, and writing. TLW: Acquisition, analysis, and writing. LKL: Interpretation of data, and writing. JL: Interpretation of data, and writing. SS: Conceptualization, interpretation of data, and writing. FS: Investigation, interpretation of data, and writing. KN: Investigation, interpretation of data, and writing. SC: Conceptualization, analysis, and writing.

Conflict of Interest

None declared.

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