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The characteristics of dietary intake according to chronic kidney disease stage in Korea: the Korean National Health and Nutritional Examination Survey

Seon Mi Kim[1], Min-ho Kim[2], Hyung Jung Oh[3], Dong-Ryeol Ryu[3]
[1]Department of Internal Medicine, Ewha Womans University Medical Center, Korea, Republic of
[2]Department of Ewha Institute of Convergence Medicine, Ewha Womans University Medical Center, Korea, Republic of
[3]Department of Internal Medicine-Nephrology, Ewha Womans University Medical Center, Korea, Republic of

Objectives: Although appropriate dietary adjustment in chronic kidney disease (CKD) patients is important, and the nutritional guideline recommends different dietary management according to CKD stage, there is no study, to our knowledge, for the characteristics of dietary intake according to CKD stage.

Methods: A cross sectional study was conducted to reveal the characteristics of dietary intake (intakes of energy, protein, and minerals) among the CKD patients using Korean national health and nutritional examination survey (KNHANES) between 2005 and 2017. According to estimated glomerular filtration rate (eGFR), we stratified these patients into three groups [CKD G3a; 45≤eGFR<60, CKD G3b; 30≤eGFR<45, and CKD G4-G5; eGFR<30mL/min/1.73m2], and investigated the amount of each nutritional intake.

Results: Of the total 3,423 CKD patients, 2,880 patients (84.14%) were diagnosed of CKD G3a, and 393 patients (11.48%) were in CKD G3b, only 150 patients (4.38%) were suffering from CKD G4 and G5. However, nutritional educations were performed in 173 patients in the CKD G3a (6.02%), 33 patients in the CKD G3b (8.42%), and 25 patients in the CKD G4-G5 (16.67%). When we investigated the characteristics of dietary intake according to CKD stage, we found that intakes of energy, protein, carbohydrates, calcium, phosphorus, sodium and potassium were decreased significantly in advanced CKD patients (G4-G5) compared with early CKD patients (G3a or b). However, the amount of energy intake was lower in all the CKD patients compared to the KDIGO guideline, while the amount of protein and sodium intakes was higher in all CKD patients compared with the guideline.

Conclusions: This analysis showed that nutritional education was conducted less than 20% CKD patients. Moreover, energy intake was lower, but protein and sodium intakes were higher than KDIGO guideline. In the future, the effect of the unbalanced nutritional support on the adverse clinical outcomes needs to be investigated.

Table 1. General characteristics of the study according to CKD classification in KNHANES between 2005-2017

Characteristics	Total	CKD classification according to eGFR , ml/min/1.73m² G3a eGFR 45-59	G3b eGFR 30-44	G4-G5 eGFR <30	P -value
Age	67.36±11.33 (N=3423)	66.82±11.34 (n=2880)	71.93±9.48 (n=393)	65.65±12.80 (n=150)	<0.001
Sex					0.001
male	38.56% (N=1320)	37.26% (n=1073)	44.53% (n=175)	48.00% (n=72)	
female	61.44% (N=2103)	62.47% (n=1807)	55.47% (n=218)	52.00% (n=78)	
Cr, ml/min/1.73m²	1.28±0.79 (N=3423)	1.13±0.16 (n=2880)	1.51±0.25 (n=393)	3.69±2.71 (n=150)	<0.001
Diagnosed CKD					<0.001
No	96.91% (N=3291)	99.02% (n=2830)	94.83% (n=367)	63.51% (n=94)	
Yes	3.01% (N=102)	0.98% (n=28)	5.17% (n=20)	36.49% (n=54)	
Income					0.086
Q1	25.38% (N=851)	24.73% (n=697)	28.57% (n=110)	29.53% (n=44)	
Q2	25.53% (N=856)	25.04% (n=706)	28.83% (n=111)	26.17% (n=39)	
Q3	22.99% (N=771)	23.52% (n=663)	18.96% (n=73)	23.49% (n=35)	
Q4	26.10% (N=875)	26.71% (n=753)	23.64% (n=91)	20.81% (n=31)	
Job					<0.001
No	66.27% (N=2226)	63.94% (n=1810)	80.47% (n=309)	74.31% (n=107)	
Yes	33.73% (N=1133)	36.06% (n=1021)	19.53% (n=75)	25.69% (n=37)	
Residential area					0.901
Rural	58.57% (N=2005)	58.72% (n=1691)	57.51% (n=226)	58.67% (n=88)	
Metropolitan	41.43% (N=1418)	41.28% (n=1189)	42.49% (n=167)	41.33% (n=62)	
Comorbid disease					
HTN					<0.001
Normal	17.76% (N=608)	18.85% (n=543)	12.21% (n=48)	11.34% (n=17)	
Pre-HTN	17.53% (N=600)	18.85% (n=543)	10.94% (n=43)	9.33% (n=14)	
HTN	64.71% (N=2215)	62.29% (n=1794)	76.84% (n=302)	79.33% (n=119)	
DM					<0.001
Normal	50.42% (N=1726)	52.60% (n=1515)	40.20% (n=158)	35.33% (n=53)	
IFG	21.27% (N=728)	22.26% (n=641)	16.28% (n=64)	15.33% (n=23)	
DM	28.31% (N=969)	25.14% (n=724)	43.51% (n=171)	49.33% (n=74)	
Nutrition Education					<0.001
No	93.24% (N=3186)	93.98% (n=2702)	91.58% (n=359)	83.33% (n=125)	
Yes	6.76% (N=231)	6.02% (n=173)	8.42% (n=33)	16.67% (n=25)	

Table 2. Characteristic of dietary intake according to CKD classification in KNHANES between 2005-2017

Dietary constituent	Total (N=3423)	CKD classification according to eGFR , ml/min/1.73m² G3a eGFR 45-59 (n=2880)	G3b eGFR 30-44 (n=393)	G4-G5 eGFR <30 (n=150)	P -value
Energy(kcal/kg)	26.77±11.22	27.04±11.41	25.26±9.62	25.60±11.10	0.004
Water(g)	723.81±482.08	732.00±488.28	676.09±422.88	691.49±501.89	0.043
Protein(g/kg)	0.92±0.71	0.94±0.75	0.85±0.46	0.84±0.45	0.010
Fat(g)	25.75±25.65	26.11±26.53	23.28±18.72	25.30±23.86	0.139
Carbohydrate(g)	283.92±105.87	285.55±105.57	277.16±104.58	270.32±113.79	0.029
Sodium(mg)	3856.86±3866.14	3970.27±4077.03	3356.11±2473.79	2991.30±2083.15	<0.001
Potassium(mg)	2512.75±1393.81	2542.91±1407.95	2408.63±1327.95	2206.39±1238.52	0.001
Calcium(mg)	436.01±396.47	445.59±410.10	385.81±312.10	383.76±305.15	0.002
Phosphorus(mg)	961.59±580.20	977.52±602.75	889.25±441.12	845.12±408.77	<0.001
Iron(mg)	13.47±14.47	13.58±15.56	13.17±9.07	11.96±9.65	0.187
Vitamin A(μgRE)	618.47±787.31	634.28±802.63	526.62±640.00	555.48±824.54	0.017
Carotene(μg)	3372.45±4449.09	3464.23±4540.62	2854.68±3507.82	2966.68±4778.10	0.012
Retinol(μg)	56.57±190.04	57.11±190.19	48.68±201.83	67.02±151.89	0.995
Thiamine(mg)	1.18±0.73	1.18±0.74	1.16±0.68	1.17±0.75	0.705
Riboflavin(mg)	0.93±0.76	0.95±0.78	0.87±0.58	0.90±0.69	0.103
Niacin(mg)	12.92±11.93	13.19±12.56	11.57±6.74	11.19±6.83	0.003
Vitamin C(mg)	86.80±90.23	88.89±92.58	78.53±77.27	68.35±71.03	0.001