The association between dietary protein and serum phosphate level on chronic hemodialysis patients

Lin WC[1], Jin MY[2], Chen TH[3], Yang SH[1,4]

[1]School of Nutrition and Health Sciences, Taipei Medical University [2]Department of Nutrition, Wanfang Hospital
[3]Department of Internal Medicine, Wanfang Hospital [4]Nutrition research center, Taipei Medical University Hospital

Introduction

Dietary phosphorus always exists with protein food. To have daily protein intake above 1.2 g/kg to achieve the K/DOQI recommends may conflict with phosphorus restriction on chronic hemodialysis (CHD) patients.

Objective

To evaluate the association between dietary protein and serum phosphate level on CHD patients.

Subjects and Methods

Eighty three subjects were recruited from CHD patients in Wanfang Hospital in 2010. We collected demographic data, anthropometric and laboratory measurements over 6 months and conducted knowledge, attitude and practice (KAP) questionnaires to evaluate subjects' awareness of adequate nutrition, dietary phosphorus and food choice.

Results and Discussion

Younger CHD patients has higher knowledge and attitude scores, but no good compliance (table1). Over 6 months, protein intake (nPCR) increased significantly and maintained nutritional status (includes GNRI and serum albumin), while elevated serum phosphate and potassium levels (table 2). Serum phosphate and Ca × P level significantly correlated with nutritional parameters (includes total protein level, albumin and protein intake). Most of processed foods are enriched with phosphorus and potassium. Subjects with poor food choice of high-protein food may lead to improper control of serum phosphate and potassium.

Conclusion

High protein with lower phosphorus food choice is important for controlling serum phosphate level among CHD patients. We suggest that fresh and high biological value (HBV) protein food should be substituted for processed food.

Table1. Comparison of KAP scores between younger and older subjects (n=73).

	score	Younger (n = 39)	Older (n = 34)	p
Knowledge score	20	10.9± 0.7*	5.6± 1.0	0.001
Attitude score	40	28.9± 1.6*	13.2± 2.7	0.000
Practice score	40	20.4± 1.2	19.7± 1.5	0.678
Total score	100	60.2± 3.0*	38.5± 4.2	0.000

Values are expressed as mean ±SE. Values with different superscripts are significantly different at $p < 0.05$ by Student's t test.

Table3. Correlation of serum phosphate and calcium phosphate product (Ca × P) and univariate variables, adjust age and sex.

	Serum phosphate		Ca × P	
	r	p	r	p
Total protein	0.15*	0.032	0.19*	0.006
Albumin	0.23*	0.001	0.32*	0.000
GNRI	0.27*	0.000	0.35*	0.000
nPCR	0.24*	0.001	0.26*	0.000

Values are correlation coefficients and p value. GNRI, geriatric nutritional risk index; nPCR, normalized protein catabolic ration.Values with different superscripts are significantly different at $p < 0.05$ by using partial correlation.

Table2.Comparison of anthropometric, laboratory and indicator of nutritional status between 6 months.

	Subjects (n=83)							p
	Baseline	Month1	Month2	Month3	Month4	Month5	Month6	
BUN, mg/dL	76.2 ± 2.3[c]	79.8 ±2.2[b]	82.3 ± 2.1[b]	85.9 ± 2.2[a]	84.2 ± 2.3[ab]	84.7 ±2.2[ab]	84.4 ± 2.2[ab]	0.000
Cr, mg/dL	11.5 ± 0.3[bc]	11.4 ±0.3[b]	11.5 ± 0.3[b]	12.1 ± 0.3[a]	11.5 ± 0.3[b]	11.7 ±0.3[b]	11.3 ± 0.3[b]	0.002
UA, mg/dL	8.7 ± 0.8	-	-	7.9 ± 0.1	-	-	8.1 ± 0.2	0.376
TP, g/dL	6.6 ± 0.1	-	-	6.6 ± 0.1	-	-	6.6 ± 0.1	0.228
Albumin, g/dL	3.8 ± 0.0[b]	3.7 ±0.0[b]	3.8 ± 0.0[ab]	3.8 ± 0.0[ab]	3.8 ± 0.0[ab]	3.9 ±0.0[a]	3.8 ± 0.0[ab]	0.122
GNRI	95.6 ± 0.8[b]	95.1 ±0.9[b]	95.9 ± 0.9[ab]	96.2 ± 0.9[a]	95.4 ± 0.9[ab]	96.9 ±0.8[a]	96.3 ± 0.8[ab]	0.130
nPCR, g/kg	1.06 ± 0.03[b]	-	-	1.14 ± 0.03[a]	-	-	1.12 ± 0.04[a]	0.009
TG, mg/dL	182 ± 14[a]	-	-	172 ± 14[ab]	-	-	159 ± 13[b]	0.064
TC, mg/dL	159 ± 4	-	-	160 ± 4	-	-	162 ± 5	0.847
HGB, mg/dL	10.0 ± 0.2[b]	10.1 ±0.1[ab]	10.3 ± 0.2[ab]	10.3 ± 0.1[a]	10.3 ± 0.1[a]	9.9 ±0.2[b]	10.0 ± 0.1[b]	0.006
Ferritin, ng/mL	641 ± 57[a]	-	-	602 ± 60	-	-	582 ± 55[b]	0.084
Ca, mg/dL	9.0 ± 0.1[b]	9.1 ±0.1[a]	9.1 ± 0.1[a]	8.9 ± 0.1[b]	9.1 ± 0.1[b]	8.8 ±0.1[c]	8.9 ± 0.1[bc]	0.000
P, mg/dL	5.2 ± 0.1[b]	5.3 ±0.2[ab]	5.3 ± 0.2[ab]	5.6 ± 0.2[ab]	5.7 ± 0.2[ab]	5.7 ±0.2[a]	5.6 ± 0.2[ab]	0.164
Ca × P, mg^2/dL^2	47.1 ± 1.4	48.6 ±1.7	48.8 ± 1.6	50.2 ± 1.6	51.6 ± 1.9	51.0 ±1.7	50.3 ± 1.8	0.382
K, mEq/L	4.7 ± 0.1[b]	4.7 ±0.1[b]	4.7 ± 0.1[b]	4.8 ± 0.1[b]	5.0 ± 0.1[a]	4.9 ±0.1[a]	4.8 ± 0.1[b]	0.000
Kt/V	1.70 ± 0[a]	1.67 ±0.03[ab]	1.62 ± 0.04[ab]	1.64 ± 0.03[b]	1.63 ± 0.03[ab]	1.61 ±0.04[b]	1.64 ± 0.04[b]	0.076

Values are expressed as mean ± SE. BUN, blood urea nitrogen; Cr, creatinine; UA, uric acid; BMI, body mass index; TP, total protein; GNRI, geriatric nutritional risk index; nPCR, normalized protein catabolic ratio; TG, triglyceride; TC, total cholesterol; HGB, hemoglobin; Ca, calcium; P, phosphate; Ca × P, calcium phosphate product; K, potassium. Values with different superscripts are significantly different at $p < 0.05$ by one-way repeated measures ANOVA.