The correlation between Alternate healthy eating index for Taiwan (AHEI-T) and the risk factors of cardiovascular disease on hemodialysis patients

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Introduction

Cardiovascular diseases is the first cause of death of hemodialysis patients (HD) (Yang et al., 2008). Alternate healthy eating index (AHEI-T) is a diet quality index which based on Taiwan's dietary guidelines.

Purpose

To assess diet quality of HD patients with AHEI-T and to investigate the correlation between AHEI-T and the risk factors of cardiovascular disease, such as cardiothoracic ratio (CTR), blood pressure, nutrition status, inflammation, lipid profile and blood sugar.

Subjects and Methods

This is a cross-sectional and follow-up study. 68 HD patients were recruited and collected the following data: anthropometric data, CTR, blood pressure, nutrition status, inflammation, lipid profile, blood sugar and dietary data. Dietary data were collected by 24h dietary recall and dietary record. AHEI-T score was analyzed for quality and quantity of diet.

Table 1. AHEI-T components and scoring criteria among hemodialysis patients[1]

	Daily intake	Score	Daily intake criteria for minimum score of 0	Daily intake criteria for maximum score of 10
Vegetable (ex)[2]	1.91 ± 0.05	3.83 ± 0.21	0	3
Fruit (ex)[2]	1.02 ± 0.08	2.76 ± 0.21	0	2
Nuts and soy protein (ex)[2]	0.34 ± 0.07	2.20 ± 0.28	0	1
White/red meat[3]	0.95 ± 0.12	3.00 ± 0.28	0	4
Whole grain (%)	1.14 ± 0.55	0.12 ± 0.06	0	≥ 50%
Trans fat (g)	0.13 ± 0.02	9.97 ± 0.02	≥ 6	≤ 1
P/S ratio	1.30 ± 0.06	8.13 ± 0.20	≤ 0.1	≥ 1
Duration of multivitamin use[4]	2.93%[5]	2.62 ± 0.06	< 5 year	≥ 5 year
Alcohol (ex)[2]	0.00 ± 0.00	0.00 ± 0.00	Male: 0 or >3.5 Female: 0 or >2.5	Male: 1.5-2.5 Female: 0.5-1.5
AHEI-T		32.51 ± 0.63	2.5	87.5

[1]Values are mean ± SEM.
[2]P/S= ratio of polyunsaturated fatty acid to saturated fatty acid ratio, ex=exchange.
[3]Score=10 if no red meat consumed.
[4]For multivitamins, the minimum score was 2.5 and the maximum score was 7.5.
[5]Percentage of using multivitamin ≧5 year.

Results and Discussion

AHEI-T score was 32.5 ± 0.6 (Table1). and found it was positively correlated to good control of systolic blood pressure (Table 2). AHEI-T was negatively associated to biomarkers of endothelial dysfunction. High AHEI-T score means better in types of fats, PUFA/SFA and trans fat (Fung et al., 2005). After 2 months follow, the High AHEI-T score group (≥ 34.3) have more improved in triglyceride (Table 3). AHEI-T score was negatively correlated to CVD or lipid abnormalities. AHEI-T focus on more healthy dietary choices (white/red meat), fat quality (PUFA/SFA, trans fat intake), and other healthy behaviors (multivitamin use) (McCullough et al., 2002). Score of vegetable was negatively correlated to CTR, it showed that the more vegetable intake, the more normal heart size (Table 4). CTR predicts cardiovascular mortality on HD patients (Chen et al., 2008). Vegetables was negatively correlated to CVD and could improve hypertension (Joshipura et al., 2001) (Galleano et al., 2010).

Table 2. Spearman rank correlation between AHEI-T and percentage of good control of blood pressure, nutritional status, inflammation, lipid profile, glycemic, and dialysis quality according to recommendation[1,2]

	SBP (mmHg)[3]	DBP (mmHg)[3]	Alb (g/dL)[3]	TP (mg/dL)[3]	Cr (mg/dL)[3]	Hb (g/dL)[3]	WBC ($10^3/\mu L$)[3]	TC (mg/dL)[3]	TG (mg/dL)[3]	AC-sugar (mg/dL)[3]
AHEI-T[3]	0.27	0.13	0.02	-0.08	-0.05	0.08	0.07	0.05	0.10	0.04
p-value[4]	0.0252	0.2836	0.8690	0.4923	0.6888	0.5163	0.5695	0.601	0.0867	0.7507

[1]Values are correlation coefficients.
[2]Recommendation: Alb≧4 g/dL, TP 6-8.2 mg/dL, Cr >10 mg/dL, Hb 11-12 g/dL, WBC 4.8-10.8 ·103/ μ L, SBP <140 mmHg, DBP <90 mmHg, TC 151-199 mg/dL, TG <150 mg/dL, AC-sugar <130 mg/dL, Kt/V >1.2.
[3]AHEI-T=Alternate healthy eating index-Taiwan, Alb = albumin, TP = total protein, Cr = creatinine, Hb = hemoglobin, WBC = white blood cell, SBP = systolic blood pressure, DBP = diastolic blood pressure, TC = total cholesterol, TG = triglyceride, AC-sugar = preprandial blood glucose.
[4]Statistical significance analysis by Spearman rank correlation at $p < 0.05$.

Table 4. Spearman rank correlation between CTR and AHEI-T components

	AHEI-T[3]	Vegetable	Fruit	Nuts and soy protein	White/red meat	Whole grain	Trans fat	P/S ratio	Multivitamin use
CTR[3]									
Unadjusted	-0.02	-0.16	0.12	0.04	-0.01	0.23	0.08	-0.05	0.07
	0.8098	0.0279	0.0938	0.5899	0.8781	0.0009	0.2377	0.5105	0.3416
Model A[4]	-0.03	-0.15	0.14	0.02	-0.01	0.16	0.10	-0.02	0.02
	0.9686	0.0314	0.0460	0.7325	0.8516	0.0231	0.1687	0.7345	0.7590
Model B[5]	--0.02	-0.35	0.16	0.05	0.07	0.31	0.10	0.02	0.06
	0.9135	0.0114	0.2675	0.7310	0.6166	0.1933	0.4781	0.8634	0.6923

[1]Values are correlation coefficients.
[2]Statistical significance analysis by Spearman rank correlation and partial Spearman rank correlation at $p < 0.05$.
[3]AHEI-T = Alternate healthy eating index-Taiwan, CTR = cardiothoracic ratio.
[4]Model A = sex and age adjusted.
[5]Model B = Model A + dialysis vintage, dialysis duration, activity, BMI, interdialytic weight gain, energy, dietary fiber, Alb, TP, Cr, Hb, WBC, SBP, TC, TG, AC-sugar, Kt/V.

Table 3. Comparison of High AHEI-T score group and low AHEI-T score group of changes in clinical measurements between baseline, 1 months and 2 months[1]

	High AHEI-T score (n=23)[2]			Low AHEI-T score (n=45)[2]			*p* for group[4]	*p* for time[4]	*p* for interaction[4]
	Baseline	Month 1	Month 2	Baseline	Month 1	Month 2			
TC (mg/dL)	180.8 ± 7.9	177.0 ± 8.3	180.7 ± 10.0	176.9 ± 8.2	177.1 ± 7.4	173.4 ± 7.5	0.75	0.81	0.54
TG (mg/dL)	156.1 ± 13.7	176.8 ± 12.4	149.1 ± 11.4[5]	224.8 ± 10.1[6]	231.4 ± 13.0	210.7 ± 18.3	0.03	0.04	0.27

[1]Values are mean ± SEM.
[2]Statistical significance analysis Friedman test at $p < 0.05$.
[3]High AHEI-T score: ≥ 34.3; Low AHEI-T score: < 34.3.
[4]TC = total cholesterol, TG = triglyceride.
[5]Significantly different from Month 1, $P < 0.05$.
[6]Significantly different from High AHEI-T score, $P < 0.05$.