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Diet quality in patients with stroke

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ABSTRACT

Objective A healthy diet is associated with reduced risk for stroke, myocardial infarction, cancer and death. We examined the prevalence of a healthy diet in patients with a recent stroke or transient ischaemic attack (TIA).

Methods We recruited a convenience sample of 95 patients with a recent ischaemic stroke or TIA. Using information from a 125-item Food Frequency Questionnaire, we calculated dietary quality and the percentage of patients meeting recommended daily intake (RDI) for common macronutrients and elements.

Results The mean age of patients was 66 years (SD: 16) and 46% were women. 39 patients (41%) were classified as having a healthy diet (35% of men and 48% of women). The majority of patients were within the RDI for carbohydrates (56.8%), total fat (61.1%), long-chain n-3 fats (68.4%), polyunsaturated fats (79.0%) and protein (96.8%). Very few patients consumed the recommended intake for sodium (25.3%), and even fewer consumed the RDI for potassium (4.2%), with the majority of patients consuming too much sodium and too little potassium.

Conclusion We found that most patients with recent stroke or TIA were not following a healthy diet before their stroke event. For most patients, sodium intake was much above and potassium intake was much below RDI.

INTRODUCTION

Ischaemic stroke is a common and disabling condition affecting over 690 000 US adults each year.[1] Proven therapies mitigate the risk for recurrent stroke, but 5% of patients still suffer a recurrence each year.[2] Therapies are needed to improve vascular health in patients with stroke, and one potential target is dietary quality. Improving dietary quality, through greater intakes of polyunsaturated fats, whole grains, fruits and vegetables, can lead to lower levels of insulin, glucose, triglycerides, blood pressure and inflammatory markers.[3 4] Whether such dietary changes can prevent subsequent atherosclerosis-related outcomes, such as recurrent ischaemic stroke, remains to be shown in controlled clinical studies.

The potential value of an intervention to improve dietary quality after stroke depends largely on the prevalence of unhealthy eating among at-risk patients. To date, reliable data on dietary quality among stroke patients have been lacking and physicians do not routinely screen patients for dietary quality.[5] In this study, we assessed and characterised premorbid dietary quality in a cohort of patients with recent stroke or transient ischaemic attack (TIA). We hypothesised that many of these patients would have poor premorbid dietary quality.

METHODS

Study participants

Eligibility criteria for the study were: English speaking, age ≥18 years, diagnosis of ischaemic stroke or TIA and pass of a cognitive screen.[6] Between April 2015 and February 2016, 113 patients were approached and 107 gave consent. We excluded seven patients with incomplete FFQs, two reporting implausible caloric intake and three with missing clinical data, leaving 95 patients.

Dietary quality

We administered a 125-item Food Frequency Questionnaire (FFQ),[7] instructing patients to recall average diet in the 2 weeks before the stroke or TIA. We sampled the time period before the stroke because our goal was to identify acute patients who would be considered for future interventions and the stroke could affect current diet habits. We assumed that diet habits would be stable long term, such that problems with dietary quality before the stroke would be present afterwards.

We converted food and nutrient totals for each FFQ into daily intake by food category (eg, fruits, meats and sodium). These categories were used to derive the Alternative Health Eating Index (AHEI-2010), which was designed to predict risk of chronic disease, including cardiovascular disease and stroke[8 9] by including food groups that have been consistently associated with a lower risk of disease (online supplementary etable 1). All food categories are scored from 0 (unhealthy) to 10 (healthiest) with a total score ranging from 0 (no adherence) to 110 (perfect adherence).

Classification of healthy diet

Because AHEI-2010 is a continuous measure, there is no established cut-off to categorise diet as healthy. For our study, we used values

Table 1 Participant features, overall and by Alternative Healthy Eating Index (AHEI) 2010 tertile

Feature	All n=95	AHEI tertile ≤46.9 n=32	46.9–56.5 n=32	≥56.6 n=31	P value*
AHEI, range	30.9–77.2	30.9–46.8	46.9–56.5	56.6–77.2	
Mean, SD	52.7 (10.1)	42.6 (3.9)	50.9 (2.8)	65.0 (5.4)	<0.001
Women	44 (46.3)	13 (40.6)	17 (53.1)	14 (45.2)	0.61
Age, mean (SD)	65.9 (15.5)	61.9 (14.1)	68.8 (15.4)	66.9 (16.5)	0.18
Education					
Less than high school	8 (8.4)	5 (15.6)	1 (3.1)	2 (6.5)	0.14
High school graduate	30 (31.6)	13 (40.6)	13 (40.1)	4 (12.9)	
More than high school	57 (60.0)	14 (43.8)	18 (56.3)	25 (80.6)	
Race					
White	75 (79.0)	22 (68.7)	27 (84.4)	26 (83.9)	0.33
Black	15 (15.8)	6 (18.8)	5 (15.6)	4 (12.9)	
Other	5 (5.2)	4 (12.5)	0	1 (3.2)	
Body mass index (kg/m^2)†	29.1 (6.4)	30.1 (7.8)	27.4 (6.4)	28.5 (5.6)	0.38
Prior stroke or TIA	20 (21.1)	4 (12.5)	10 (31.3)	6 (19.4)	0.18
Hypertension history	66 (69.5)	24 (75)	20 (62.5)	22 (71)	0.54
Hyperlipidaemia history	60 (63.2)	22 (68.8)	20 (62.5)	18 (58.1)	0.68
Diabetes	25 (26.3)	23 (71.2)	23 (71.2)	24 (77.4)	0.85
Atrial fibrillation	18 (19.0)	2 (6.3)	7 (21.9)	9 (29.0)	0.06
Stroke (vs TIA)	78 (83)	26 (81.3)	27 (84.4)	25 (80.6)	0.91
NIHSS (mean, SD)‡	4 (5)	5 (5)	4 (5)	2 (3)	0.02

Values are n (%) unless otherwise specified.
*P value from ANOVA for continuous and χ^2 for categorical variables.
†Includes 92 participants with measured weight for BMI.
‡Includes 87 participants with NIHSS score.
AHEI, Alternative Health Eating Index; ANOVA, analysis of variance; BMI, body mass index; NIHSS, NIH Stroke Scale; TIA, transient ischaemic attack.

from an observational study of over 112 000 healthy adults that found that in this population, patients in the fourth and fifth quintile of AHEI-2010 had a decreased risk of stroke as compared with the first quintile.[8] We used the lower bound of the fourth quintile (55.3 for men and 51.4 for women) to define a healthy diet.

Statistical analysis

Participant characteristics were evaluated across tertiles of AHEI-2010. We examined the distribution of daily intake of common macronutrients and elements for men and women. We calculated the percentage of patients who consumed the recommended daily intake (RDI) of macronutrients and elements for men and women.

RESULTS

Dietary quality

Only one baseline characteristic, the NIH Stroke Scale Score, was significantly different across tertiles defined by the AHEI-2010. The score was 5 in the lowest AHEI tertile compared with 4 in the middle and 2 in the highest AHEI tertile (p value 0.02 by analysis of variance, table 1). However, we observed several trends that were quantitatively important but that did not reach statistical significance. First, patients with the lowest dietary quality (first AHEI-2010 tertile) were on average younger, had less education and were more likely to be non-white race as compared with patients with higher dietary quality (ie, the second and third tertile). Second, patients with the lowest dietary quality had higher rates of hypertension and hyperlipidaemia as compared with patients with higher dietary quality. Third, diabetes rates were similar across dietary quality tertiles. Fourth, atrial fibrillation was more common in those with the highest dietary quality.

Healthy diet

Overall, 39 patients (41%) were classified as having a healthy diet (35% of men and 48% of women).

Recommended daily intakes

Most patients were within the RDI for the macronutrients carbohydrates (56.8%), total fat (61.1%), long-chain n-3 fats (68.4%), polyunsaturated fats (79.0%) and protein (96.8%) (table 2). The minority of patients were within

Table 2 Daily intake and per cent of patients meeting recommended daily intake (RDI) of common macronutrients, elements and food groups

	Daily intake			P value*	Definition of RDI for each macronutrient or element	RDI met		
	All	Men	Women			All	Men	Women
Total energy (kcal)	1730 (756)	1855 (796)	1584 (688)	0.08				
Macronutrients								
Carbohydrates (g)	210.8 (94.8)	223.5 (101.5)	196.1 (85.0)	0.16	45%–65% of total calories	54 (56.8)	27 (52.9)	27 (61.4)
Total fat (g)	65.0 (35.0)	69.7 (37.0)	59.7 (32.1)	0.17	20%–35% of total calories	58 (61.1)	31 (60.8)	27 (61.4)
Long-chain n-3 fats (g)	1.6 (0.9)	1.6 (0.9)	1.6 (0.9)	0.98	0.6%–1.2% of total calories	65 (68.4)	35 (68.6)	30 (68.2)
Polyunsaturated fat (g)	15.0 (8.0)	15.8 (8.2)	13.9 (7.8)	0.25	5%–10% of total calories	75 (79.0)	39 (76.5)	36 (81.8)
Protein (g)	72.4 (35.7)	79.0 (36.3)	64.8 (54.5)	0.05	10%–35% of total calories	92 (96.8)	49 (96.1)	43 (97.7)
Saturated fat (g)	20.8 (12.2)	22.0 (13.2)	19.4 (10.7)	0.31				
Trans fat (g)	2.2 (1.4)	2.4 (1.6)	1.9 (1.1)	0.10				
Elements								
Sodium (g)	2.8 (1.4)	3.1 (1.4)	2.5 (1.2)	0.03	1.5–2.3 g/day	24 (25.3)	15 (29.4)	9 (20.5)
Potassium (g)	2.5 (1.0)	2.7 (1.1)	2.4 (1.0)	0.17	≥4.7 g/day	4 (4.2)	3 (5.9)	1 (2.3)
Food groups and fibre								
Fibre (g)	17.2 (7.3)	18.0 (7.5)	16.3 (7.1)	0.26				
Fruit (servings)	2.3 (1.6)	2.2 (1.6)	2.3 (1.7)	0.70				
Vegetables (servings)	2.3 (2.0)	2.1 (1.4)	2.4 (2.5)	0.45				
Fish (servings)	0.2 (0.3)	0.2 (0.3)	0.2 (0.3)	0.91				
Nuts (servings)	0.3 (0.4)	0.3 (0.5)	0.2 (0.2)	0.05				
Meat (servings)	0.9 (0.8)	1.0 (0.8)	0.8 (0.8)	0.13				
Dairy (servings)	0.6 (0.6)	0.6 (0.5)	0.6 (0.6)	0.67				
Whole grain (servings)	0.6 (0.6)	0.6 (0.6)	0.5 (0.6)	0.24				
Beverages								
Alcohol (g)	6.8 (11.7)	7.9 (13.0)	5.4 (9.9)	0.32				
SSB (servings)	1.1 (1.6)	1.3 (2.0)	0.8 (0.9)	0.16				

Values for daily intake represent mean (SD) for all participants (n=95); men (n=51) and women (n=44).
RDI is defined from from: https://ods.od.nih.gov/Health_Information/Dietary_Reference_Intakes.asp.
RDI met is displayed as n (%).
*P value represents two-sided t-test of differences of means between men and women.
SSB, sugar-sweetened beverages.

the RDI for the elements sodium (25.3%, n=24) and potassium (4.2%, n=4), with average sodium intake being higher and potassium intake being lower than recommended (table 2). The mean sodium intake was 2.8 g/day (SD: 1.4), and the mean potassium intake was 2.5 g/day (SD 4.2). Men consumed a significantly higher amount of protein and sodium as compared with women (table 2).

DISCUSSION

In this study, we found that overall dietary quality was poor, with most patients not following a healthy diet before the stroke event. Second, we found that most patients had high sodium and low potassium intake, which is closely associated with hypertension, the major risk factor for stroke. Our findings suggest that among hospitalised patients who had a stroke, premorbid dietary quality is poor with particular problems related to sodium and potassium.

Only one prior study examined dietary quality among patients with a recent stroke. This study included 73 participants from South Korea with recent stroke and used an 85-item FFQ to calculate diet quality, using the diet quality index, in the year preceding the stroke.[10] In agreement with our findings in a US population, the authors found that, overall, patients with recent stroke had low diet quality, high sodium consumption and low potassium consumption preceding their ischaemic event.

Our results suggest that dietary quality in patients with recent stroke and TIA is similar to dietary quality in the US adult population. A large cohort study including women age 30–55 years and men age 40–75 years reported a mean score AHEI-2010 score of 48 (SD: 11) in women and 52 (SD: 12) in men.[9] In this cohort study, 40% of participants consumed a healthy diet,[9] similar to the 41% rate observed in this study of participants with stroke or TIA.

We asked patients to recall their diet pattern during the 2 weeks prior to their stroke, but we believe the findings likely reflect diet quality after stroke. Without intense counselling, patients rarely make substantial changes in

their diet. If we are correct, our findings may have implications for secondary stroke prevention. Improved diet quality, including reduced sodium intake and increased potassium intake, may ameliorate stroke risk factors such as high blood pressure, dyslipidaemia, glucose metabolism and vascular inflammation.[11 12] Our work suggests that counselling patients who had a stroke on a dietary pattern that emphasises low sodium and high potassium, such as the Dietary Approaches to Stop Hypertension diet, may positively impact the blood pressure of patients poststroke.[13]

A limitation of the study is that it was performed at a single centre, which may limit generalisability, as it is known that diet varies by region.[14] In addition, we recruited a convenience sample, although we have no reason to believe that enrolled patients differ from other patients admitted to the hospital with stroke. We report dietary information on a relatively small sample; however, we also note that the distribution of scores (SD: 10.1) was similar to the distribution of scores in a large general population sample (SD: 11 in 71 495 women and SD: 12 in 41 029 men[9]), suggesting that our sample size was adequate to represent the full distribution of dietary intake. Dietary information was collected by self-report, which is a subjective measure. The limitations to the use of FFQs in observational research apply to our measure of dietary quality. FFQs can results in random measurement errors or systemic biases in patient reporting due to personality or disease-related factors.[15] Additionally, this study was only able to capture diet in patients who were able to complete an FFQ unassisted, which eliminated those with the most severe strokes, aphasia or other cognitive deficits. This group of patients severely affected by the stroke represents an ongoing challenge to adequately measure dietary practices retrospectively and prospectively.

Average dietary quality is poor in patients with a recent stroke or TIA and could potentially be improved by nutritional counselling and interventions for behavioural change. Although it remains to be shown that dietary change reduces risk for recurrent vascular events or improves functional outcomes, it is known that dietary change can improve stroke risk factors such as blood pressure, lipid concentrations and glucose tolerance.[13 16] Clinical trials are warranted to test dietary improvement for secondary prevention.

Contributors JLD: study design, primary authorship of manuscript, statistical analysis, interpretation of data and approval of final manuscript. No disclosures. TK: data collection and approval of final manuscript. No disclosures. MP: data collection and approval of final manuscript. No disclosures. ZS: data collection and approval of final manuscript. No disclosures. WNK: study design, data interpretation, manuscript revision and approval of final manuscript. No disclosures.

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