

Comparison of the Availability and Cost of Foods Compatible With a Renal Diet Versus an Unrestricted Diet Using the Nutrition Environment Measures Survey

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Objective: Hemodialysis patients' ability to access food that is both compatible with a renal diet and affordable is affected by the local food environment. Comparisons of the availability and cost of food items suitable for the renal diet versus a typical unrestricted diet were completed using the standard Nutrition Environment Measures Survey and a renal diet–modified Nutrition Environment Measures Survey.

Design: Cross-sectional study.

Setting: Twelve grocery stores in Northeast Ohio.

Main Outcome Measure: Availability and cost of food items in 12 categories.

Results: The mean total number of food items available differed significantly ($P \leq .001$) between the unrestricted diet (38.9 ± 4.5) and renal diet (32.2 ± 4.7). The mean total cost per serving did not differ significantly ($P = 0.48$) between the unrestricted diet ($\$5.67 \pm 2.50$) and renal diet ($\5.76 ± 2.74).

Conclusion: The availability of renal diet food items is significantly less than that of unrestricted diet food items, but there is no difference in the cost of items that are available in grocery stores. Further work is needed to determine how to improve the food environment for patients with chronic diseases.

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Introduction

THE FOOD ENVIRONMENT is relevant for both health promotion and treatment of diet-related chronic diseases. The food environment includes several

attributes such as the physical presence of food that affect a person's diet, a person's proximity to food store locations, and the distribution of different outlets where food may be obtained.¹ The food environment can be studied at the macro level, looking at spatial characteristics such as number and location of food outlets, or at the micro level, examining the consumer environment within food outlets. Barriers in the consumer food environment such as a greater distance to full service supermarkets, lack of fresh fruits, vegetables, or disease-specific foods, and lower income are associated with worse outcomes for chronic diseases such as diabetes, obesity, hypertension, and chronic kidney disease.²⁻⁵ For hemodialysis patients, diet is an important factor contributing to both morbidity and mortality.⁶⁻⁸ The food environment may affect hemodialysis patients' ability to access food that is affordable and compatible with the renal diet. Comparisons of the availability and cost of food items suitable for the renal diet versus a typical unrestricted diet were completed using the standard Nutrition Environment Measures Survey (NEMS) survey and a renal diet–modified NEMS survey (see [Appendix](#)).

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Methods

Geographic sampling was used to identify the 6 largest hemodialysis facilities located in 3 diverse geographic

settings in Cleveland, Ohio: the urban core ($n = 2$), inner ring suburbs ($n = 2$), and outer ring suburbs ($n = 2$). Next, renal dietitians at these facilities identified nearby grocery stores that they were aware their patients frequented. One full service grocery store and 1 discount grocery store within a 3-mile radius of each hemodialysis facility were selected as our study sample resulting in 12 stores.

Structured observations of each store were conducted using the NEMS and a renal diet–modified NEMS. The NEMS is a validated survey instrument used to assess 11 measures of the consumer environment within stores using availability and price differences between healthier and less healthy food items.⁹ Modifications were made to the standard NEMS to create a renal diet–modified NEMS. A panel of 3 renal dietitians developed the modifications to the NEMS based on standard diet counseling provided to hemodialysis patients.

The National Kidney Foundation's (NKF) Dietary Guidelines for Adults Starting on Hemodialysis¹⁰ list foods to “eliminate,” “limit,” or “avoid.” These lists were used to determine the inclusion and exclusion of food items. Fruits and vegetables that are higher in potassium were removed and replaced with fruits and vegetables that are lower in potassium. Fruits and vegetables from the National Kidney Foundation “choose” list were added to the modified NEMS using the USDA Economic Research Service data on per capita use of fruits¹¹ and vegetables¹² to select highest use products. Bananas, oranges, cantaloupe, honeydew, tomatoes, and broccoli were replaced with blueberries, tangerines, grapefruit, pineapple, greens, and zucchini.

Other modifications were completed using the standard renal diet criteria described in previous work for evaluating entrees and side dishes.¹³ These include (1) ≤ 900 mg of sodium for entrees and ≤ 300 mg of sodium for side dishes, (2) no dry beans, high-potassium fruits, or high-potassium vegetables listed as the first, second, or third ingredient, (3) no whole-grain flour listed as the first ingredient, and (4) a calcium content of $\leq 20\%$ of the daily value. Note

that the calcium content was used as a proxy for milk and other dairy products that are likely to contain substantial amounts of naturally occurring phosphorus. The ingredients list for each item was read to determine which products did not contain phosphorus additives. Almond milk was used in place of milk as it has the highest market share of nondairy milk alternatives^{14,15} and is 1 of the commonly recommended milk substitutes for the renal diet.¹⁶

The renal diet–modified NEMS was pilot tested in 6 stores by study staff, including renal dietitians and nephrologists. The survey was completed, and notations made regarding food items and brands available in each store. Further modifications were made to the survey to include brand names and package sizes when possible for consistency in comparisons across stores. National or regional brands with the most shelf space were chosen when multiple brands were available. Store brands were not used as the preferred product because the survey was conducted across multiple store chains.

Data were analyzed using JMP Pro 12 by SAS (SAS Institute, Cary, NC). The number of items available and cost per serving are reported as means. A paired *t*-test was used to compare the availability and cost of the unrestricted and renal diets in each food category. The price comparison analysis was completed using only the foods that were available and reported as price per serving. Typical serving sizes such as 1 hotdog or 1 slice of bread were used for serving and price calculations.

Results

As indicated in Table 1, the mean total number of food items available differed significantly ($P \leq .001$) between the unrestricted diet (mean = 38.9 ± 4.5) and renal diet (mean = 32.2 ± 4.7). The largest differences were milk (3.2, $P \leq .001$) and frozen dinners (1.9, $P = .005$). As indicated in Table 2, the mean total cost per serving was similar ($P = .48$) for the renal diet ($\$5.76 \pm 2.50$) compared with the unrestricted diet ($\$5.67 \pm 2.74$). There were significant

Table 1. Comparison of the Availability of Foods Compatible With a Renal Diet Versus an Unrestricted Diet Using the Nutrition Environment Measures Survey (NEMS)

Category	Mean Number of Items for Unrestricted Diet	Mean Number of Items for Renal Diet	Difference Unrestricted Minus Renal	<i>P</i> Value
Milk	3.9 (0.3)	0.7 (0.5)	3.2	<.001
Fruit	8.7 (1.6)	9.0 (1.2)	−0.3	.04
Vegetables	10.0 (0.0)	9.8 (0.5)	0.2	.08
Ground beef	1.8 (0.6)	1.8 (0.6)	0.0	1.00
Hot dog	2.0 (0.0)	1.6 (0.5)	0.4	.02
Frozen dinners	2.7 (2.6)	0.8 (1.0)	1.9	.005
Baked goods	2.0 (0.0)	1.8 (0.4)	0.2	.17
Beverages	4.0 (0.0)	3.5 (0.8)	0.5	.05
Bread	2.0 (0.0)	1.8 (0.5)	0.3	.08
Chips	1.8 (0.4)	1.4 (0.5)	0.4	.02
Total	38.9 (4.5)	32.2 (4.7)	6.7	<.001

Results are shown as means (standard deviations).

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