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Comparison of the availability and cost of foods compatible with a renal diet versus an unrestricted diet using the Nutrition Environment Measures Survey (NEMS)

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Abstract

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 (NEMS) and a renal diet modified NEMS.

Design—Cross-sectional study

Setting—12 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 ($p < 0.001$) 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 ($\$5.76 \pm 2.74$).

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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.

Keywords

food environment; hemodialysis; renal diet; Nutrition Environment Measures Survey (NEMS)

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).

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 one 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 three 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 NKF “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 dishes¹³. 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 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 non-dairy milk alternatives^{14,15} and is one 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 was analyzed using JMP Pro 12 by SAS (SAS Institute, Cary, North Carolina). 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 ($p<0.001$) between the unrestricted diet (mean = 38.9 ± 4.5) and renal diet (mean = 32.2 ± 4.7). The largest differences were milk (3.2, $p<0.001$) and frozen dinners (1.9, $p=0.005$). As indicated in Table 2, the mean total cost per serving was similar ($p=0.48$) for the renal diet ($\$5.76\pm2.50$) compared to the unrestricted diet ($\$5.67\pm2.74$). There were significant differences for some individual food categories. The renal diet cost per serving was significantly higher for milk ($\$0.47\pm0.05$ vs. $\$0.20\pm0.02$, $p<0.001$), hot dogs ($\$0.48\pm0.27$ vs. $\$0.33\pm0.17$, $p=0.004$), and bread ($\$0.16\pm0.05$ vs. $\$0.14\pm0.04$, $p=0.009$).

The mean number of food items available for each diet differed significantly at both full service and discount stores. Full service stores had a mean of 42.3 ± 2.3 items for the

unrestricted diet and 35.3 ± 1.5 items for the renal diet ($p < 0.001$). Discount stores had a mean of 35.5 ± 3.5 items for the unrestricted diet and 29.0 ± 4.7 items for the renal diet ($p = 0.002$).

Discussion

The renal diet modified NEMS captured the limited availability of foods compatible with the renal diet. It did not show an increased cost associated with the renal diet that Soinski et al and León et al found.^{17,18} These studies calculated total meal costs for multiple days while we priced individual items in a food category. The small number of food items priced in each category may have limited our ability to detect cost differences between them. To calculate a true cost of diet, other food items are required to make complete meals.

The Centers for Disease Control's Built Environment and Health Initiative (also known as Healthy Community Design Initiative)¹⁹ lists increasing access to healthy food as a priority. Given the abundance of research linking the food environment to diet^{20,21} and health issues^{2-5,22}, policy makers should consider incentives for retail food establishments to encourage stocking foods compatible with the diet parameters of chronic conditions as part of the public health effort to improve the food environment. Making these foods readily available and easily identifiable by shoppers could improve outcomes and is an area for further research. Most grocery stores already have gluten free, organic, and diabetic areas which cater to a much smaller population than Chronic Kidney Disease.²³ Research in grocery store marketing has shown that placement strategies increase sales.²⁴ Consumers prefer fewer options and that too much choice can be overwhelming. In addition when healthier foods are placed in a separate section, such as health foods, they are viewed as better tasting than when positioned with all foods of that category.²⁵ On a local level, hemodialysis facilities should consider giving clinicians time to develop relationships with local retailers to create kidney friendly shelves to simplify shopping for patients. As food products and their ingredients are continually changing, ongoing partnerships between clinicians and retailers to update appropriate foods is warranted.

There are several limitations to our findings. First, the number of stores surveyed was small and limited to one geographical area. Second, we modified a validated survey based on an unrestricted diet to try and capture the needs of a renal diet. This survey methodology while reliable for unrestricted diets, may not be the best way to capture the difficulties patients face when shopping for renal diet appropriate foods. Third, only grocery stores were surveyed. The inclusion of corner stores could have an impact on availability and price. More work needs to be done to ascertain the best way to measure consumer food environments for populations with diet restrictions.

Practical Application

The decreased availability of renal diet compatible foods in grocery stores may create a barrier for patients trying to comply with the renal diet. Clinicians should ask patients where they shop, and inventory these stores for items that are compatible with the renal diet. Clinicians could then educate and advise patients on appropriate choices that are available

where they shop. Patients could also be directed to alternative shopping venues that might have a better selection of renal appropriate foods. Clinicians may want to develop relationships with local retailers to create a kidney friendly shelf that would help patients choose appropriate foods without searching through the store.

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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	p value
Milk	3.9(0.3)	0.7(0.5)	3.2	<0.001
Fruit	8.7(1.6)	9.0(1.2)	-0.3	0.04
Vegetables	10.0(0.0)	9.8(0.5)	0.2	0.08
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	0.02
Frozen dinners	2.7(2.6)	0.8(1.0)	1.9	0.005
Baked goods	2.0(0.0)	1.8(0.4)	0.2	0.17
Beverages	4.0(0.0)	3.5(0.8)	0.5	0.05
Bread	2.0(0.0)	1.8(0.5)	0.3	0.08
Chips	1.8(0.4)	1.4(0.5)	0.4	0.02
TOTAL	38.9(4.5)	32.2(4.7)	6.7	<0.001

Results are shown as means and (standard deviations).

Table 2

Comparison of the cost per serving of foods compatible with a renal diet versus an unrestricted diet using the Nutrition Environment Measures Survey (NEMS).

Category	Mean cost per serving, \$ for unrestricted diet	Mean cost per serving, \$ for renal diet	Difference, \$ unrestricted minus renal	p value
Milk	0.20(0.02)	0.47(0.05)	−0.27	<0.001
Fruit	0.70(0.25)	0.75(0.29)	−0.05	0.04
Vegetables	0.43(0.10)	0.38(0.09)	0.05	<0.001
Ground beef	1.37(0.40)	1.37(0.40)	0.00	1.00
Hot dog	0.33(0.17)	0.48(0.27)	−0.15	0.004
Frozen dinners	3.43(0.15)	3.18(0.15)	0.25	0.05
Baked goods	0.52(0.10)	0.52(0.12)	0.00	0.81
Beverages	0.29(0.08)	0.28(0.10)	0.01	0.71
Bread	0.14(0.04)	0.16(0.05)	−0.02	0.009
Chips	0.38(0.11)	0.31(0.12)	0.07	0.002
TOTAL	5.67(2.50)	5.76(2.74)	−0.09	0.48

Results are shown as means and (standard deviations).

Negative numbers in the difference column reflect a higher cost for renal diet food items.