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Self-management of dietary intake using mindful eating to improve dietary intake for individuals with early stage chronic kidney disease

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Abstract

Using mindful eating to improve specific dietary recommendations has not been adequately studied. This feasibility study examined an intervention, self-management of dietary intake using mindful eating, with 19 participants that had mild to moderate chronic kidney disease, using a prospective, single group, pretest–posttest design. The intervention had six weekly classes focused on self-management using mindful eating, goal-setting, problem-solving, and food label reading. Weight, body mass index (BMI), 3-day 24-h dietary recalls and fasting blood samples were measured. Participants improved significantly in mean weight (203.21 ± 42.98 vs 199.91 ± 40.36 lbs; $P = 0.03$) and BMI (32.02 ± 5.22 vs 31.57 ± 5.27 kg/m^2; $P = 0.04$), but not in dietary intake nor blood measures with the exception of cis-beta-carotene levels (0.020 + 0.012 vs 0.026 + 0.012 mcg/mL; $P = 0.008$), which correlates to fruit and vegetable servings. These promising results warrant further testing of the intervention in randomized control trials.

Keywords

Mindful eating; Dietary intake; Self-management; Dietary adherence; Chronic kidney disease

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Compliance with ethical standards

Conflict of interest Gayle M. Timmerman, Muna J. Tahir, Richard M. Lewis, Deborah Samoson, Holli Temple, and Michele R. Forman declares that they have no conflict of interest.

Human and animal rights and informed consent All procedures performed in study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments. Informed consent was obtained from all individual participants included in the study.

Introduction

Optimum treatment to slow the progression of chronic kidney disease (CKD) in the early stages frequently requires improvements in diet that generally target the underlying causes of the disease (e.g., diabetes and hypertension) (de Waal, Heaslip, & Callas, 2016; National Kidney Disease Educational Program, 2015). For example, numerous studies report that consumption of diets rich in fruits and vegetables help reduce risk of CKD and its progression (Goraya et al., 2012; Lin et al., 2011; Nettleton et al., 2008), while weight loss for persons with CKD reduces proteinuria, blood pressure, and further renal function decline (Navaneethan et al., 2009).

Despite the beneficial effects of diet in reducing symptoms and progression of CKD (Chauveau & Aparicio, 2011; Jain & Reilly, 2014), many people struggle with making dietary changes (Beto, Schury, & Bansal, 2016; Desroches et al., 2013). To improve quality of diet, self-management (SM) skills for dietary intake (i.e., problem-solving based on knowledge required to make informed decisions) need to be developed since it is the individual who makes the day-to-day decisions to deal with chronic health problems, incorporating personal preferences that provide a sense of control and quality of life (Lorig & Holman, 2003; Redman, 2004).

SM is a recommended part of the treatment plan for CKD (National Kidney Foundation, 2002). Indeed SM interventions have improved health behaviors, health outcomes, and quality of life for persons with a variety of chronic illnesses (Choi & Lee, 2012; Flesher et al., 2011; Lorig & Holman, 2003; Redman, 2004; Yuan et al., 2014). Yet, few SM interventions have been tested in individuals with CKD, but these few (Constantini et al., 2008; Curtin et al., 2008) support improvements in self-efficacy (Lin et al., 2013), self-care practices and knowledge of CKD (Choi & Lee, 2012; Flesher et al., 2011). To address this gap, this manuscript describes a feasibility study that examines the acceptability and effectiveness of an intervention designed to address the lack of research on SM interventions for dietary recommendations in those with early stage CKD.

The intervention, *self-management of dietary intake using mindful eating (SM-DIME)*, is unique because traditional SM skills were combined with both mindful eating and mindful eating meditations skills. Mindful eating is being in the moment while eating and being fully aware of the sight, smell, texture and taste of food (Kristeller & Wolever, 2011). Since taste and pleasure are important in our food choices (Glanz et al., 1998) and CKD dietary recommendations (e.g., low sodium, moderate protein intake) can be perceived as restrictive and unpalatable (Wells, 2003), mindful eating was used to enhance eating experiences (Arch et al., 2016) and to cope with dietary recommendations. The mindful eating meditations focused on increasing one's awareness of body cues (e.g., hunger, fullness) (Kristeller & Wolever, 2011). Mindful eating interventions have successfully led to: (1) weight loss and decreased caloric and fat intake in perimenopausal women (Timmerman & Brown, 2012); and (2) decreased sugar consumption and improved fasting glucose levels in individuals with obesity (Mason et al., 2016). To date, no mindful eating interventions have been tested in CKD populations or to improve specific dietary recommendations (e.g., reducing sodium intake).

Aims

To test the feasibility of the *SM-DIME* intervention, pre- to post-intervention changes were examined in: (1) weight; (2) body mass index (BMI); (3) dietary and nutrient intake from 3-day 24-h recalls (3-day average of daily intake of energy/calories, fat, saturated fat, protein, carbohydrates, sodium, potassium, phosphorus, beta-carotene, lutein + zeaxanthin, alpha-carotene, beta-cryptoxanthin, lycopene and servings of fruit and vegetables); and (4) fasting blood samples (estimated glomerular filtration rate (eGFR) and carotenoid panel). Expected outcomes included (1) weight loss and reduction of BMI; (2) reduced intake of calories, fat, saturated fat, and sodium; (3) avoidance of excess protein; and (4) increased fruit and vegetable servings, related micronutrients, and carotenoid levels. The eGFR, which measures kidney function, was not expected to change over 6 weeks; however, eGFR would be an important variable to measure in studies with longer follow up (Tirosh et al., 2013). Exit interviews were conducted to determine participants' perceived acceptability of the intervention and measures.

Methods

The study used a pre-test, post-test design delivered in 6 weekly 2-h sessions to examine the feasibility and efficacy of the *SM-DIME* intervention using a running cohort enrollment of five groups of 6–8 participants per group including significant others. Data were collected at baseline (Time 1) and after completion of the intervention at 6 weeks (Time 2). The study was approved by The University of Texas at Austin Institutional Review Board, and informed signed consent was obtained from all participants.

Study sample

The target population included community dwelling adults (aged 45–78 years): (1) identified as Stage 1–3 CKD by their health care provider; (2) who could read and speak English; and (3) who had reliable communication and transportation. Exclusion criteria included: terminal diagnosis, current or planned dialysis or kidney transplant, autoimmune diseases, eating disorders, newly diagnosed or unstable hypothyroidism, psychiatric disorders, cognitive impairment, steroid use that affects weight, and BMI < 18.5 kg/m^2 (i.e., below normal weight).

Participants were recruited from two nephrology practices and a primary care clinic in Austin, TX from June 2015 to November 2015. Recruitment involved a 4-pronged approach: (1) health care providers identified potential participants and their contact information (n = 6); (2) graduate research assistants recruited and screened participants on site (n = 6); (3) potential participants were identified from the practice data base and screened via phone to determine their eligibility (n = 7); and (4) potential participants responded to flyers at the nephrology office (n = 2).

Of the 21 eligible participants who started the study, 90.5% (n = 19) completed the study. The mean number of sessions attended was 5.58 ± 0.65; 58% attended all 6 sessions, 32% attended 5 sessions (with 4 opting to come early to "make up" a missed session) and the rest (10%) attended 4 sessions. Although participants were expected to attend all sessions, there was no minimum number of sessions required to participate. To enhance retention, participants received $30 gift card at the completion of baseline data collection, a $60 gift card at the completion of post-intervention data collection, and $15 for each session to offset travel expenses.

Intervention

The intervention had four key elements: (1) information to improve dietary intake for individuals with CKD; (2) theory and evidenced-based behavioral change strategies to improve self-efficacy (e.g., goal setting, addressing barriers, practicing food label reading) (Ammerman et al., 2002; Stuifbergen, Seraphine, & Roberts, 2000); (3) self-management of recommended dietary intake using problem solving; and (4) mindful eating and mindful eating meditations. Weekly content and mindful eating exercises for each session appear in Table 1. To reinforce the content, participants had handouts and interactive exercises divided into weekly modules. This intervention was partly adapted from the author's previous intervention, *Mindful Restaurant Eating*, which successfully led to weight loss over a period of six weeks in perimenopausal women who ate out at least three times per week (Timmerman & Brown, 2012).

Individualized dietary recommendations for each participant were received from health care providers using a standard form with recommendations to: (1) lose or maintain weight; (2) follow a diabetic diet; and (3) restrict sodium, protein, phosphorus, or potassium intake (when appropriate). To improve dietary intake for individuals with CKD, information was provided to target weight management (managing calories and portions), heart healthy eating (i.e., reduce saturated fats, increase fruit and vegetables), reduce sodium intake, manage carbohydrates for diabetics, and avoid excess protein intake [RDA of 0.8 g/kg of body weight; National Kidney Disease Education Program (NKDEP), 2015]. For the few participants with potassium or phosphorus restrictions, discussions focused on the ability to adapt recommendations to accommodate their specific restrictions (e.g., identification of fruits with high concentrations of potassium).

Since multiple studies have demonstrated that diabetes, hypertension, and obesity may negatively affect kidney function (United States Renal Data System, 2016), dietary intake that improves blood sugar and blood pressure control (weight loss, diabetic diet/reduced carbohydrates and lower sodium intake) may delay CKD progression (NKDEP, 2015). Additionally, CKD is an independent risk factor for cardiovascular disease (United States Renal Data System, 2016), which substantiates the intervention's focus on a heart healthy eating and attaining a healthy weight. Avoiding excess protein intake can reduce the burden on the kidneys since the end product of protein broken down (urea) must be removed by the kidneys (NKDEP, 2015) All content for the dietary intervention was consistent with evidence-based practice guidelines for nutritional management of CKD (Ash et al., 2006).

Each session was run by an advanced practice nurse experienced in leading small group interventions on mindful eating and behavior change. The sessions build SM skills through practice, providing mastery experiences that build self-efficacy (Schnoll & Zimmerman, 2001). For example, participants set weekly goals aimed at improving dietary intake (e.g., increased fruit and vegetable intake) or behaviors that would help them improve dietary intake (e.g., use of smaller plates to reduce portions, taking 20 min to eat to reduce intake by waiting to feel full). Reading food labels and problem solving dietary challenges were addressed at each session. For example when eating out, participants learned to access and use nutrition information prior to visiting a restaurant to choose the best options (e.g., low in sodium and fat). Pre-portioned snacks (fruit, veggies, nuts, and yogurt) with nutrition information were used to model portion sizes and practice making decisions with nutrition information.

The innovative aspect of this intervention was the focus on mindful eating and mindful eating meditations as SM skills. Mindful eating meditations are a series of guided meditations to increase awareness of body cues (e.g., hunger, fullness, taste satiety, and eating triggers) (Kristeller & Wolever, 2011). Mindful eating meditations involve the intentional, nonjudgmental focus on the experience of eating (Hayes, Follette, & Linehan, 2004). For mindful eating, participants practiced the awareness of the sight, smell, texture and taste of food while eating (Kristeller & Wolever, 2011). Ideally, mindful eating enhances the satisfaction and joy of eating, allowing participants to enjoy small amounts of restricted foods and opting for larger servings of fruits and vegetables to satisfy hunger. Thus, mindful eating has the potential to help the individual follow his or her dietary recommendations.

Participants were asked to work on weekly activities (e.g., mindful eating, food label reading, practicing mini-meditations) and self-set goals in between group sessions. These weekly activities were designed to further build self-efficacy. Self-efficacy, confidence in one’s ability to do a behavior, is an important determinant of health behaviors (Pender, Murdaugh, & Parsons, 2010). The weekly activity log submitted served as a fidelity check on mindful eating and other activities. The average number of days per week that participants reported engaging in mindful eating over five weeks was 4.4 (SD = 1.89) with 47% mindfully eating at least 5 days/week, 37% mindfully eating 3–4 days/week, and 16% mindfully eating less than 3 days/week.

Outcome measures

The endpoints for this study included: assessment of weight, BMI, dietary intake (average of three 24-h dietary recalls), and analysis of fasting blood samples: eGFR to measure kidney function and plasma carotenoid panel as a proxy for fruit and vegetable intake. Since weight loss can improve control of hypertension and diabetes (Jensen et al., 2013), the predominant contributors to CKD progression, weight is a short term measure of success. Weight was measured by a trained research assistant to the nearest 0.1 kg using a calibrated beam medical scale and height was measured to the nearest 0.1 cm with stadiometer. BMI was calculated from the measured heights and weights (kg/m^2).

At baseline and post-intervention, three 24-h dietary recalls were collected using the multiple pass method. The three 24-h dietary recalls, which included two week days and one weekend, are an optimal approach to calculating average dietary intake (St. Jeor, 2002). The multiple pass method includes five distinct interview passes reviewing 24-hour intake to provide participants multiple opportunities to recall intake; the 5th pass reviews reported dietary intake with the participant to ensure accuracy (Nutrition Coordinating Center, 2016). To enhance the accuracy of the 24-h dietary recalls, a nutritionist trained in the multiple pass method using the Nutrition Data System for Research software (NDSR, 2016; University of Minnesota, Minneapolis, MN) used standard prompts to input food intake directly into the software program. Two-dimensional food models were provided for participants to improve estimations of portion size. Dietary data were analyzed for nutrient and dietary intake (3-day average of daily intake of energy/calories, fat, saturated fat, protein, carbohydrates, sodium, potassium, phosphorus, beta-carotene, lutein + zeaxanthin, alpha-carotene, beta-cryptoxanthin, lycopene and servings of fruit and vegetables).

Based on a study examining differences between the multiple pass method for 24-h dietary recalls and measured food intake, there is less than 10% difference in intake of all macronutrients (Conway, Ingwersen, & Moshfegh, 2004). Studies support that this recall method accurately assesses intake of a range of nutrients (Blanton et al., 2006; Conway et al., 2004). One of the 3 day 24-h recalls (both pre-and post-intervention) was collected in person and two additional unscheduled 24-h dietary recalls were then obtained within the week via telephone for both pre- and post-intervention. Based on a paired *t* test, there were no significant differences in mean total caloric intake between the single in-person and the two averaged telephone recalls.

A fasting blood draw was obtained at pre-intervention and at post-intervention by a trained phlebotomist using standardized laboratory procedures and sent to an established laboratory for analyses. Laboratory values analyzed were eGFR, a standard measure of kidney function used to identify stage of kidney disease, and plasma carotenoids. Plasma carotenoid levels are validated biomarkers/determinants of fruit and vegetable intake in a dose dependent relationship (Campbell et al., 1994) when compared with dietary intake collected via food frequency questionnaires or 24 h dietary recalls (Burrows et al., 2015a). Plasma carotenoids are biomarkers used to assess the relationship between chronic diseases, such as cardiovascular disease and cancer, and fruit and vegetable intake (Broekmans et al., 2000; McEligot et al., 1999). Since the phytochemicals in fruits and vegetables are diverse, it is important to use a range of carotenoids as biomarkers for fruit and vegetable intake (Burrows et al., 2015b). Therefore, this study examined the following carotenoids: lutein, zeaxanthin, cis-lutein/zeaxanthin, alpha-cryptoxanthin, beta-cryptoxanthin, trans-lycopene, cis-lycopene, alpha-carotene, trans-beta-carotene and cis-beta-carotene. The intra-and inter-individual coefficients of variation respectively for each carotenoid peak were: 1.04 and 1.05 for lutein; 2.30 and 6.88 for zeaxanthin; 2.22 and 7.94 for α-cryptoxanthin; 1.30 and 4. 44 for β-cryptoxanthin; 1.04 and 4.07 for trans-lycopene; 0.66 and 3.32 for cis-lycopene; 1.07 and 9.30 for α-carotene; 0.75 and 5.69 for trans-β-carotene; and 0 l.65 and 5.89 for total β-carotene.

Statistical analyses

Data were entered, reviewed and analyzed using Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 23.0, Armonk, NY). Given the small sample size, log transformations were not used to correct for normality. Descriptive statistics, including means and proportions, were calculated to describe the sample and variables. Paired sample t-tests were computed to test the differences in the means between pre- and post-intervention outcomes. Significance was set at the *P* value of 0.05.

Results

Participants were on average adults aged 64.7 year old (SD = 8.1) with the majority male (73.7%), well-educated (63.2%) (at least some college or a Baccalaureate degree), and retired (73.7%). The sample was diverse in race/ethnicity and income (see Table 2). Hypertension was the most common co-morbidity and over half of the participants had Type 2 Diabetes. Indeed over half had three or more health conditions other than CKD (inclusive of hypertension and diabetes) and were taking seven or more prescription medications. Over half (53%) of the participants were classified as obese and 42% were overweight.

Participants experienced significant weight loss from baseline to post-intervention (see Table 3). Overall, the mean weight decreased by 3.3 lb. However, the mean value for weight loss masks the effects of the intervention. Nine participants lost from 3 to 17 lb with the average weight loss for that group of 8.4 lb (SD = 4.8). An additional 8 participants remained weight neutral within 2 lb of their starting weight, while the final 2 participants gained 3 and 5 lb, respectively. Similarly, BMI improved significantly.

From baseline to post-intervention, there were no significant differences in nutrient and dietary intake from the averaged 3-day 24-h recalls (see Table 3); however, the percentage of participants who met nutrient recommendations improved for: (1) total fat of ≤30% (16 to 32%); (2) saturated fat of <7% (5 to 16%); (3) protein of 0.8 g/kg of an individual’s weight or the health care provider’s individualized recommendation (84 to 89%); (4) sodium of ≤2300 mg (50 to 100%); (5) sodium of ≤1500 mg (12.5 to 38%); (6) at least 2 fruit servings for females and 3 fruit servings for males (15.8 to 26.3%); and (7) at least 3 vegetable servings for females and 4 vegetable servings for males (21.1 to 26.3%) (American Heart Association, 2016; Institute of Medicine, 2005).

Increases were seen in several plasma carotenoid values, as shown by mean changes between baseline and post-intervention in Table 4. In particular, compared to baseline levels, cis-beta-carotene levels increased significantly ($P = 0.008$), while cis-lutein/zeaxanthin ($P = 0.06$) and alpha-carotene ($P = 0.06$) approached significance. These increases were correlated with increases in fruit and vegetable intake from baseline to post-intervention. Correlations between number of fruit and vegetable servings as determined by the NDSR and the plasma carotenoid values were significant for lutein (r = 0.62; $P = 0.005$), zeaxanthin (r = 0.52; $P = 0.02$), and trans-beta-carotene (r = 0.61; $P = 0.006$), and marginally significant for cis-lutein/zeaxanthin (r = 0.42; P = 0.0.07), cis-beta-carotene (r = 0.42; $P = 0.08$), and alpha-carotene (r = 0.44; $P = 0.06$).

Open-ended questions during exit interviews with participants yielded positive responses for both the intervention and the modules. Mindful eating and mindful eating meditations were the top ranked intervention component spontaneously identified (7 of 19 participants). Goal setting (7 of 19 participants) followed by label reading (6 of 19 participants) were identified as being the most useful of the homework assignments. When asked about making improvements to the intervention, 10 of 19 participants had no suggestions and 5 participants recommended more sessions. This data supports a high level of acceptability to participants.

Discussion

The six-week *SM-DIME* intervention was found to be effective in promoting weight loss (mean loss 3.3 lbs.) and reducing BMI. Our findings are similar to both the *Mindful Restaurant Eating* study from which this intervention was adapted (average weight loss for sample of perimenopausal women 3.7 lbs.) (Timmerman & Brown, 2012) and the *Mindfulness-Based Eating Awareness Training* for persons with Type 2 Diabetes with an average weight loss of 3.4 lbs (Miller et al., 2012). With 95% of this CKD sample being overweight or obese and hypertensive, weight loss was an important dietary recommendation for potentially preventing further renal decline (Navaneethan et al., 2009).

About half of the participants had a substantial mean weight loss of 8.4 lbs., which is consistent with findings from the mindful eating intervention by Dalen et al. (2010) whose participants with a BMI ≥ 30 experienced a mean weight loss of 8.8 lb over 12 weeks. Two other mindful eating studies did not demonstrate significant weight loss (Daubenmier et al., 2011; Kidd, Graor, & Murrock, 2013). In a review of mindfulness and weight loss, the authors conclude that based on limited evidence, mindfulness training paired with weight management strategies seem to promote more positive effects for weight loss (Katterman et al., 2014). This explains the nonsignificant results found by some studies which did not focus on weight as a primary outcome and also supports using mindful eating as part of self-management interventions focused on weight as an outcome rather than a stand-alone treatment. These studies looking at the effect of mindful eating on weight had small samples of less than 60 (Dalen et al., 2010; Daubenmier et al., 2011; Kidd et al., 2013; Miller et al., 2012; Timmerman & Brown, 2012), furthering the need for additional research with larger samples.

Participants in the study improved their fruit and vegetable intake, most notably as measured by the fasting blood carotenoid panel, avoiding issues with underreporting that can occur with self-report dietary intake (Johnson, 2002). The correlations between fruit and vegetable servings and carotenoid levels in the blood ranged from −0.36 to 0.62 with the strength of the positive correlations moderate to strong for 6 out of 10 carotenoids. The significant correlations were comparable to or higher than those observed in the Nurses' Health Study and the Health Professionals Follow-Up Study (Michaud et al., 1998). These correlations are strong biomarkers of increases in fruits and vegetables that were an important focus of the *SM-DIME* intervention.

None of the past mindful eating intervention studies measured fruit or vegetable intake as outcomes. Improved dietary intake for persons with CKD should include measures for fruit and vegetable intake, especially in light of recent research in which a diet rich in fruits and vegetables reduced urinary markers of kidney damage in early stage CKD (Goraya et al. 2012).

The focus on mindful eating of fruits and vegetables (e.g., red peppers, yams) can be a strategy to increase satisfaction with one's diet (especially for those with a sweet tooth), while at the same time possibly reducing calorie intake by increasing fruit and vegetable consumption. Recent research has confirmed that even a brief mindful eating intervention can increase the enjoyment of both pleasurable food (i.e., chocolate) and less pleasurable food (i.e., raisins) (Arch et al., 2016). Increasing consumption of fruits and vegetables was emphasized in multiple ways throughout the *SM-DIME* intervention. For example, fruits and vegetables were identified as low sodium foods (unless canned), used as snacks during sessions, and highlighted in mindful eating exercises.

Although sodium intake did not have a statistically significant decrease, it is important to note that the percent of participants who met the sodium intake recommendations (≤2300 mg) improved dramatically from 50 to 100%. None of the mindful eating studies examined sodium intake as an outcome. Mindful eating has been primarily used as an intervention for binge eating, emotional eating and weight management (Katterman et al., 2014) rather than to address specific dietary recommendations. This is the first study to date to use mindful eating as a SM strategy to improve the dietary intake for those with complex dietary recommendations.

Strengths and limitations

The study limitations, due to the funding constraints of a feasibility study, need to be addressed in future research. The main limitations of this feasibility study were the small sample and the absence of a randomized control group. Future research needs to compare SM-DIME intervention to a SM only intervention in order to discern the contributions that the mindful eating component contributes to the outcomes. Although the weekly log documented the frequency that the participant ate mindfully, no specific questionnaire assessed pre- to post changes in mindful eating or in the pace or enjoyment of meals. If these data were collected, our carotenoid blood panel would have represented an independent biomarker of mindful eating response.

Long-term follow up is another limitation that needs to be addressed in future studies by including extended support (e.g., telephone or email support after initial intervention) and following participant outcomes for at least 1 year (Tirosh et al., 2013). The long term impact of this intervention is important to determine since maintenance of weight loss remains a challenge (Leahey et al., 2016). Extended treatment has been shown to consistently improve weight maintenance (Perri & Corsica, 2002) and innovative strategies to reduce behavioral costs (e.g., boredom) that affect long term maintenance need to be considered in interventions addressing dietary changes (Leahey et al., 2016). Long-term follow up has also been identified as a gap in the literature on the efficacy of interventions designed to improve diets for management of chronic disease (Desroches et al., 2013).

An additional limitation was the use of multiple comparisons without statistical adjustments (e.g., Bonferroni) to reduce the risk of missing differences (type II error) in a feasibility study that may be underpowered (Perneger, 1998). Lastly, the use of self-reported dietary intake is a limitation due to the tendency toward underreporting (Johnson, 2002). To address possible underreporting of food intake, we used the multiple pass method for 24-h recalls with 2-dimensional models to increase accuracy (Conway et al., 2004) and importantly had objective measures of weight, BMI and the fasting carotenoid panel pre and post-intervention to assess validity of dietary intake.

Despite these limitations, this study has several strengths. Once participants started the intervention both the attendance (average number of sessions attended 5.6 out of 6) and retention (90.5%) were high, demonstrating a strong commitment to the study in a diverse group of primarily men with multiple challenging health conditions. Individuals with CKD are identified as facing multiple barriers to clinical trial participation (Decker & Kendrick, 2014). The retention and attendance along with the positive feedback in the exit interviews from this study indicates that this intervention has a high level of acceptability to participants. This study contributes to the literature because SM interventions applying mindful eating as a component have not been previously tested. Further, mindful eating interventions have not been used to improve the diets for those with individualized dietary recommendations nor in the CKD population.

Conclusions

At the completion of the 6-week feasibility study, participants significantly lost weight and BMI with almost half of the participants losing on average 8.4 lb and increased cis-beta-carotene levels. Additional improvements were noted in the percentage of participant who met nutrient recommendations from pre to post-intervention. Also, increases appeared in several plasma carotenoid values, which provide an objective measure of fruit and vegetable intake. The results from this study are promising and require further testing in a randomized clinical trial that compares SM-DIME, SM only, and usual care treatment groups along with longer duration of follow up since interventions to improve dietary intake in the early stages of CKD are essential to preserving kidney function, delaying dialysis, and improving health outcomes in this population.

If SM-DIME proves to be effective, the use of small groups can be translated into practice through the use of group appointments in primary care or specialty practices. With its focus on SM, the intervention can be used by anyone in their daily lives, making it cost efficient. Thus, the approach has the potential to change treatment of CKD, reduce financial burden, and be applicable for widespread dissemination in the U.S.

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Table 1

SM-DIME intervention content and mindful eating exercises

	Content outline	Mindful eating and meditations (Timmerman & Brown, 2012)
1	Essential SM skills: setting goals, problem solving, reading food labels; behavior change strategies (e.g., self-monitoring)	Introduction to principles of mindful eating and mindful meditation; practice of mindful eating (raisins and grapes)
2	Weight management principles; heart healthy eating; planning for barriers to self-management of CKD diet recommendations	Use of mini-meditations; practice mindful eating (cheese and crackers); hunger awareness vs emotional hunger meditation
3	Understanding your diet recommendations for CKD; salt restriction; avoiding excess protein; potassium and phosphorus; resource utilization	Practice mini-meditations; taste satiety awareness meditation; practice mindful eating (chocolate); fullness awareness meditation
4	Managing the food environment and strategies for eating out; practice comparing food choices on menus	Practice mini-meditations; eating triggers meditation; practice mindful eating—making choices (cookies vs chips)
5	Review food groups and portions; diabetes, CKD and carbs; staying motivated; benefits of SM of CKD diet recommendations	Integrated mindful eating meditation/visualization of favorite meal; practice making mindful eating choices—salad bar
6	Review of previous sessions and skills; relapse prevention; long term goal setting	Review and practice of mindful eating and mindfulness meditation skills

Table 2

Demographic and clinical characteristics of participants (n = 19)

Variable	
Gender (%)	
Male	73.7
Female	26.3
Age [mean (SD)]	64.74 (8.08)
Race/ethnicity (%)	
Non-Hispanic White	36.8
Hispanic White	36.8
African American	15.8
Asian	10.6
Education level (%)	
Less than high school or high school graduate	36.8
Some college or baccalaureate degree	47.4
Masters/doctorate/professional degree	15.8
Income level (%)	
Less than $20,000	31.6
$20,001–$40,000	26.4
$50,000–$75,000	26.3
More than $75,000	15.8
Employment (%)	
Employed, full-time	15.8
Employed, part-time	10.5
Unemployed/retired	73.7
Self-reported stage of CKD (%)	
Unsure of stage of CKD	57.9
Stage 1 CKD	15.9
Stage 2 CKD	10.5
Stage 3 CKD	15.8
Stage of CKD measured by eGFR at baseline [% (n = 18)]	
Stage 1 CKD	5.2
Stage 2 CKD	21.1
Stage 3 CKD	52.6
Stage 4 CKD	15.8
Missing	5.2
Weight categories by BMI (%)	
Normal weight (18.5–24.9 kg/m^2)	5.2
Overweight (25–29.9 kg/m^2)	42.1
Obese (≥30 kg/m^2)	52.6
Other health problems (%)	
Hypertension	94.7

Variable	
Type 2 diabetes mellitus	52.6
High cholesterol	42.1
Depression	36.8
Heart problems	21.1
Anemia	10.5
Thyroid problems	10.5
Number of co-morbidities other than CKD (%)	
One other health problem	15.7
Two other health problems	26.3
Three other health problems	21.1
Four other health problems	21.1
Five or more other health problems	15.8
Number of medications (%)	
3–6 prescription medications	47.4
7–10 prescription medications	42.1
>10 prescription medications	10.5

Table 3

Baseline and post-intervention comparisons of means using paired *t* tests for weight, BMI and average dietary intake for three 24-h dietary recalls (n = 19)

Variable	Baseline (mean ± SD)	Post-intervention (mean ± SD)	*P* value
Weight (lbs)	203.21 ± 42.98	199.91 ± 40.36	0.03
BMI (kg/m^2)	32.02 ± 5.22	31.57 ± 5.27	0.04
Calories (kcal)	1340.21 ± 276.66	1289.18 ± 346.75	0.32
Total fat (g)	54.68 ± 15.89	50.61 ± 15.45	0.22
Saturated fat (g)	17.32 ± 7.21	16.85 ± 7.28	0.74
Total protein (g)	60.53 ± 19.13	60.03 ± 16.95	0.92
Total carbohydrate (g)	158.97 ± 43.45	151.72 ± 51.70	0.32
Sodium (mg)	1872.40 ± 578.35	1640.44 ± 617.40	0.16
Potassium (mg)	2032.25 ± 713.15	2021.49 ± 621.37	0.98
Phosphorus (mg)	901.98 ± 231.64	866.74 ± 209.88	0.44
Beta-carotene equivalents (mcg)	2274.67 ± 2665.29	3841.98 ± 3955.38	0.10
Lutein + zeaxanthin (mcg)	1588.60 ± 2382.68	1690.98 ± 1387.26	0.80
Alpha-carotene (mcg)	365.30 ± 542.50	651.95 ± 605.82	0.02
Beta-cryptoxanthin (mcg)	78.26 ± 81.76	216.28 ± 631.51	0.37
Lycopene (mcg)	4216.26 ± 4608.84	2936.21 ± 3527.93	0.35
Servings of fruit	1.24 ± 1.32	1.83 ± 1.59	0.26
Servings of vegetables	2.57 ± 1.53	2.56 ± 1.60	0.98

Table 4

Baseline and post-intervention comparison of mean laboratory values using paired *t* tests (n = 18)

	Baseline (mean ± SD)	Post-intervention (mean ± SD)	*P* value
Estimated glomerular filtration rate—eGFR (ml/min/1.73 m^2)	51.00 ± 24.34	52.44 ± 24.22	0.42
Lutein (mcg/mL)	0.122 ± 0.083	0.147 ± 0.153	0.18
Zeaxanthin (mcg/mL)	0.045 ± 0.024	0.044 ± 0.278	0.78
Cis-lutein/zeaxanthin (mcg/mL)	0.022 ± 0.025	0.028 ± 0.024	0.055
Alpha-cryptoxanthin (mcg/mL)	0.020 ± 0.009	0.019 ± 0.009	0.11
Beta-cryptoxanthin (mcg/mL)	0.076 ± 0.032	0.082 ± 0.036	0.28
Trans-lycopene (mcg/mL)	0.138 ± 0.069	0.123 ± 0.048	0.29
Cis-lycopene (mcg/mL)	0.155 ± 0.067	0.146 ± 0.049	0.37
Alpha-carotene (mcg/mL)	0.036 ± 0.029	0.050 ± 0.041	0.06
Trans-beta-carotene (mcg/mL)	0.137 ± 0.117	0.148 ± 0.082	0.48
Cis-beta-carotene (mcg/mL)	0.020 ± 0.012	0.026 ± 0.015	0.01