

Impact of Cooking and Home Food Preparation Interventions Among Adults: A Systematic Review (2011–2016)

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ABSTRACT

Objective: To update a review of the impact of interventions for adults that included a cooking component on diet, health, and psychosocial outcomes.

Design: A total of 3,047 records were identified by searching MEDLINE, Agricola, Web of Science, and the Cochrane Central Register of Controlled Trials (January, 2011 to March, 2016). A total of 34 articles met inclusion and exclusion criteria for analysis. Study description and outcomes were extracted and synthesized to generate conclusions regarding impact.

Results: Less than half of the studies included a control group. The most common intended outcomes were improvements in fruit and/or vegetable intake and weight. The majority of studies showed positive dietary behavior changes and improvements in cooking confidence and knowledge. Limitations included the lack of a control group, no follow-up past after intervention, the use of nonvalidated assessment instruments, and small convenience samples.

Discussion: Findings were similar to a previous review regarding positive impact on dietary and cooking confidence outcomes. Clinical and weight outcomes were addressed in more studies included in the current review than in the previous 1; however, limitations were similar.

Conclusions and Implications: Intervention design and assessment tools need to be strengthened in intervention studies with cooking components.

Key Words: cooking, adults, systematic review, impact, diet, eating patterns, health promotion (*J Nutr Educ Behav.* 2017;■■:■■–■■.)

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INTRODUCTION

Recent reviews of cooking interventions generally supported the view that more frequent cooking at home and food preparation based on improved skills lead to better diet quality and improved health and weight status among adults.¹⁻⁶ These findings likely fueled interest in the development and implementation of interventions for adults in community and medical set-

tings designed to improve cooking and food skills. These reviews provided some understanding about which outcomes are commonly addressed in cooking interventions to improve health and prevent chronic disease, their effectiveness or impact, and limitations.¹⁻⁶

Rees et al¹ reviewed 13 community-based interventions among groups of adults conducted in the United Kingdom from 1995 onward for

effectiveness in improved skills and knowledge about home cooking. Beneficial effects were noted for some studies, but overall evidence of effectiveness was judged to be inconclusive because of the lack of quality evaluation methods. Several other reviews reported more positive findings. Iacovou et al² reported results from 10 international studies of cooking interventions in community kitchens published between 1997 and 2010 involving adults and families. Positive effects were reported on improvements in participants' cooking skills, social interactions, and dietary intake. Another review of 9 community-based interventions to improve cooking skills among adults (2004–2016) described consistent improvement in confidence in cooking skills, with less consistent evidence for improvement in eating behavior.³ Reicks et al⁴ reviewed 28 studies for effectiveness of cooking interventions for adults (published between 1980 and 2011), with generally positive findings for dietary

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intake, knowledge and skills, and health outcomes. However, the lack of controlled studies, the wide variety of study populations, and the use of nonvalidated assessment tools were noted as factors that limited stronger conclusions.

Two reviews also characterized the variety of outcomes addressed in cooking interventions.^{5,6} McGowan et al⁵ presented information about specific cooking and food skills based on the intended outcomes of 41 previous cooking interventions. The theoretical basis and relationships to diet were also examined. Common intervention outcomes measured in these interventions were positioned within cooking skills including food preparation and cooking frequency, and general cooking confidence and cooking ability. Common food skills included planning food shopping, as well as purchasing and shopping behaviors. Common dietary outcomes measured were meal patterns and usual food selection. Raber et al⁶ summarized the outcomes of 59 cooking interventions to prevent chronic disease within a conceptual framework involving 5 major constructs and a series of individual behaviors. The 5 major constructs included cooking frequency, skills and methods, minimal use of ingredients that guidelines suggested should be limited,⁷ ingredient additions and replacements, and flavorings. Observational studies of the relationship among home cooking and diet, health, and social outcomes were also reviewed. Mills et al⁸ reported results based on a narrative synthesis of 38 primarily cross-sectional studies. From these studies, a conceptual model was introduced that illustrated established and potential relationships between determinants of home cooking and various influential factors.

The last comprehensive review of the effectiveness of cooking or food preparation interventions covered 1980 to 2011 and resulted in 28 studies.⁴ However, a number of interventions that included cooking components were published over the past 5 years, indicating that another comprehensive review of their effectiveness is warranted. Therefore, the purpose of this study was to review the impact of interventions for adults that included a cooking component, from

January, 2011 to March, 2016, on diet, health, and psychosocial outcomes.

METHODS

Search Strategy

A team composed of 1 nutrition professor (MR) and 1 public health research analyst (JR), both of whom had expertise in community-based public health programs with cooking components, and 1 science librarian trained in systematic reviews (MK) conducted the review. The systematic review of literature focused on cooking and home food preparation interventions published between January, 2011 and March, 2016. The protocol for this systematic review is registered on PROSPERO (CRD42016036081). The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines⁹ were used to conduct this review. The search strategy was developed and executed by a librarian (MK). Searches were performed in 4 electronic databases (MEDLINE, Agricola, Web of Science, and the Cochrane Central Register of Controlled Trials) for articles related to cooking interventions and diet- or health-related outcomes. Search terms included but were not limited to: *cooking; cookery; food preparation; health promotion; health education; self-efficacy; health behavior; body mass index; diabetes mellitus; overweight; health knowledge, attitudes, practice; choice behavior; health status; feeding behavior; diet; eating; health promotion; family health; nutrition; dietary habits; dietary outcome; skills; food habits; food intake; eating patterns; and dietary intake*. The complete MEDLINE search strategy can be accessed via the PROSPERO record. The MEDLINE strategy was adapted for the other databases. The search period was from January 1, 2011 to March 3, 2016. The authors selected 2011 as the start period because a previous review covered interventions before and including 2011.⁴ All studies published in 2011 and included in the previous study were excluded from the current review.

Article Selection and Inclusion Criteria

The [Figure](#) illustrates the article search and selection process. Initial screen-

ing by title and abstract was performed using a reference management program (version 1.0, RefWorks, ProQuest LLC, Bethesda, MD, 2016) and was split among the 3 authors so that 2 researchers screened each reference. In cases of disagreement, the 2 researchers who had screened the article discussed it and reached an agreement. For studies selected through the initial screening, full-text articles were obtained for further evaluation. Again, the articles were distributed among the 3 authors so that 2 researchers read each article and assessed it for inclusion. Articles were included if they (1) were published in a peer-reviewed, English-language journal; (2) were original studies that included a cooking intervention component; (3) reported outcomes for adult populations; (4) reported outcome measures that applied to individuals who were participating in the cooking intervention; and (5) reported outcomes with quantitative measures. Articles were excluded if (1) they were not written in English; (2) they were published only as abstracts; (3) interventions targeted only at children; (4) they were not intervention studies (eg, cross-sectional, qualitative, or quantitative studies such as dietary assessment, attitude, and behavior surveys, focus group or individual interviews, case studies, reports, commentary, and formative development of programs); (5) they were intervention studies with an insufficient description of the cooking component; (6) they were intervention studies that did not include a cooking or food preparation component; (7) food preparation was described without evaluation measures; (8) food safety was the only reported outcome; and (9) outcomes from the cooking intervention were not related to cooking (eg, cooking as behavioral therapy).

In instances in which multiple articles reported on the results of the same study, all 3 authors reviewed the articles and discussed which article should be included based on comprehensiveness of reporting outcomes. The primary reason for exclusion at this stage was that articles were not about cooking interventions (eg, many articles related to cook stoves showed up in search results).

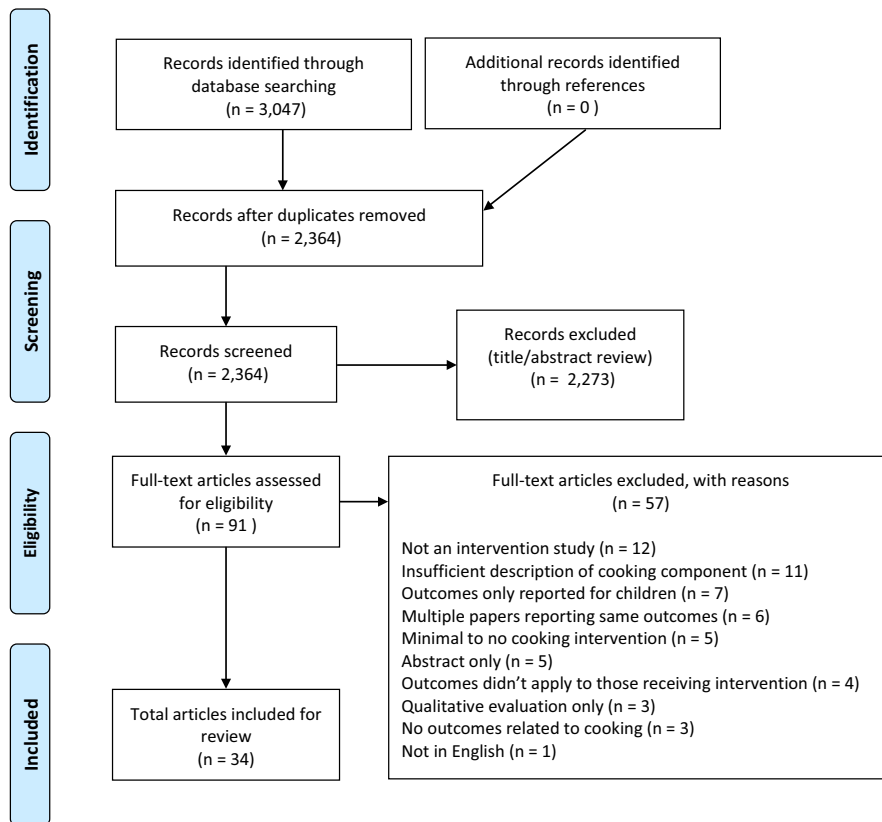


Figure. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow diagram of the process to identify and screen included studies.

A total of 34 articles¹⁰⁻⁴³ met the inclusion criteria. The researchers examined their references to identify other articles for inclusion in the review, but this yielded no further articles that met the search criteria.

Data Extraction and Synthesis

One author extracted data from the 34 articles and entered them into a matrix table (Table); they were verified by a second author (the work was split among all 3 authors). The matrix included information for each study regarding the reference, study design, population, location, intervention, duration, outcome measures, and key findings.

Quality Rating

Each of the 34 articles was given a quality rating of positive, negative, or neutral based on the Academy of Nutrition and Dietetics Evidence Analysis Library's (EAL) quality criteria check-

list for primary research.⁴⁴ This checklist evaluates the validity of articles based on a clear statement of the research question, the presence of bias in the selection of study subjects, parity between study groups, the methods for handling withdrawals, the use of blinding to mitigate bias, a description of the intervention, the validity and reliability of outcome measurements, appropriate statistical analysis, whether the conclusions drawn are supported by the results, and the absence of bias in funding sources. Two researchers filled out the checklist for each article and assigned a rating independently (the work was again divided among all 3 authors). Initially, 74% agreement was reached on quality ratings. For quality ratings in which there was disagreement, all 3 authors discussed the rating until a consensus was reached and there was 100% agreement. An overall quality grade of fair was given to the whole set of articles using the Conclusion Grading Table from EAL.⁴⁴ All 3 re-

searchers completed the grading table together and reached a consensus on the grade.

RESULTS

About one third of studies (n = 15) were based in the US^{12,13,15,19,24,26,28,30-33,35,36,38,39}; Minnesota had the largest number of cooking-related studies (n = 4) of the 50 states.^{24,30-32} Among the included studies, 7 European countries were the geographic location, as well as Australia, Micronesia, Indonesia, Japan, and Hong Kong. In addition, 1 study featured a globally accessible online course.⁴¹ Settings for the cooking interventions ranged from cooperative extension classes in the US to adult community courses, hospitals, congregate meal sites, mobile health centers, private teaching kitchens, universities, and fire stations. The majority of studies targeted only adults and largely enrolled women, with the exception of 1 study aimed at reducing high blood pressure in men with a diagnosis of hypertension¹⁰ and another for those diagnosed with prostate cancer.¹³ Although the studies enrolled adults of all ages, age distribution across studies was skewed toward middle-aged or older adults.

Twenty-four studies did not specify a theoretical basis for the intervention. Of the 10 studies that indicated a theoretical framework was employed, Social Cognitive Theory⁴⁵ was used in 5; other studies also used the Transtheoretical Model–Stages of Change,⁴⁶ self-efficacy,⁴⁵ and Adult Learning Theory.⁴⁷ The description of how a particular theoretical framework informed the intervention varied. For a limited number of studies, authors described theoretical constructs in some detail and identified components of the intervention that were consistent with operationalizing the specific construct(s).^{12,15,35,36} However, for other studies, it was not always clear how the theory was incorporated into the structure of the intervention or the evaluation and interpretation of results. Twenty studies included some type of hands-on cooking experience as part of the intervention. Eight included only cooking demonstrations with no mention of study participants taking

Table. Study Information: Design, Population, Location, Intervention Description, Measures, and Findings

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
Interventions with a control group						
McGorrian et al (2015) ¹⁰	RCT, baseline, 6-, and 24-mo assessment	Sample: overweight/obese patients undergoing cardiac rehabilitation, mean age 63 y, 81% male, I: n = 57, C: n = 51 at 6 mo Setting: adult education center, Ireland Duration: 5 wk, 2-h sessions	To provide high-quality and engaging program to motivate participants to modify their dietary patterns and lose weight successfully	I: Cookery skills course, demonstrations, written educational materials, recipe C: Written materials only TF: None	Lifestyle risk factor questionnaire, FFQ, measurement of height to weight ratio to assess BMI and macronutrient change	No difference in BMI, macronutrient, energy, fiber, alcohol, FV, or other food group intakes at 6- or 24-mo follow-up
Poelman et al (2015) ¹¹	RCT (wait-list control), baseline T0, 3 mo (T1), 6 mo (T2), 12 mo (T3) assessment	Sample: overweight/obese nutritional gatekeepers, mean age 46 y, 97% Dutch, 85% female, n = 278 Setting: 6 urban areas, 21–45 km from Amsterdam, Netherlands Duration: 3 mo T0–T1	To determine effectiveness of <i>PortionControl@HOME</i> intervention on BMI and portion control behavior	I: PortionSize@awarenessTool, portion control strategies, cooking class, home-screener, 3 online portion control boosters via e-mail, demonstrations of appropriate svgs of common foods and preparation of meals lower in energy density C: Wait-list control group TF: None BS: Self-regulation	Measurement of height to weight ratio to assess BMI, questionnaire to assess strategy use and dieting behavior	Increased frequency portion control behavior at 3-, 6-, and 12-mo follow-up. BMI decreased only at 3-mo follow-up; effect on BMI mediated by portion control behavior
Greenlee et al (2015) ¹²	RCT, baseline, 3-, 6-, and 12-mo assessments	Sample: Hispanic women with breast cancer, mean age 57 y, I: n = 34; C: n = 36 Setting: Columbia Teachers College, New York City	To examine effect of culturally based approach to dietary change on increasing FV intake and decreasing fat intake	I: nutrition education, cooking classes, food-shopping field trips, cooking methods and patterns of FV and fat intake, shared meal, facilitated discussion of barriers	3 24-h recalls to assess change in daily FV svgs and percent calories from total fat	At 6 mo, increase in mean svgs FV, decreased energy intake in I compared with C; increase in intake targeted FV, nonsignificant

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Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
Carmody et al (2012) ¹³	RCT, baseline, 3-mo follow-up assessments	Duration: 9 sessions (1.5–3 h for 24 h over 12 wk) Sample: men with prostate cancer, 91% non-Hispanic white, mean age 69 y, I: n = 17, C: n = 19 Setting: central Massachusetts Duration: 11 weekly 2.5-h classes	Using a ratio of animal to vegetable proteins (A:V) to evaluate whether a comprehensive dietary change was self-sustaining after completion of 11 weekly dietary and cooking classes that integrated mindfulness training	C: written dietary recommendations. TF: SCT, TTM-SOC I: prepared and cooked study-compliant meal, ate family style, mindfulness training, meditation and stretching exercises. C: usual care TF: none	Prostate-specific antigen, body weight, quality of life, 3 24-h recalls to assess dietary intake and A:V	decrease in percent calories from fat and weight I: decreased animal protein, energy, increased vegetable protein, improved A:V compared with C, maintained at follow-up
Villarini et al (2012) ¹⁴	RCT, baseline, end of chemotherapy (~3 mo)	Sample: women undergoing chemotherapy, I: mean age 53 y, n = 47, C: mean age 48 y, n = 47 Setting: Milan, Italy Duration: 2 times/wk for duration of chemotherapy (~3 mo)	To test whether a diet aiming to lower insulin levels, based on Mediterranean and macrobiotic recipes, could prevent an increase in body weight usually observed during adjuvant chemotherapy for breast cancer	I: kitchen activities (cooking classes and common meals) with instructions on how to reduce gastrointestinal side effects of chemotherapy C: baseline recommendations only TF: none	Weight, BMI, WC, HC, triceps skin fold, bicep skin fold, underscapular skinfold, suprailliac skinfold, fat mass, fat-free mass, basal metabolism, total water, 6 24-h recalls to assess dietary compliance	I: reduction in body weight, body fat mass, WC, HC, underscapular and suprailliac skinfolds compared with C at end of chemotherapy, no difference in hematological changes between groups; I: more frequent whole-grain cereals, legumes, less frequent sugar, refined cereal,

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Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
Peters et al (2014) ¹⁵	RCT, 2 eating pattern groups: whole foods, plant-based group; moderate-fat group with and without added ground flaxseed, baseline, 6-, 12-mo assessment	Sample: menopausal women, mean age 57 y, 70% white, 80% non-Hispanic, whole foods, plant-based, group, n = 22; moderate-fat group, n = 49 Setting: teaching kitchen, greater New York City area Duration: 14 weekly sessions followed by biweekly sessions, then monthly sessions/1 y, 24 sessions	To determine the degree of dietary adherence or change in eating patterns, and demographic, psychosocial, and study characteristics associated with adherence	I: behavioral sessions, hands-on cooking classes, food demonstrations and tastings, progress review, newsletters, among 2 eating pattern groups TF: SCT, self-efficacy, and self-control theories BS: goal-setting and action plans	24-h food recalls, psychosocial questionnaire, nonadherence score; svgs out of compliance with recommendations to assess change in svgs of specific foods, change in nonadherence	dairy products compared with C, no difference in meat, vegetables, fruit between groups Changes in intake of select foods maintained at follow-up, no changes in attitudes, weight, or BMI. Decreased nonadherence scores in both groups maintained at 12-mo follow-up
Flego et al (2014) ¹⁶	Quasi-experimental, wait-list control group, baseline T1, program completion T2, 6-mo follow-up T3 assessment	Sample: adults, I: n = 694 T1, 383 T2, 214 T3, 56% > 50 y, 77% female, C: n = 237 T1, 129 T2, 64% > 50 y, 87% female Setting: fixed site, main Ipswich shopping	To evaluate the immediate impacts and longer-term outcomes of Jamie's Ministry of Food program	I: cooking course to prepare simple basic meals from scratch, specific cooking techniques, good nutrition, meal planning, and budgeting C: wait-list control group TF: none	Questionnaire to assess cooking confidence, vegetable intake, frequency of cooking from basic ingredients, eating ready-made meals at home,	I: increases in all cooking confidence measures (over time and group × time), increases in frequency eating vegetables with main meal and daily vegetable

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Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
Fahmida et al (2015) ¹⁷	Quasi-experimental, 4 intervention groups combined into 2 groups, baseline, 6-mo assessment	precinct, Queensland Duration: 10 wk, 1.5-h weekly classes Sample: mothers of children 9–16 mo at baseline, CFR group, n = 239, non-CFR group, n = 216 Setting: Subvillages and homes in East Lombok, West Nusa Tenggara Province, Indonesia Duration: 6 mo	To assess effectiveness of promoting optimized CFRs for improving maternal knowledge, feeding practices, and child intakes of key problem nutrients (calcium, iron, niacin, and zinc)	I: monthly cooking sessions with cooking demonstrations and practice, a cooking competition, and games, making complementary foods, using feeding recommendations, listing foods consumed by children on a daily basis C: weekly visits to collect forms TF: none	vegetables with main meal, eating fruit, and eating takeaway foods Structured interview, 24-h recall, and 1-wk FFQ to assess nutrition knowledge, child feeding practices, and child nutrient intakes	intake compared with C Improved knowledge, feeding practices
Kitaoka et al (2013) ¹⁸	Non-RCT, baseline, postassessment	Sample: hypertensive men, I: n = 38, mean age 66 y, C: n = 26, mean age 64 y Setting: Kyoto, Japan and nearby towns, Kyoto Prefectural University Duration: 5 monthly sessions, 4 h long	To evaluate the effect of a dietary educational program	I: lecture on diet to reduce BP, cooking instructions; cooked lunches and ate together, kept diet records C: data collection only TF: none BS: self-monitoring, individualized feedback, reinforcement, problem solving	Measurement of height to weight ratio, BMI, WC, BP, body fat, serum cholesterol, urinary sodium and potassium and excretion, and sodium to potassium excretion ratio. FFQ including dietary habits to assess salt reduction awareness and behaviors	I compared with C greater decrease in urinary sodium to potassium excretion ratio; I: salt restriction awareness improved, decreased intake of Japanese noodle soup, low-density lipoprotein and diastolic BP reduction; I and C: decrease in sodium excretion and weight

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Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
Condrasky et al (2013) ¹⁹	Randomized, delayed intervention control group, baseline, postassessment (15 mo)	Sample: Cooks from 57 churches, 99% African American, 80% > 50 y, I: n = 42, C: n = 42 Setting: AME churches, 4 areas of South Carolina Duration: 1 8-h session, 15 monthly mailings	To describe the development and evaluation of a participatory training for cooks	I: hands-on cooking workshop, chef demonstration of skills, menu-building exercises, food safety and cooking for healthy lifestyle, monthly mailings, technical assistance phone calls, booster sessions offered; Community-based participatory research CBPR approach C: delayed-treatment control TF: none	Surveys to assess cooking confidence and skills	I: improved self-rated cooking skills and confidence compared with C
Vadstrup et al (2011) ²⁰	RCT, individual vs group-based counseling, baseline, postassessment (6 mo)	Sample: adults with type 2 diabetes, mean age 58 y, n = 143 Setting: primary health care center; diabetes outpatient clinic, Copenhagen Duration: group 1: 12 wk, 6 90-min sessions/wk, 90-min exercise 2 times/wk, 2 3-h cooking sessions. Group 2: 4 1-h sessions, 2 30-min follow-ups	To determine the effectiveness of group-based rehabilitation vs individual counseling on HRQOL and self-rated health	I: group 1: group-based diabetes management, tailored exercise component, cooking classes with supermarket visit; group 2: individual counseling with personalized information and guidance, goal setting and action planning, with follow-up TF: none BS: empowerment approach and goal setting	Medical Outcome Study SF36 to assess HRQOL, Diabetes Symptom Checklist to assess self-rated health	No difference in HRQOL and self-rated health between groups. Individual counseling had greater improvement in vitality score, hyperglycemic and hypoglycemic distress compared with group counseling
Sorensen et al (2011) ²¹	RCT, cooking vs NLP course, baseline, post	Sample: patients achieving 8% weight loss in	To test the hypothesis that weight regain is	I: cooking: low-fat, high-flavor meals preparation with pleasurable	Body weight to assess weight maintenance	No difference in weight loss maintenance

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Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
	(5 mo), follow-up assessment (3 y)	previous program, mean age ~40 y, 48% to 56% female, baseline, n = 49, 3-y follow-up, n = 34 Setting: private cooking school, Denmark Duration: cooking and NLP: 10 sessions/5 mo, 3-y follow-up	partially attributable to poor compliance because of a lack of palatability and culinary pleasure with traditional fat-reduced cuisine	textures, C: NLP for behavior modification to sense bodies' needs TF: none		between groups during treatment and follow-up; lower dropout rate in cooking group
Plüss et al (2011) ²²	Prospective, 1-y RCT, 5-y follow-up assessment	Sample: Patients with MI, mean age 64 y, ~ 78% male, n = 224 Setting: hospital and hotel, Sweden Duration: Both groups, 1 y: 60-min exercise sessions, 2 times/wk for 3 mo, 1-h counseling, 2 90-min educational sessions; expanded: 5-d hospital stay, 20 2-h group stress management sessions, 3 3-h weekly cooking sessions	To evaluate whether an expanded cardiac rehabilitation program intended to alter patients' lifestyle could decrease cardiac events compared with standard cardiac rehabilitation over 5 y	I: standard and expanded care: exercise, cardiologist counseling, insurance/welfare counseling, smoking cessation in groups or individually; expanded care: hospital stay with exercise and information; stress management, cooking sessions C: standard care TF: none BS: stress management	Cardiovascular events: death, MI, readmission for CVD, days in hospital	Number of cardiovascular events, days in hospital for CVD reasons reduced in expanded care group compared with standard care group
Kwon et al (2015) ²³	RCT, baseline, 12-wk follow-up assessment (6 mo)	Sample: prefrail women, mean age ~77 y, n = 89, 25–27/group	To examine the effects of a combined physical training	I: exercise group: warm-up, stretching, muscle strengthening, and balance exercises,	Dietary variety score, Medical Outcomes Study SF36 to assess	Postintervention E group increased handgrip strength compared with

(continued)

Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
		Setting: research center, Tokyo, Japan Location: Exercise: 1-h weekly session for 12 wk, Exercise/Nutrition: exercise plus weekly 2- to 3-h cooking class	and nutritional program administered through a cooking class on physical performance and HRQOL	cool-down; exercise/nutrition group: same exercises plus cooking classes, instruction and practice, eating together, clean-up, and nutrition education including dietary variety C: neither exercise or nutrition TF: none	HRQOL, skeletal muscle mass, physical performance, muscle strength, balance, and walking speed	control; no positive effects maintained at follow-up; role of emotional score increased in EN group compared with control after intervention; dietary variety not compared postintervention
Studies with no control group						
Anderson et al (2015) ²⁴	Single-group, baseline, 4-mo assessment	Sample: low-income, n = 33, mean age 38 y, 79% Hispanic, 76% female Setting: park and recreation centers, Minneapolis, MN Duration: 16 weekly 2-h classes	To test the hypothesis that a childhood obesity intervention would be efficacious in helping families achieve evidence-based healthy behaviors, and ultimately healthier BMIs	Cooking and eating, educational activities, and PA Focus on value of balanced meals and snacks complemented by recipes and cooking lessons TF: none	Health-related behavior survey and measurement of height to weight ratio to assess screen time, sugared beverage intake, frequency of eating breakfast, weekly, PA, and BMI	Increased mean daily FV intakes, average number of days per week with at least 30 min PA; decreased mean daily sugar-sweetened beverage intake and mean daily hours computer screen time. No change in BMI
Villarini et al (2015) ²⁵	Single-group, baseline, 6-mo assessment	Sample: adults, mean age 57 y, 62% female, n = 186 Setting: community-run pharmacies, Perugia, Italy Duration: 5 conferences, 5 cooking classes, 12 PA	To evaluate the impact of a lifestyle intervention in changes in metabolic risk factors	Booklet with recommendations regarding MetS, kitchen courses to reduce glycemic and insulinemic response through moderate caloric restriction, reduced intake of high-glycemic foods, saturated fat, protein	PA and diet questionnaires, measurement of height to weight ratio, BP, cholesterol, TG, and glycemia to assess intake of calories, intake of high-glycemic foods, saturated	No differences in dietary intake or PA from pre- to postassessment; improvements in MetS parameters (weight, BMI, and cholesterol) but not BP, TG, or glycemia

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Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
Mayfield et al (2014) ²⁶	Single-group, baseline, post, 2-mo assessment	sessions/6 mo Sample: Child care food service staff, n = 446, pre-post assessment, n = 160, follow-up assessment Setting: Indiana Duration: Half-day workshop	To evaluate a program with pre-post assessment at workshops and a follow-up assessment to measure changes in knowledge, attitudes, and reported behavior	and intake TF: none Workshop on practices to enhance role modeling, improve environment, create nutritious snacks and meals, involve children, and partner with parents; menu makeover, food demonstrations, tasting opportunities, video clips, and goal setting TF: Adult Learning Theory	fat, and animal protein Questionnaire to assess change in knowledge, attitudes, and reported behavior	Improved knowledge of whole-grain recommendations and feeding practices, improved attitudes, and behaviors
Chung and Chung (2014) ²⁷	2 treatment groups with different food provision rates, baseline, 6-mo assessment	Sample: Chinese adults, mean age 74 y, 1:5 men–women ratio, n = 60 Setting: mobile integrative health center, Hong Kong Duration: 3-weekly seminars	To evaluate a 3-wk program composed of cooking demonstrations with free food samples in motivating elderly adults to cook more and improve their nutritional status	Seminars on nutrition, nutrient function, healthy food choices and food labeling, 1-d recipe with video of cooking steps, free ingredients TF: none	Mini-nutrition assessment scores and survey to assess nutrition status, compliance, appetite, and easiness of program	Group with more frequent food provision had greater compliance than the other group. Nutrition assessment scores improved at 6 mo for combined groups. Both groups had strong intention to continue to cook with recipes. Improved diet assessment scores, compliance, appetite, easiness of program at 3 wk time points
Goheer et al (2014) ²⁸	Single-group, post-only assessment	Sample: 90 participants from	To design, implement, and	Nutrition education, demonstration of	Survey to assess health, weight,	88% reported trying new food or

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Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
		6 stations, 78 completed postintervention survey Setting: Volunteer/paid fire department, Maryland Duration: Monthly 90-min sessions for 6 mo	evaluate a pilot nutrition intervention to reduce obesity and risk of heart attack	healthy meal preparation, tools/resources, handouts, brochures, posters TF: SCT	and risk of heart attack, trying new foods and food preparation methods, and changes in station and home food environment	preparation method; 59% reported changes in station food environment; 71% reported changes in home food environment
Garcia et al (2014) ²⁹	Single-group, baseline, 1-y assessment	Sample: parents of nursery-aged children, 97% female, most <45 y, n = 102 baseline, n = 44 at 1 y Setting: nurseries, Ayrshire and Arran, Scotland Duration: weekly practical sessions for 2 h for 4–8 wk	To evaluate longitudinally the effectiveness of a cooking program on self-reported confidence about cooking skills and food consumption patterns	Group activities, games, shopping, label reading skills, preparing and cooking ≥1 dishes to take home TF: none	Questionnaire to assess cooking confidence, eating patterns, dietary and knowledge changes, family eating habits, shopping, cooking, and budgeting skill	Confidence in 4 aspects of cooking increased from baseline to postintervention, retained at 1-y follow-up only for following simple recipe and preparing or cooking new foods. Improved food consumption patterns from baseline to postintervention (ready-meal consumption reduced, FV consumption increased pre-post, sustained at 1-y follow-up)
Hearst et al (2014) ³⁰	Single-group, baseline, 6-wk assessments	Sample: Somali women, mean age 44 y, n = 25,	To determine the feasibility, acceptability, and	Group nutrition and health education, 1 interactive cooking session with	Survey to assess nutrition knowledge,	Mothers provided children more frequent svgs FV;

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Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
		with children (3–10 y) Setting: community housing center, Minneapolis, MN Duration: 6 wk	impact of a parent-centered intervention to increase FV svgs and consumption among children	demonstration and hands-on opportunity to prepare and cook a variety of FV, grocery store field trip TF: none	importance of FV, barriers and self-efficacy to serving FV, frequency of serving FV to children at meals/snacks	increase in parent-reported intake of FV for themselves and their children
May et al (2014) ³¹	Single-group, baseline, postassessment	Sample: rural, low-income <i>Supplemental Nutrition Assistance Program</i> participants, n = 57; 45 completed pre- and postassessment Setting: Minnesota counties Duration: 6 2-h sessions	To improve self-efficacy and confidence, general food-related behaviors, and food- and health-related knowledge	20 lesson choices by food groups, hands-on activities to shop and store foods, observation of cooking demonstration, practice preparing and cooking, discussion of nutrition-related concepts, newsletters, equipment TF: Interactive Learning Theory	Questionnaire and FFQ to assess FV intake, use of shopping list, PA, self-efficacy to plan and prepare healthy meals and meals from scratch	Increased intake of FV, use of shopping list, making dishes with beans, being physically active, self-efficacy to plan and prepare healthy meal, and making foods from scratch
Rustad and Smith (2013) ³²	Single-group, baseline, 6-wk assessment	Sample: ethnically diverse, low-income women, mean age 35 y, n = 118 Setting: community setting, Minneapolis–St Paul Duration: 3 weekly sessions (wk 2–4), 75–90 min/class	To assess the impact of a short-term nutrition intervention using education on a comprehensive array of nutrition and health topics	Nutrition and health topics, hands-on activities and skill building, taste testing, resources. TF: none	Survey and FFQ to assess nutrition knowledge, general nutrition and health behaviors	Increased nutrition knowledge and vegetable intake, using herbs/spices in cooking, reading nutrition labels, PA with children, preparing healthy meals at home for family; decreased intake of fast foods, high-sugar foods, addition of sugar, salt and butter to foods

(continued)

Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
Bielamowicz et al (2013) ³³	Single-group, baseline, post third, post fourth final lesson assessment	Sample: previous diabetes management lessons, 79% ≥ 55 y, 76% white, 81% female, baseline n = 2,853; post n = 2,064; final n = 1,026 Setting: 86 counties, Texas Duration: 4 lessons, short-term	To evaluate participants' knowledge and use of healthy cooking practices as they relate to controlling diabetes	Cooking demonstrations, diabetes recipes to cut fat, sugar, and sodium and increase fiber; diabetes cookbook TF: multiple including Adult Learning Theory	Questionnaires to assess knowledge and use of healthy cooking practices to control diabetes, self-reported A1C levels	Improved perceived knowledge on 5 items and knowledge score, and 8 of 10 healthy cooking practices
Balagopal et al (2012) ³⁴	Single-group, baseline, postassessment (2 SES subgroups)	Sample: Mean age 42 y, 53% female, age ≥ 18 y, baseline n = 1,681, n = 1,638 postintervention Setting: rural village, Gujarat, India Duration: 5 individual and 5 group lessons, 6 mo	To test the effectiveness of a 6-mo community-based diabetes prevention and management program	Personalized health advice, glucose management counseling, weight loss education if needed, cooking competitions, demonstrations of model meals, healthy diet education. CBPR approach. TF: none	Diet recall, diabetes risk factor knowledge, PA score, glycemic status, BP, measurement of height to weight ratio, WC, HC, HbA1C, lipids, albumin, creatinine	Reduced blood glucose, BP, obesity, improved risk factor knowledge, benefits of PA (greater improvement in higher SES), improved FV intake pattern
Francis (2012) ³⁵	Single-group, assessment at 1, 4, and 16 wk	Sample: baseline n = 21, post n = 19, 100% white, 86% female, age range 23–74 y Setting: 2 extension offices/library, Wyoming Duration: 4 weekly 1.5- to 2-h classes	To evaluate heart healthy lifestyle practices on reported familiarity	Cooking practicum (hands-on preparation main and side dish) and discussion of CVD risk factors, energy balance, healthy diet TF: Social Marketing Theory	Questionnaire to assess familiarity with 14 heart healthy lifestyle practices	Increases in average heart healthy construct scores from pre to post and maintained at follow-up
Archuleta et al (2012) ³⁶	Single-group, baseline, postassessment	Sample: people with type 2 diabetes, mean age 63 y,	To determine whether cooking classes improved	Hands-on cooking school, nutrition education regarding diabetes diet	3-d food records to assess changes in energy and	Decreased energy intake, total fat, saturated fat,

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Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
	(1 mo)	66% non-Hispanic, 78% female, n = 117 Setting: community locations, 15 counties, New Mexico Duration: 4 3-h classes in 1 mo	nutrient intake patterns	guidelines. TF: SCT	selected nutrient intakes	carbohydrate, cholesterol, sodium, and percent calories from fat; increased percent calories from protein; no change in intake of protein, fiber, sugar, and percent calories from carbohydrates
Hanson et al (2011) ³⁷	Single-group, baseline and postassessment (12 mo)	Sample: adults, 74% women, 21–70 y, n = 68 Setting: Kapinga Village, Kolonia, Pohnpei, Micronesia Duration: 2-d workshop, 12-mo follow-up	To evaluate the effect of interventions on food intake patterns	Workshops on container gardening, cooking, charcoal ovens, promotion of local foods, and PA for disease prevention TF: none	7-day FFQ for use in Micronesia	Increased local FV, imported vegetables, sugary drinks, sugary foods, local fish intake; no change in local starchy foods, eggs, imported fish, high-fat foods, imported salty foods, local snack foods
Wunderlich et al (2011) ³⁸	Two treatment groups, HDM, CM, baseline	Sample: older adults, mean age 74 y CM, 79 y HDM, mostly white women, n = 355 Setting: CM and HDM locations, Northern New Jersey Duration: CM: 4	To examine nutrition risk factor scores and nutrition behaviors of CM and HDM participants after nutrition intervention	CM: group nutrition education and counseling on age-tailored topics, cooking demonstrations, discussion, handouts. HDM: same content as CM, phone counseling, handouts TF: none BS: interactive learning	Nutrition risk screening checklist to assess nutrition behaviors	HDM group improved nutrition risk scores, ≥2 meals/d, vegetable intake. Nonsignificant increase in nutrition risk scores in CM and in several nutrition behaviors in

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Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
		yearly 30- to 40-min sessions/2 y, HDM: learn at home				both groups
Flynn et al (2013) ³⁹	Single-group, baseline (4 wk before classes), post (6 wk), follow-up assessment (6 mo)	Sample: low income, mean age 52 y, 84% female, 67% white, n = 63 Setting: community food bank, Rhode Island Duration: 6 30-min demonstrations/wk for 6 wk, 1 meeting/mo for 6 mo	To improve food purchases of food pantry clients while decreasing food expenditures by using a 6-wk cooking program including plant-based recipes that include extra virgin olive oil with the goal that participants would use the recipes for 3 meals/wk	Cooking classes, observation of plant-based recipe preparation, discussion of health benefits, eating meal together, provided with groceries to prepare recipes TF: none	Height and weight questionnaire and grocery receipts to assess average amount spent per week, purchases of whole-grain products, meat, poultry, desserts, carbonated beverages, snacks, and total groceries	FV intake variety; meatless meals/wk using olive oil increased; decreased purchases of meat, carbonated beverages, desserts, snacks, and total groceries. Food insecurity score and BMI decreased
Dasgupta et al (2012) ⁴⁰	Single-group, baseline, postassessment (6 mo)	Sample: People with type 2 diabetes, mean age 60 y, 68% women, 76% Euroid, n = 53 Setting: grocery store kitchen workshops, Canada Duration: 15 3-h group sessions/24 wk	To empower adults with type 2 diabetes to meet the challenges of improving weight control and increasing step counts in the modern obesogenic environment	Preparation of balanced, low-energy meals, skills in food selection, preparatory work, cooking techniques, nutrition education discussion, recipes to prepare at home, daily step count monitoring TF: none BS: self-monitoring strategies	Height, weight, WC, HC, systolic and diastolic BP, HbA1c, and FFQ to assess total energy, salt, and nutrient intakes, questionnaire to assess hours dedicated to meal preparation, self-perceived cooking ability, Weight Efficacy Lifestyle Questionnaire, Weight Stages of Change–Short	Reduction in weight; seasonal differences in step counts; no change in frequency of eating out or macronutrient and fiber intake; reductions in energy and salt intake; improvements in a range of behaviors related to control of eating; increases in time dedicated

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Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
Adam et al (2015) ⁴¹	Single-group, baseline, postassessment (5 wk)	Sample: adults with children, 86% female, 69% aged ≥30 y, 60% white, n = 7,422 Setting: online, >80 countries Duration: 5-wk course, 47 short (4- to 6-min) videos	To assess the effectiveness of open, online nutrition and cooking instruction in improving eating behaviors	Instructional cooking videos to increase skills and self-efficacy for healthful cooking and family meals by modeling, involving children, and focusing on benefits rather than risks TF: SCT	Survey of eating and food preparation behaviors and meal composition, self-efficacy, levels of enjoyment, perceived healthfulness and ease of making healthy food choices and home-cooked meals	to meal preparation on weekdays and in glycemic control and systolic BP; no change in WC or HC; increase in overall and subscale Weight Efficacy Lifestyle scores Increased percentage of cooking at home with mostly fresh foods, describing food choices for the previous night's dinner as improved; increased intake of fresh FV; increase in percentage finding the previous night's dinner to be very or extremely enjoyable and healthy, reporting it was easy to make healthy choices and to prepare home-cooked meals
Houssain et al (2015) ⁴²	Single-group, baseline, post, follow-up	Sample: low-income adults, mean age 31 y, 81% female,	To assess how activities offered by the	Healthy lifestyle program, practical, hands-on nutrition activities, meal	Survey to assess knowledge, skills regarding healthy	Improved attitudes about affordability of home-cooked (continued)

Table. Continued

Reference	Design	Sample and Setting	Objective	Intervention	Outcomes Measures	Key Findings
	assessment (3 mo)	n = 176 Setting: regional, rural communities, Australia Duration: not reported	intervention increased knowledge and skills to adopt healthy eating behaviors, and increase parents' ability to establish healthy eating behaviors in their children	planning, healthy cooking TF: none	eating behaviors, parents' ability to establish healthy eating behaviors in their children, and maintenance of changes	vs takeaway meals and importance of eating breakfast; no difference in sugary drink intake, eating breakfast, preparing foods with ingredients on hand, eating takeaway foods and FV; other results not tested for significance
Penn et al (2013) ⁴³	Single-group, baseline, 6-, and 12-mo follow-up assessment	Sample: adults with >11 FINDRISC, mean age ~52 y, 69% women at baseline, n = 134 Setting: socioeconomically disadvantaged areas in England, leisure and community settings Duration: 1.5 h sessions 2 times/ wk for 10 wk	To assess the feasibility and acceptability of the intervention and change in behavioral and health-related outcomes over time	Supervised PA, cookery sessions to show ease of preparing healthy foods, reflective discussion on behavior change, monthly newsletters, weight reduction for overweight. TF: Social marketing, modeling strategies	Survey to assess change in PA levels and variety from 24-h recall, weight, WC, and diet assessment questions about specific foods	Increased PA levels (total and leisure time), variety of PA; decreased BMI, weight, WC, FINDRISC. Increased brown bread, soft margarine, 5 FV portions/d, decreased white bread, hard margarine, butter

A:V indicates animal to vegetable protein ratio; BMI, body mass index; BP, blood pressure; BS, behavioral strategies; C, control; CBPR, community-based participatory research; CFR, complementary feeding regimen; CM, congregate meals; CVD, cardiovascular disease; FFQ, food frequency questionnaire; FINDRISC, Finnish Diabetes Risk Score; FV, fruits and vegetables; HbA1C, glycated hemoglobin; HC, hip circumference; HDM, home-delivered meals; HRQOL, health-related quality of life; I, intervention; MetS, metabolic syndrome; MI, myocardial infarction; NLP, neurolinguistic programming; PA, physical activity; RCT, randomized controlled trial; SCT, Social Cognitive Theory; SES, socioeconomic; SF36, 36-item Short Form Health Survey; SMT, Social Marketing Theory; svgs, servings; T, time; TF, theoretical framework; TG, triglycerides; TTM-SOC, Transtheoretical Model–Stage of Change; WC, waist circumference.

part in the cooking itself. In 5 studies, it was unclear whether the cooking component involved hands-on experience or observation.

In 22 of the studies, interventions were present in addition to a cooking component. Examples of these co-interventions include individual and group dietary counseling, medication management, physical activity components, gym memberships, telephone coaching, mindfulness practice, insurance counseling, smoking cessation, food shopping trips, written educational materials, newsletters, container gardening, and charcoal oven workshops. The duration and dosage of the interventions varied greatly; the shortest was a half-day workshop and the longest was an implied but not specified multiyear time frame. The majority of interventions were <16 weeks. The frequency of contacts within each of the intervention time frames differed as much as the time frames themselves. For example, 1 5-week intervention consisted of 47 short videos whereas another 3-week intervention met for 75–90 minutes each week. Four of the 34 studies had postintervention assessments that ranged from 15 months to 5 years. More than half did not assess beyond 6 months postintervention. In several studies, the intervention length and follow-up were unclear.

The most common study design was a single-group, prospective cohort.^{24,43} No control group was included in the majority of studies (20 of 34 studies).^{24,43} Participants most often self-selected whether they would participate, and in 1 study that had an intervention and control group, participants were allowed to select the group to which they wanted to be assigned. Interventions were delivered by dietitians, dietetics students, doctors, nurses, chefs, counselors, community health workers, and cooperative extension educators. A number of studies did not specify who delivered the intervention or certain parts of an intervention. Little to no information was included as to how those who delivered the intervention were trained or assessed for competency in content expertise or skill level in communicating health education messages to the target audience. Details about process evaluation procedures or find-

ings were limited. Whereas almost all studies included data on the number of initial participants and how many completed the program/intervention or assessments at differing times, none of the studies included information about fidelity to the intervention model, actual program costs in relation to the planned program budget, obstacles to implementation, or how they were overcome.

The most common outcomes of interest were changes in dietary intake, psychosocial factors such as cooking confidence and knowledge, and health outcomes including physical activity and anthropometric and clinical outcomes. Dietary outcomes were based on changes in a variety of dietary factors or components including energy and nutrient intakes, intake from various food groups, and eating patterns. Dietary outcomes were primarily measured quantitatively through food frequency questionnaires, food records, dietary recalls, and single or multiple questions regarding dietary intake. For 7 studies, energy, nutrient, and food group intakes were estimated using previously tested and validated instruments or adapted from such instruments.^{10,13,16,18,29,37,40} Six studies provided references as the basis for intake questions or for food and nutrient software programs or manuals.^{12,15,24,32,36,38} Ten studies reported intake based on methods for which no information on previous testing or use was provided.^{11,14,25,30,31,34,39,41-43} Measured and reported body weight and height and other anthropometric parameters were used, as well as blood pressure, biochemical markers, and a variety of scores specific to health outcomes. Information was provided regarding validation of a mini-nutrition assessment score,²⁷ for assessment of health-related quality of life,^{20,23} and for documentation of cardiovascular events.²²

References were provided for methods to calculate physical activity,⁴³ for physical activity recommendations,²⁴ and for a modified version of a measurement instrument.³⁴ Physical activity was assessed in 3 studies based on questionnaires or methods for which no information on the source, testing, or

validation was provided.^{25,31,40} Three studies assessed cooking confidence and other confidence outcomes based on validated or tested instruments^{16,19,29}; 2 studies reported confidence outcomes based on questions for which validation or testing was not reported.^{31,42} Two studies reported use of knowledge questions that were tested or validated^{29,33}; 6 studies reported knowledge outcomes based on questions for which no source or testing/validation information was provided.^{17,26,27,32,34,35} Changes in behaviors were reported for 2 studies for which reliability and/or validity of questions were established^{33,41}; 3 studies used questions to assess behavior change for which testing or validation was not reported.^{28,31,32}

According to the Academy of Nutrition and Dietetics EAL quality criteria checklist,⁴⁴ 9 studies were rated as positive, 17 as neutral, and 8 as negative. All 9 studies rated as positive included a control group and 4 studies rated as neutral included a control group. Neutral and negative ratings were most commonly based on not using reliable and valid measurement instruments, not assessing attendance or compliance, and not using appropriate statistical analysis. Based on these ratings, an overall grading of fair was given for the overall strength of evidence for a conclusion or recommendation using the Academy of Nutrition and Dietetics Evidence Analysis Library's Conclusion Grading Table.⁴⁴ For the 5 elements listed in this table, the researchers assigned a fair rating based on quality, consistency, quantity, and clinical impact, and a limited rating based on generalizability. Generalizability, in particular, was limited because the studies were not uniform in population or study design.

The EAL quality criteria checklist⁴⁴ included relevance and validity questions for primary nutrition and dietetics research. The checklist included an examination of several components proposed to contribute to effective nutrition education interventions⁴⁸: (1) clearly indicating specific intervention outcomes, (2) ensuring appropriate intensity and duration of the intervention to produce meaningful effects, (3) measuring outcomes based on valid and reliable instruments and procedures,

and (4) describing the intervention exposure in detail. However, the checklist did not include questions about using a theoretical framework to design the intervention and addressing theory-based determinants in the intervention, which limited the usefulness of the checklist for assessing the quality of nutrition education interventions.

Dietary Outcomes

Energy and nutrient intake. Five studies assessed changes in energy and nutrient intake.^{10,12,13,36,41} Changes in energy intake were mostly positive, whereas changes in nutrient intake were mixed. Two single-group studies showed decreased energy intake from pre- to postassessment in studies involving adults with type 2 diabetes.^{36,41} Two controlled studies showed decreased energy intake in intervention compared with control groups of men with prostate cancer and women with breast cancer,^{12,13} and 1 showed no difference in change between groups of patients undergoing cardiac rehabilitation.¹⁰ In the same study involving patients undergoing cardiac rehabilitation, improvements in fat and saturated fat intakes were observed in intervention and control groups but no differences were found between groups.¹⁰ In addition, no differences in changes in intake of cholesterol, carbohydrate, total sugar, fiber, and alcohol were observed between groups.¹⁰ No differences were observed in the percentage of calories from fat or saturated, mono-unsaturated, polyunsaturated, or trans fats between intervention and control groups of women with breast cancer.¹² For the 2 studies involving adults with type 2 diabetes, 1 found no difference in carbohydrate, fat, protein, and fiber intake from pre- to postassessment,⁴⁰ and 1 found decreased fat, saturated fat, percentage of calories from fat, and cholesterol, sodium, and carbohydrate intakes from pre- to postassessment.³⁶

Reduction in sodium or salt intake was measured in 3 studies.^{18,36,40} In the 2 single-group studies with adults with type 2 diabetes, a decrease in sodium or salt intake was observed from pre- to postassessment.^{36,40} Among hypertensive Japanese men, intake of a

specific product related to decreasing sodium intake (Japanese noodle soup) was observed in the intervention compared with the control group.¹⁸

Food group intake. The most common food group outcome assessed was fruit and/or vegetable intake (18 of 34 studies), with positive outcomes in 4 of 6 studies including a control group, and 11 of 12 single-group studies. Of the 6 studies including a control group, 3 involving hypertensive men, women with breast cancer, or a general audience reported increased vegetable intake, 2 reported increased fruit intake and 1 reported increased vegetable intake during a main meal in intervention compared with control groups.^{15,16,18} Another study involving women with breast cancer showed increased fruit and vegetable intake and increased intake of targeted fruits and vegetables in an intervention compared with control group.¹² Among patients undergoing cardiac rehabilitation in 1 study, no difference in compliance with fruit and vegetable intake recommendations was observed between intervention and control groups,¹⁰ and another study with women undergoing chemotherapy showed no difference in fruit or vegetable intake between intervention and control groups.¹⁴

In the 12 single or 2 treatment group studies, 7 studies involving a variety of community groups reported increased vegetable intake from pre- to postassessment.^{29-32,34,37,39} Four studies reported either increased fruit and vegetable intake,^{24,43} increased fruit and vegetable variety,³⁹ or increased consumption of fresh fruits and fresh vegetables with dinner,⁴¹ whereas 1 study showed no difference from pre- to postassessment.⁴² Two studies with control groups examined changes in other food groups.^{10,15} One involving patients undergoing cardiac rehabilitation found no differences in compliance with recommendations for intake of starchy foods, dairy, meat, or high-fat foods between intervention and control groups¹⁰; the other showed differences among menopausal women in intakes of reduced-fat dairy and high-fat foods within or between intervention and control groups.¹⁵

Modifications in beverage intake generally did not have desirable out-

comes. Four single-group studies with pre- and postassessment were designed to reduce sugar-sweetened beverage and alcohol intakes.^{24,37,38,42} Only 1 reported decreased sugar-sweetened beverage intake among low-income adults²⁴ whereas 1 reported increased intake of local sweetened beverages among Micronesian adults,³⁷ 1 reported no difference in reported alcohol intake among older adults,³⁸ and 1 reported no difference in intake of sugary drinks among low-income adults.⁴² In 1 study with a control group, no difference was reported in alcohol intake between groups.¹⁰

Eating patterns. Mixed results were observed in several studies that included outcomes based on selected dietary characteristics.^{11,15,25} One study with a control group involving overweight and obese adults showed improvement in portion control behaviors between groups.¹¹ Two others examined scores related to adherence to principles addressed in the interventions, with inconsistent results.^{15,25} One single-group study showed no difference in an adherence score based on cancer prevention recommendations from pre- to postassessment,²⁵ whereas a controlled study involving menopausal women reported decreases in nonadherence scores during adoption and maintenance periods for eating whole foods or a moderate-fat diet.¹⁵

Several studies with generally positive results were designed to address intake of specific foods.^{13,14,37,39,43} For example, 1 controlled study involving women undergoing chemotherapy showed an increased intake of whole-grain cereal, legumes, and dairy products and less sugar and refined cereal in an intervention compared with control group.¹⁴ A single-group study with adults at risk for diabetes showed increased intake of brown bread and soft margarine and reduced intake of refined-grain bread and butter or margarine from pre- to postassessment.⁴³ Improvement was observed in 1 controlled study of men with prostate cancer in the ratio of animal protein to vegetable protein intake in the intervention compared with control group.¹³ One single-group study with low-income, predominantly female adults showed

an increase in meals without meat and the use of plant-based recipes including those with olive oil and not containing meat, poultry, or seafood.³⁹ An increase in intake of local fish and seafood among Micronesian adults from pre- to postassessment was observed in another single-group study.³⁷

Three single-group studies examined changes in meal patterns before and after an intervention program. Two with low-income adults failed to show a difference from pre- to postassessment in breakfast intake.^{24,42} One study with older adults showed an increase in eating ≥ 2 meals/d.³⁹

Psychosocial Outcomes

Cooking confidence and knowledge. Cooking confidence was based on a variety of concepts regarding cooking and food preparation. Confidence outcomes were generally improved after the interventions. These outcomes were commonly measured in studies that were primarily designed to teach participants cooking skills rather than using cooking as a supplementary activity.^{16,19,29,31,40-42} Of these 7 studies, only 1 included a control group.¹⁶ In the controlled study, improvements were observed immediately post-program in cooking confidence measures based on 5 practices, an overall confidence score, the frequency of cooking from basic ingredients, and the frequency of takeaway consumption per week between intervention and control groups, but no difference was observed in the frequency of eating ready-made meals at home. At 6 months' follow-up, similar results were observed but the frequency of consumption of eating ready-made meals at home improved.¹⁶

Single-group studies also showed improvements in cooking confidence.^{19,29,31,40-42} In 1 study involving parents with young children, confidence in being able to cook from basic ingredients, follow a simple recipe, taste new foods, and prepare and cook new foods was improved immediately after the intervention but was not maintained at follow-up.²⁹ Confidence to plan a healthy meal and make foods from scratch improved from pre- to postassessment in another study involving rural low-income

adults.³¹ One study showed increased pre-post rating of confidence in preparing healthy meals for others and increased rating of skill in cooking among church cooks.¹⁹ Another study involving adults with type 2 diabetes showed no difference in the frequency of eating out, whereas the amount of time dedicated to meal preparation increased from pre- to postassessment.⁴⁰ An increased percentage of adults with children completing an online intervention reported cooking at home with mostly fresh foods and that dinner the evening before was enjoyable.⁴¹ Low-income adults reported increased confidence after a program for 5 activities and at 3 months' follow-up for 2 activities, but no statistical significance was reported for these changes.⁴²

Knowledge and attitudes. Seven studies without control groups reported generally positive results for knowledge change from pre- to postassessment based on a variety of nutrition concepts and dietary recommendations.^{17,26,29,32-35} Two studies reported improvements in caregiver knowledge of micronutrient function and food sources,¹⁷ and dietary recommendations and desirable child-feeding practices.²⁶ General nutrition knowledge was increased in 2 studies involving parents, based on the nutritional content of food, dietary requirements, and the relationship between diet and health.^{29,32} Three studies reported increased knowledge regarding diet and diabetes and heart disease.³³⁻³⁵

No differences were observed among menopausal women for attitudes and beliefs about behavioral outcomes, self-efficacy, or barriers between intervention and control groups.¹⁵ However, attitudes were improved in a single-group study of low-income adults regarding affordability of home-cooked meals and the importance of eating breakfast.⁴²

Other Behavior Change Outcomes

A variety of positive behavior changes were reported in studies without a control group. Two included improvements in child feeding practices among mothers from pre- to post-

assessment.^{17,30} One study with firefighters with only postassessment showed that positive changes were reportedly made in the food environment.²⁸ Three studies used a battery of behavioral items to assess changes from pre- to postassessment; there were improvements in 9 of 11 items related to healthy cooking and eating among low-income women,³² increased use of 8 of 10 healthy cooking practices for people with diabetes,³³ and improved ease for all 8 items related to making healthy food choices and preparing home-cooked meals among parents.⁴¹

Food purchasing and food security were assessed in 2 single-group studies. Low-income adults showed a decrease in the purchase of meat, carbonated beverages, desserts, snacks, and total groceries from pre- to postassessment and a decrease in a food-insecurity score.³⁹ Participants in the *Supplemental Nutrition Assistance Program* reported more frequent shopping with a grocery list in another study.³¹

Health-Related Outcomes

Physical activity. Six studies assessed changes in physical activity (without a control group) using a variety of indicators, with mixed results. Three showed improvements from pre- to postassessment; 2 with low-income adults reported an increased number of days with 30 minutes of physical activity^{24,31} and 1 involving adults at risk for diabetes reported increases in total and leisure-time physical activity and in the variety of physical activities.⁴³ One study reported an increased physical activity score, with a high-socioeconomic status (SES) group having a greater change than a low-SES group.³⁴ Another study of adults at risk for metabolic syndrome did not observe differences in the daily duration of moderate-intensity exercise,²⁵ and another with type 2 diabetics showed seasonal differences in step counts.⁴⁰

Anthropometric outcomes. Changes in weight outcomes were reported for 12 of the 34 studies. Outcomes included body mass index (BMI), body weight, waist circumference (WC), hip circumference, waist to hip ratio; biceps,

underscapular, and supriliac skinfolds; weight loss, and weight maintenance. Seven were controlled studies involving mostly clinical populations with overweight/obesity, cancer, heart disease, or hypertension, with limited positive findings. Four found no differences in BMI between intervention and control groups within periods ranging from 5 to 24 months^{10,12,15,18}; another observed no difference in weight maintenance at 5 months and 2–3 years between groups.²¹ One study found a difference between the intervention and control groups only at 3 months and not at 6 and 12 months.¹¹ A reduction in BMI (2.9 kg on average) and reductions in WC, hip circumference, and biceps, underscapular, and supriliac skinfolds were reported in 1 study at 4 months.¹⁴

Five studies without a control group involving adults at risk for diabetes or metabolic syndrome, and with general audiences, examined weight outcomes and reported more positive findings. Two showed improvements in BMI at 6 months²⁵ and 6 and 12 months.⁴³ One study reported weight loss at 6 months and a decrease in WC.³⁹ Another showed improved weight at 6 months⁴⁰ but no differences in waist to hip ratio and WC. One study did not find differences in BMI at 4 months.²⁴

Clinical outcomes. Seven studies reported on a variety of health-related outcomes, with mixed results. Mini-nutrition assessment scores indicating malnutrition based on protein deficiency among Chinese adults were not different from pre- to postassessment for 2 groups receiving food packages at a different rate.²⁷ In a single-group study involving outcomes related to metabolic syndrome, significant differences were observed between education groups for total cholesterol from pre- to postassessment, but not for diastolic or systolic blood pressure, fasting serum glucose, or triglycerides.²⁵ Two other studies also examined changes in blood pressure.^{18,34} One study of hypertensive men showed no differences in systolic blood pressure between groups, and lower diastolic blood pressure and improved urinary sodium to potassium excretion ratio in the intervention compared with the control

group.¹⁸ In a single-group study involving adults in a rural Indian village, systolic and diastolic blood pressure were reduced in low- and high-SES groups from pre- to postassessment, and a reduction in blood glucose was observed for those with diabetes and prediabetes.³⁴ Another single-group study reported decreased glycosylated hemoglobin values from pre- to postassessment in people with type 2 diabetes.⁴⁰

Two studies assessed health-related quality of life using the Medical Outcomes Study Short Form 36-item Health Survey (SF36).^{20,23} Both group and individual counseling improved within group scores in 1 study on the SF36 and a diabetes symptoms checklist with no differences between groups except for improvement in hyperglycemia and hypoglycemia distress.²⁰ Another study assessed SF36 outcomes with a nutrition and exercise group and an exercise-only group.²³ Improvements in the physical component summary score and 2 of 8 domains of the SF36 were observed within the exercise and nutrition group, and improved handgrip strength was observed for the exercise group compared with the exercise and nutrition group. No changes in performance of the stork stand and walking speed were observed between groups.²³ One controlled study reported a reduction in the number of cardiovascular events in an intervention vs control group (based on myocardial infarctions and days in the hospital).²²

DISCUSSION

This updated review was based on 34 included studies (2011–2016) with generally positive impacts on fruit and/or vegetable and energy intakes, and cooking confidence and knowledge outcomes; however, impacts on nutrient intakes, weight, physical activity, and a variety of health outcomes were mixed. A previous review with similar methodology based on 28 studies (1980–2011) also showed overall positive results regarding similar dietary outcomes (various nutrients, food groups, and specific foods) and cooking confidence.⁴ The researchers observed differences between the 2 reviews regarding the number of studies within a specific time frame,

the type of outcomes assessed, and the nature of the target audiences. The previous review spanned about 30 years and included 28 studies. The current review was based on about 5 years and included 34 studies, which indicated that more studies were being published based on the use of cooking activities as intervention components to improve lifestyle risk behaviors. Only 3 of 28 studies assessed BMI in the previous review, whereas 12 of 34 studies in the current review assessed some type of weight outcome, possibly based on the increased prevalence of obesity over the past 30 years.⁴⁹ A small number of studies in the previous review examined clinical outcomes such as blood pressure and serum lipids.⁴ However, about half of the studies in the current review assessed some type of clinical outcome, which suggested that cooking activities may be considered a desirable strategy to address compliance with therapeutic diets.

Only about half of the studies in the current review used measurement instruments to evaluate dietary and psychosocial outcomes that had been previously tested for reliability and validity. This proportion was similar to the previous review,⁴ indicating some concern about the lack of progress being made in the development of useful tools to assess outcomes based on intervention components involving cooking activities. Several recent studies reported on the development and testing of instruments to measure impacts on cooking confidence, skills, and food resource management^{50–53}; however, the availability of valid, reliable tools that measure cooking outcomes and food skills was limited. This limited availability may have affected the likelihood that researchers used tested measurement tools in the studies included in the current review. For many single-group studies, assessment of diet-related behavior changes was based on single or multiple questions that had not been previously tested or used in previous studies. Additional research is needed to develop simple, valid, and reliable means to measure outcomes from cooking interventions that could strengthen the quality of dietary intake reporting.

In addition to concerns about nonvalidated measurement tools, the

lack of a control group in most studies conducted in nonclinical settings and the absence of a power calculation to ensure an adequate sample size limited the amount of confidence in some study findings. Because the majority of participants in the 34 studies were female and were often of lower income, it is unknown whether outcomes would have been similar in higher-income individuals or males. The limited amount of process evaluation information beyond the numbers of participants who were lost to follow-up made it difficult to assess the quality of the intervention's delivery. Therefore, when neutral or negative outcomes were found, it was difficult to determine whether they were from flawed assumptions in the intervention framework or poor or partial delivery. Furthermore, coupled with the wide variety of intervention lengths, dosages, and co-interventions, these methodological issues made it essentially impossible to create evidence-based recommendations for what an ideal cooking intervention would contain. It was not clear from the data whether longer, more frequent, or more intense contacts produced better outcomes. Nor was it apparent which specific types of cooking activities or teaching approaches were superior or by whom they were best delivered. The added benefit of including co-interventions alongside a cooking component and the type of co-interventions that would most likely improve outcomes could not be determined. Finally, studies reviewed did not contain information about the cost of program delivery, provide a cost-effectiveness or cost-benefit analysis, or discuss the ability of the intervention to be scaled up to serve larger populations or be conducted in different settings.

A previous systematic review of the efficacy of dietary interventions employed an approach that characterized efficacy based on a comparison of the stated purpose or objective to outcomes.⁵⁴ This approach allowed the researchers to examine factors that might have contributed to efficacy. In the current study, researchers used the same approach to determine that 13 and 2 studies were successful and unsuccessful, respectively, in achieving positive results for all outcomes iden-

tified. Another 19 studies showed mixed results in which some outcomes were successfully addressed and others were not. The imbalance in the number of successful vs unsuccessful attempts to produce positive impacts did not allow for an examination of best practice recommendations for ideal cooking interventions.

A limitation of this systematic review is that the researchers assigned ratings together for the overall grade rather than independently. In addition, the search strategy was designed to be broad, spanning multiple databases and using a wide range of search terms to reduce bias. It was limited because it did not include unpublished or gray literature and articles not published in English, which may have resulted in source selection bias.⁵⁵ Inclusion of these sets of articles may have contributed to the findings. Some studies in this review were published as brief research reports, which thus limited the ability of the authors to report important information such as details regarding the testing of measurement tools, sample size calculations, and cost-effectiveness. These interventions may have been implemented with programmatic funds and therefore may have had limited capability to include a rigorous research design. In addition, the purpose or objective of 7 studies was to test feasibility or proof of concept, or to provide preliminary data for further studies,^{13,28,30,33,40,41,43} which indicated that implementation using a controlled, rigorous research design may not have been appropriate at an early stage.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Although cooking-focused interventions for adults showed some promise in improving dietary intake and psychosocial measures, significant improvements in study methodology are needed to inspire greater confidence in these results. Nutrition educators and researchers who are planning cooking-based interventions should be encouraged to select and fully integrate a theoretical basis to their intervention, not only to increase the chances of program success

but also to strengthen the evaluation. A control group, power calculations to determine sample size, and steps to minimize self-selection and self-report biases should be employed. When programmatic funds are used to implement community-based interventions, collaboration with researchers should be encouraged to enable the use of more rigorous research methods.

The increase in the number of studies conducted in clinical settings and the greater inclusion of measurement of BMI and biochemical values suggest growing interest by clinicians, hospitals, and health systems in cooking as a means to prevent or lessen the impact of chronic diseases. Although this creates an opportunity for foods, cooking, and nutrition education to have a new or larger role in the health care system and supports the desire to focus funding on prevention rather than tertiary care, valid outcome measurements as well as evidence of cost savings will be essential for the transferability and sustainability of cooking interventions.

Culinary education is generally thought to have value for participants based on a nationally representative survey conducted in the US.⁵⁶ Findings from the current review indicated that participants in the interventions were convenience samples involving mostly women and those who were middle-aged or older. A cross-sectional study of Irish adults showed that relationships between cooking/food skills and diet quality varied between male and female respondents.⁵⁷ These findings indicated that future interventions with a cooking component may need to target specifically men. Finally, an important target audience includes younger adults who may not be exposed to culinary education in schools,⁵⁸ are cooking meals over a longer period, and may be preparing food for young children.

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REFERENCES

1. Rees R, Hinds K, Dickson K, O'Mara-Eves A, Thomas J. *Communities That Cook: A Systemic Review of the Effectiveness and Appropriateness of Interventions to Introduce Adults to Home Cooking*. London, UK: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London; 2012.
2. Iacovou M, Pattieson DC, Truby H, Palermo C. Social health and nutrition impacts of community kitchens: a systematic review. *Public Health Nutr*. 2013;16:535-543.
3. Garcia AL, Reardon R, McDonald M, Vargas-Garcia EJ. Community interventions to improve cooking skills and their effects on confidence and eating behavior. *Curr Nutr Rep*. 2016;5:315-322.
4. Reicks M, Trofholz AC, Stang JS, Laska MN. Impact of cooking and home food preparation interventions among adults: outcomes and implications for future programs. *J Nutr Educ Behav*. 2014;46:259-276.
5. McGowan L, Caraher M, Raats M, et al. Domestic cooking and food skills: a review. *Crit Rev Food Sci Nutr*. 2017;57:2412-2431.
6. Raber M, Chandra J, Upadhyaya M, et al. An evidence-based conceptual framework of healthy cooking. *Prev Med Rep*. 2016;4:23-28.
7. US Department of Health and Human Services and US Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 8th ed. <http://health.gov/dietaryguidelines/2015/guidelines/>. Accessed January 17, 2017.
8. Mills S, White M, Brown H, et al. Health and social determinants and outcomes of home cooking: a systematic review of observational studies. *Appetite*. 2017;111:116-134.
9. Moher D, Liberati A, Tetzlaff J, Altman DG, the PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: the PRISMA Statement. *PLoS Med*. 2009;6:e1000097.
10. McGorrian C, O'Hara MC, Reid V, Minogue M, Fitzpatrick P, Kelleher C. A brief cookery skills intervention is no more effective than written information alone in reducing body mass index in overweight cardiac rehabilitation patients [corrected]. *Health Promot Int*. 2015;30:228-238.
11. Poelman MP, de Vet E, Velema E, de Boer MR, Seidell JC, Steenhuis IHM. PortionControl@HOME: results of a randomized controlled trial evaluating the effect of a multi-component portion size intervention on portion control behavior and body mass index. *Ann Behav Med*. 2015;49:18-28.
12. Greenlee H, Gaffney AO, Aycinena AC, et al. *Cocinar Para Su Salud!* randomized controlled trial of a culturally based dietary intervention among Hispanic breast cancer survivors. *J Acad Nutr Diet*. 2015;115:709-723, e3.
13. Carmody JF, Olendzki BC, Merriam PA, Liu Q, Qiao Y, Ma Y. A novel measure of dietary change in a prostate cancer dietary program incorporating mindfulness training. *J Acad Nutr Diet*. 2012;112:1822-1827.
14. Villarini A, Pasanisi P, Raimondi M, et al. Preventing weight gain during adjuvant chemotherapy for breast cancer: a dietary intervention study. *Breast Cancer Res Treat*. 2012;135:581-589.
15. Peters NC, Contento IR, Kronenberg F, Coletton M. Adherence in a 1-year whole foods eating pattern intervention with healthy postmenopausal women. *Public Health Nutr*. 2014;17:2806-2815.
16. Flego A, Herbert J, Waters E, et al. Jamie's Ministry of Food: quasi-experimental evaluation of immediate and sustained impacts of a cooking skills program in Australia. *PLoS ONE*. 2014;9:e114673.
17. Fahmida U, Kolopaking R, Santika O, et al. Effectiveness in improving knowledge, practices, and intakes of "key problem nutrients" of a complementary feeding intervention developed by using linear programming: experience in Lombok, Indonesia. *Am J Clin Nutr*. 2015;101:455-461.
18. Kitaoka K, Nagaoka J, Matsuoka T, et al. Dietary intervention with cooking instructions and self-monitoring of the diet in free-living hypertensive men. *Clin Exp Hypertens*. 2013;35:120-127.
19. Condrasky MD, Baruth M, Wilcox S, Carter C, Jordan JF. Cooks training for Faith, Activity, and Nutrition project with AME churches in SC. *Eval Program Plann*. 2013;37:43-49.
20. Vadstrup ES, Frolich A, Perrild H, Borg E, Roder M. Health-related quality of life and self-related health in patients with type 2 diabetes: effects of group-based rehabilitation versus individual counseling. *Health Qual Life Outcomes*. 2011;9:110.
21. Sorensen LB, Greve T, Kreutzer M, et al. Weight maintenance through behaviour modification with a cooking course or neurolinguistic programming. *Can J Diet Pract Res*. 2011;72:181-185.
22. Plüss CE, Billing E, Held C, et al. Long-term effects of an expanded cardiac rehabilitation programme after myocardial infarction or coronary artery bypass surgery: a five-year follow-up of a randomized controlled study. *Clin Rehabil*. 2011;25:79-87.
23. Kwon J, Yoshida Y, Yoshida H, Kim H, Suzuki T, Lee Y. Effects of a combined physical training and nutrition intervention on physical performance and health-related quality of life in prefrail older women living in the community: a randomized controlled trial. *J Am Med Dir Assoc*. 2015;16:263, e1.
24. Anderson JD, Newby R, Kehm R, Barland P, Hearst MO. Taking steps together: a family- and community-based obesity intervention for urban, multiethnic children. *Health Educ Behav*. 2015;42:194-201.
25. Villarini M, Lanari C, Barchiesi L, et al. Effects of the "PreveDi" lifestyle modification trial on metabolic syndrome. *Ann Ig*. 2015;27:595-606.
26. Mayfield BJ, Graves LM. Recipe for growing healthy children: child care culinary workshops lead to improved menus, mealtime environments, and nutrition education. *J Nutr Educ Behav*. 2014;46:627-628.
27. Chung LMY, Chung JWY. Effectiveness of a food education program in improving appetite and nutritional status of elderly adults living at home. *Asia Pac J Clin Nutr*. 2014;23:315-320.
28. Goheer A, Bailey M, Gittelsohn J, Pollack KM. Fighting fires and fat: an intervention to address obesity in the fire service. *J Nutr Educ Behav*. 2014;46:219-220.
29. Garcia AL, Vargas E, Lam PS, Shennan DB, Smith F, Parrett A. Evaluation of a cooking skills programme in parents of young children—a longitudinal study. *Public Health Nutr*. 2014;17:1013-1021.
30. Hearst MO, Kehm R, Sherman S, Lechner KE. Increasing fruit and vegetable consumption and offerings to Somali children: the FAV-S pilot study. *J Prim Care Community Health*. 2014;5:139-143.

31. May JK, Brady A, Van Offelen S, Johnson B. Simply good cooking: online curriculum for the interactive SNAP-Ed classroom. *J Nutr Educ Behav.* 2014; 46:85-87.
32. Rustad C, Smith C. Nutrition knowledge and associated behavior changes in a holistic, short-term nutrition education intervention with low-income women. *J Nutr Educ Behav.* 2013;45:490-498.
33. Bielamowicz MK, Pope P, Rice CA. Sustaining a creative community-based diabetes education program: motivating Texans with type 2 diabetes to do well with diabetes control. *Diabetes Educ.* 2013;39:119-127.
34. Balagopal P, Kamalamma N, Patel TG, Misra R. A community-based participatory diabetes prevention and management intervention in rural India using community health workers. *Diabetes Educ.* 2012;38:822-834.
35. Francis SL. Heart disease nutrition education program increases familiarity with heart-healthy lifestyle recommendations. *J Nutr Educ Behav.* 2012;44:658-660.
36. Archuleta M, Vanleeuwen D, Halderson K, et al. Cooking schools improve nutrient intake patterns of people with type 2 diabetes. *J Nutr Educ Behav.* 2012;44: 319-325.
37. Hanson M, Englberger L, Duncan B, Taren D, Mateak H, Johnson E. An evaluation of a nutrition intervention in Kapinga Village on Pohnpei, Federated States of Micronesia. *Pac Health Dialog.* 2011;17:173-184.
38. Wunderlich S, Bai Y, Piemonte J. Nutrition risk factors among home delivered and congregate meal participants: need for enhancement of nutrition education and counseling among home delivered meal participants. *J Nutr Health Aging.* 2011;15:768-773.
39. Flynn MM, Reinert S, Schiff AR. A six-week cooking program of plant-based recipes improves food security, body weight, and food purchases for food pantry clients. *J Hunger Environ Nutr.* 2013;8:73-84.
40. Dasgupta K, Hajna S, Joseph L, Da Costa D, Christopoulos S, Gougeon R. Effects of meal preparation training on body weight, glycemia, and blood pressure: results of a phase 2 trial in type 2 diabetes. *Int J Behav Nutr Phys Act.* 2012; 9:125.
41. Adam M, Young-Wolff KC, Konar E, Winkleby M. Massive open online nutrition and cooking course for improved eating behaviors and meal composition. *Int J Behav Nutr Phys Act.* 2015; 12:143.
42. Hossain D, Yuginovich T, Lambden J, Gibson M, Allen R. Impact of Red Apple Healthy Lifestyles Programme on healthy eating behaviour of low socioeconomic participants in rural and regional communities in Australia. *Int J Health Promot Educ.* 2015;53:136-146.
43. Penn L, Ryan V, White M. Feasibility, acceptability and outcomes at a 12-month follow-up of a novel community-based intervention to prevent type 2 diabetes in adults at high risk: mixed methods pilot study. *BMJ Open.* 2013; 3:e003585.
44. Academy of Nutrition and Dietetics. Evidence analysis manual: steps in the academy evidence analysis process. <https://www.andeal.org/evidence-analysis-manual>. Accessed September 9, 2017.
45. Bandura A. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice-Hall, Inc; 1986.
46. Prochaska JO, DiClemente CC. Stages and processes of self-change of smoking: toward an integrative model of change. *J Consult Clin Psychol.* 1983;51:390-395.
47. Knowles M. *The Adult Learner: A Neglected Species*. 3rd ed. Houston, TX: Gulf Publishing; 1984.
48. Contento IR. *Nutrition Education: Linking Research, Theory & Practice*. 3rd ed. Burlington, MA: Jones & Bartlett Learning; 2015.
49. Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US adults, 1999-2008. *JAMA.* 2010;303:235-241.
50. Condrasky MD, Williams JE, Catalano PM, Griffin SF. Development of psychosocial scales for evaluating the impact of a culinary nutrition education program on cooking and healthful eating. *J Nutr Educ Behav.* 2011;43:511-516.
51. Pinard CA, Uvena LM, Quam JB, Smith TM, Yaroch AL. Development and testing of a revised Cooking Matters for Adults Survey. *Am J Health Behav.* 2015; 39:866-873.
52. Barton KL, Wrieden WL, Anderson AS. Validity and reliability of a short questionnaire for assessing the impact of cooking skills interventions. *J Hum Nutr Diet.* 2011;24:588-595.
53. Winkler E, Turrell G. Confidence to cook vegetables and the buying habits of Australian households. *J Am Diet Assoc.* 2010;110(5 suppl):S52-S61.
54. Murimi M, Kanyi M, Mupfudze T, Ruhul Amin M, Mbogori T, Aldubayan K. Factors influencing efficacy of nutrition education interventions: a systematic review. *J Nutr Educ Behav.* 2017;49:142-165.
55. Rothstein H, Sutton AJ, Borenstein M. *Publication Bias in Meta-Analysis: Prevention, Assessment and Adjustments*. Chichester, UK: John Wiley & Sons; 2005.
56. Wolfson JA, Frattaroli S, Bleich SN, Smith KC, Teret SP. Perspectives on learning to cook and public support for cooking education policies in the United States: a mixed methods study. *Appetite.* 2017;108:226-237.
57. McGowan L, Pot GK, Stephen AM, et al. The influence of socio-demographic, psychological and knowledge-related variables alongside perceived cooking and food skills abilities in the prediction of diet quality in adults: a nationally representative cross-sectional study. *Int J Behav Nutr Phys Act.* 2016;13:111.
58. Nelson SA, Corbin MA, Nickols-Richardson SM. A call for culinary skills education in childhood obesity-prevention interventions: current status and peer influences. *J Acad Nutr Diet.* 2013;113:1031-1036.

CONFLICT OF INTEREST

An author of this review (J. Reeder) serves on the JNEB staff as Associate Editor. Review of this article was

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