Cooking and Its Impact on Childhood Obesity: A Systematic Review
Devilal Dimple, MSc; Gowri Ramesh, PhD

ABSTRACT
Introduction: This systematic review aimed to study the effect of a cooking intervention on obesity among children and adolescents aged < 18 years.
Methods: Articles that studied the effect of cooking intervention with at least 4 sessions among children and adolescents on obesity (from January, 2000 to December, 2021) were included for analysis. Of the 500 articles identified through PubMed and ScienceDirect database, 9 studies qualified to be included in this review.
Results: One-third of the studies found a positive effect of a cooking intervention on obesity among children and adolescents. School-based studies conducted among elementary school students were promising. Centers for Disease Control and Prevention body mass index percentile was the most common tool used to identify children and adolescents with overweight and obesity. The majority of the studies had a strong methodology.
Discussion: All studies showed improvement in diet-related factors. Active participation of parents is crucial in making childhood interventions successful. It is difficult to delineate the effect of cooking alone on obesity as almost all studies had multicomponent interventions.
Implications for Research and Practice: These diverse results highlight the need for longitudinal studies in natural settings to comprehend the effect of long-term cooking on obesity in children and adolescents.
Key Words: meal preparation, childhood obesity, public health, school children, adolescent

INTRODUCTION
The United Nations Decade of Action on Nutrition for 2016–2025 aims to realize global nutrition and noncommunicable disease targets to end all forms of malnutrition, including obesity, and meet 2 of the 17 sustainable development goals. Globally, about 18% and 7% of children are found to be overweight and obese, respectively.Although childhood obesity is a known risk factor for adult obesity and a myriad of complications or noncommunicable diseases, it may be preventable. Behavior modification is a crucial aspect of dealing with obesity. Food preparation and meal planning skills could be essential behavior modification techniques to combat childhood obesity. Making cooking classes available to school children is recommended by the Report of the Commission on Ending Childhood Obesity of the World Health Organization, European Union Action Plan on Childhood Obesity 2014–2020, and European Food and Nutrition Action Plan 2015–2020 as part of their comprehensive and community-based programs for school children and adolescents to reduce obesity. However, concrete evidence on the effect of cooking on obesity among children and adolescents is missing.

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Table 1. PICOS Criteria for Inclusion and Exclusion of Studies

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
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<tbody>
<tr>
<td>Population</td>
<td>Children and adolescents aged ≤ 18 y</td>
<td>Adults aged &gt; 18 y</td>
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<tr>
<td>Intervention</td>
<td>Meal preparation activity in school/preschool/community (at least 4 sessions during the entire study period) among children and adolescents</td>
<td>Meal preparation activities in school/preschool in which &lt; 4 sessions were conducted during the entire study period</td>
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<tr>
<td>Comparator</td>
<td>Control group</td>
<td>Not applicable</td>
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<tr>
<td>Study design</td>
<td>Experimental study design</td>
<td>Qualitative studies, review articles, book chapters, conference abstracts, editorials and any gray literature, observational study (cross-sectional, cohort, or case-control)</td>
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PICOS indicates Population, Intervention, Comparator, Outcomes, and Study Design.

of dietary behavior and cooking confidence in everyday life.11

Children’s cooking skills should be age-appropriate, comprising many motor and developmental skills.15 These skills can range from the simple tasks of tearing leaves and washing vegetables to complex tasks like peeling and cutting vegetables and using equipment like the oven, microwave, and stove to cook food.16 According to Dean et al,16,17 children aged 2–3 years can wash fruits and vegetables, tear leaves, and roll mixtures into balls, whereas children aged 3–5 years can mash, spread, sieve, and squeeze.17 Skills like breading, flouring, dipping, and crushing and pounding can be performed by children aged 5–7 years. With adult supervision, children aged 7–9 years can weigh and measure ingredients and use equipment such as a grater or hand mixer. Children above the age of 9 years can display skills in cutting and chopping, using an oven, microwave, and stove, and performing simpler tasks without supervision.17

A survey showed that adults who learned to cook in their childhood were less reliant on takeaways and convenient foods, resorted to home cooking with fresh ingredients, and had a better diet quality than those who learned culinary skills later in adulthood.17–19 Cooking skills learned during childhood (aged < 12 years) and adolescence (aged 13–18 years) could be one of the many ways to tackle the burden of being overweight and obese.6,17,20

Several studies have shown that children actively involved in some meal preparation activities positively impact healthy eating behavior, such as consuming foods from a variety of food groups.12,21–28 Cooking practices in children were also shown to increase their willingness to try new foods,25,27,29 improve knowledge,6,26,28 attitude, self-efficacy, and other psychosocial factors26,29–32 but data on its effect on weight management and obesity was found to be scarce and scattered.6 Thus, this systematic review attempts to answer the question: Does cooking intervention affect obesity among children and adolescents? This systematic review aimed to explore and critically appraise all the quantitative studies analyzing the effect of a cooking intervention on obesity and weight management among children and adolescents aged < 18 years.

METHODS

The current systematic review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.33 The PRISMA 2020 checklist is available in Supplementary Table 1. The research team comprised a nutrition professor and a nutrition research scholar with expertise in community and school-based public health programs dealing with behavior modification for obesity. This paper briefly discusses non-obesity parameters studied while discussing outcomes on obesity-related parameters in detail.

Inclusion and Exclusion Criteria

The Population, Intervention/Exposure, Comparator, Outcomes, and Study design criteria were used to identify and appraise relevant quantitative studies for this systematic review (Table 1). All quantitative original research articles published in the English language from 2000 to 2021 reporting the effect of a cooking-based intervention (at least 4 sessions during the study period) among children and adolescents aged <18 years on their body mass index (BMI) or any other adiposity indicator were included in this systematic review. Studies were excluded from this systematic review if (1) the participants were aged > 18 years; (2) the participants suffered from any known chronic condition other than obesity; (3) the study design was anything other than an experimental study design; (4) the published article was a review article, book chapter, conference abstract, or an editorial; (5) the study reported effects of family cooking or caregiver cooking instead of the child or adolescent cooking; or (6) the study conducted < 4 cooking sessions during the study period. An additional filter (ie, open access and open archive) was also applied to the ScienceDirect database. Multicomponent studies consisting of cooking or a meal preparation activity conducted for a considerable duration meeting these inclusion criteria were included in this review, including pilot studies.

Literature Search

The literature search for this systematic review was performed using the PubMed and ScienceDirect databases. The search strategy included the use of the following search terms,
including MeSH terms in the PubMed database: (“cooking” OR “meal preparation” OR “cooking class” OR “cooking skill” OR “cooking habits” OR “cooking intervention”) AND (“obesity” OR “overweight” OR “adiposity” OR “Body Mass Index”) AND (“children” OR “adolescent”).

Literature Search Strategy and Data Extraction

The PRISMA 2020 flow diagram for new systematic reviews was used to identify, screen, and include articles (Figure 1). Based on the search terms and filters used for the inclusion criteria, the literature search produced 71 articles in PubMed and 429 in the ScienceDirect database. On screening the title and abstract of all 500 articles for eligibility, 488 were excluded as they did not meet the eligibility criteria or objective of the current systematic review. The remaining 12 articles were retrieved and assessed for eligibility. Five of the 12 articles met all the inclusion criteria and were included in this review. The citations of all 12 retrieved articles were also assessed to identify relevant articles. An additional 4 articles were found to be eligible and were included in this review. Thus, for all the 9 articles included in this review, the following information was extracted: authors, year of publication, setting, study design, sample size, data collected, intervention details, and main findings (Table 2). Data were extracted from selected articles into a template by 2 independent reviewers. Extracted data were evaluated, and discrepancies were authenticated with the original article and settled through discussion.

Quality Assessment

The quality of the studies was assessed using the “Quality Assessment Tool for Quantitative Studies” developed by the Effective Public Health Practice Project (EPHPP), Canada (Supplementary Material 2). This tool evaluates 6 domains (selection bias, study design, confounders, blinding, data collection method, withdrawals, and dropouts) for each study that can be marked as strong, moderate, and weak. A final quality rating was assigned to each study. Studies with no weak ratings were described as having a strong methodology, whereas those with 1 weak and ≥2 weak ratings were described as having a moderate and weak methodology, respectively. The authors assessed the quality of each article individually. All studies, irrespective of their methodological quality, were included in the synthesis of results.

RESULTS

Sample and Study Characteristics

Seven of the 9 studies included in this review were conducted in the US, and the other 2 were conducted in Europe (1 in Germany and 1 in Hungary). Participants in these studies were aged between 2 and 17 years. The sample size varied between 44 and 8,500 participants. Among the included studies, 6 were randomized controlled trials (RCTs), 2 were prepost-intervention studies, and 1 was a controlled clinical trial. Three studies out of the 9 were pilot studies. A total of 5 studies provided a delayed intervention to the control group after the completion of the study. Studies with no weak ratings were described as having a strong methodology, whereas those with 1 weak and ≥2 weak ratings were described as having a moderate and weak methodology, respectively. The authors assessed the quality of each article individually. All studies, irrespective of their methodological quality, were included in the synthesis of results.

Five studies used convenience sampling, whereas 3 employed criterion sampling design. Of the 6 RCTs, 3 of the 6 RCTs did not use a random sampling technique to recruit participants but randomly assigned the selected
<table>
<thead>
<tr>
<th>Reference</th>
<th>Setting</th>
<th>Study Design</th>
<th>Sample and Sample Size</th>
<th>Data Collected</th>
<th>Cooking Features/ Intervention Description</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Castro et al34</td>
<td>Carrboro, NC (families with low income)</td>
<td>Prepost-intervention study design</td>
<td>95 children aged 2−15 years: both boys and girls</td>
<td>AA: CDC age and gender-specific BMI percentiles</td>
<td>Intervention study Cooking component: 7-wk cooking workshop Noncooking component: Weekly gardening session, 7-wk nutrition workshop, and social events for children and their parents</td>
<td>AO: All children with a baseline BMI classification of normal had maintained themselves in the normal BMI category, and 17% (n = 6) of obese or overweight children and adolescent had improved their BMI classification. DO: Postintervention availability of fruits and vegetables increased by 146%, and consumption of fruits (28%) and vegetables (33%) also increased in children</td>
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<tr>
<td>Davis et al35</td>
<td>Los Angeles, CA (families with low income)</td>
<td>CCT</td>
<td>104 fourth and fifth-grade students (70 in control and 34 in the intervention group): both boys and girls</td>
<td>AA: CDC age and gender-specific BMI percentiles, WC BC: body fat percentage</td>
<td>LA Sprouts pilot intervention Cooking component: 45-min interactive cooking and nutrition education lesson (combined) once a week for 12 wk Noncooking component: 45-min gardening session once a week for 12 wk</td>
<td>AO: The intervention group had a significant reduction in BMI (1% vs 1%) and less weight gain (1% vs 4%) as against the control group CO: The intervention group had decreased diastolic blood pressure (5% vs 3%) DO: The intervention group also increased their dietary fiber intake (22% vs 12%)</td>
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<tr>
<td>Davis et al36</td>
<td>Austin, Texas (families with low income)</td>
<td>School-based cluster RCT</td>
<td>3,135 children with a mean age of 9.2 y (1,412 in the intervention group and 1,723 in control or delayed intervention group): both boys and girls</td>
<td>AA: BMI and CDC age and gender-specific BMI percentiles, WC BC: body fat percentage</td>
<td>Texas Sprouts’ intervention had 18 lessons of 60 min each in length Cooking component: Cooking activity (11 lessons). Noncooking component: Garden taste test (7 lessons)</td>
<td>AO: No statistically significant difference was observed between both groups BCO: No statistically significant difference was observed between both groups CO: No statistically significant difference was observed between both groups DO: Increased vegetable intake (0.48 vs 0.04 frequency/d) was observed in the intervention group</td>
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| De Bock et al37  | Baden-Württemberg, Southwest Germany (urban and rural setting) | Cluster-based RCT | 377 children aged 3-6 years (194 in the intervention and 183 in the control group): both boys and girls | AA: CDC age and gender-specific BMI percentiles, waist-to-height ratio  
BC: skin fold thickness for body fat  
DA: Fruit and vegetable intake; and water and sugared drink consumption  
DC: Baseline, 6 mo, and 12 mo postintervention | The intervention was administered once weekly for 6 mo (total 15 sessions)  
Cooking component: Joint meal preparation activities for children and parents-tasting and preparing nutritious, fresh foods | AO: No statistically significant difference was observed between both groups  
BCO: No statistically significant difference was observed between both groups  
DO: There was a significant increase in fruit and vegetable intake in children |
| Fulkerson et al38 | Minneapolis, MN                                      | RCT            | 44 child (aged 8–10 y)/parent dyads (22 in intervention and 22 in control group): both boys and girls | AA: BMI, CDC age and gender-specific BMI percentiles  
DA: Home food availability, nutrition quality of foods served at family meals, 3 24-hour recall interviews, family dinner frequency and source of foods, parental self-efficacy, child food preparation skill  
DC: Baseline, postintervention, and 6 mo follow-up | Intervention study with 5 90-min sessions  
Cooking component: cooking skill building and hands-on meal preparation  
Noncooking component: Interactive nutrition education, taste-testing, and parent discussion groups | AO: No statistically significant difference was observed between both groups  
DO: Children in the intervention group were significantly more likely to report greater food preparation skill development. Trends also suggested that children in the intervention had higher consumption of fruits and vegetables and higher intakes of key nutrients as compared with children in the control group |

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<td>Gatto et al</td>
<td>Los Angeles Unified School District, CA (families with low income)</td>
<td>RCT</td>
<td>319 third to fifth-grade Latino/ Hispanic students (172 in the intervention group and 147 in the control): both boys and girls</td>
<td>AA: BMI z-scores and CDC age and gender-specific BMI percentiles, WC</td>
<td><em>LA Sprouts</em> intervention study: Classes were held once a week for 12 wk Cooking component: 45-min interactive combined cooking and nutrition lesson Noncooking component: 45-min gardening lesson</td>
<td>AO: Children in the intervention group had significantly greater reductions in BMI z-scores (−0.1 vs −0.04, respectively) and WC (−1.2 vs 0.1 cm). BO: Fewer children in the intervention group had MS after the intervention than before, whereas controls with MS increased. CO: No statistically significant difference was observed between both groups DO: There was an increase in dietary fiber intake (3.4% vs −16.5%) in the intervention group. All participants decreased vegetable intake, but reductions were lesser in the <em>LA Sprouts</em> intervention group (−3.7% vs −26.1%)</td>
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<td>Resnicow et al</td>
<td>Four public housing developments in the US (low-income setting)</td>
<td>Prepost-intervention study design</td>
<td>57 overweight African American females aged 11—17 y. Results compared between high attendees (n = 26) and low attendees (n = 31) of intervention sessions</td>
<td>AA: Height, weight BC: 2 site skin fold and DEXA BA: Nonfasting TC and HDL</td>
<td>Intervention study: For the first 4 mo, sessions were conducted twice per week; for the final 2 mo of each cycle, sessions were conducted weekly Cooking component: Preparation and tasting of low-fat, portion-controlled meals. Noncooking component: (1) an interactive educational/behavioral activity, (2) 30−60 min of physical activity</td>
<td>BCO: High attendees had a small decrease in body fat (both by skin fold estimation and DEXA) and an increase in HDL. However, low attendees had a slight increase in these adiposity measures BO: Low attendees had a decrease in HDL. Both groups had a reduction in TC CO: Both groups had reductions in systolic blood pressure DO: No statistically significant difference was observed between both groups</td>
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</thead>
<tbody>
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<td>Takacs et al 41</td>
<td>Budaors, Pest County, Hungary (urban setting)</td>
<td>RCT</td>
<td>229 (117 in intervention and 112 in control group) sixth and seventh-grade Hungarian students: both boys and girls</td>
<td>AA: BMI, WC BC: fat mass Other health assessment: Aerobic fitness, muscle strength, endurance, and flexibility DA: Nutrition knowledge and behavior DC: Baseline, postintervention, and after summer holidays</td>
<td>Intervention study: 27 interactive sessions were delivered over 9 mo Cooking component: 5 sessions of after-school cooking classes (open to the entire family) Noncooking component: Weekly classroom-based education (25−45 min). Online education materials were distributed via e-mails and social media</td>
<td>AO: Waist circumference increased in the control group, especially during the summer holidays. Other health outcomes: Aerobic fitness increased in the intervention group only DO: Marginal improvement was observed in dietary knowledge and habits from baseline to postintervention, but it did not persist after summer</td>
</tr>
<tr>
<td>White et al 42</td>
<td>Five states (Maine, Nebraska, South Dakota, Tennessee, and West Virginia) in the US (rural communities with low income)</td>
<td>RCT of community-based participatory research</td>
<td>228 family dyads of 9- and 10-y-old children and the adults who were the main food preparers (77 in control and 151 in the treatment group): both boys and girls</td>
<td>AA: BMI z-scores, WC CA: BP DA: Block food screeners for ages 2−17 years, 2007 DC: Baseline, 0, 4, 12, and 24 mo postintervention</td>
<td>Intervention study called iCook 4-H.: 6 2-h, biweekly sessions Cooking component: cooking workshop Noncooking component: eating and playing together</td>
<td>AO: BMI z-scores significantly increased in the intervention group. No other significant changes were seen between control and treatment youths at 4 months or over the 24-mo intervention study</td>
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AA indicates anthropometric assessment; AO, anthropometric outcomes; BA, biochemical assessment; BC, body composition assessment; BMI, body mass index; BCO, body composition outcomes; BO, biochemical outcomes; BP, blood pressure; CA, clinical assessment; CDC, Centers for Disease Control and Prevention; CO, clinical outcomes; DA, dietary Assessment; DC, data collection time points; DEXA, dual-energy x-ray absorptiometry; DO, dietary outcomes; FFQ, food frequency questionnaire; HDL, high-density lipoprotein; HHHQ, Health Habits, and History Questionnaire; LDL, low-density lipoprotein; MS, metabolic syndrome; RCT, randomized controlled trial; SPAN, School Physical Activity and Nutrition; SSB, sugar-sweetened beverage; TC, total cholesterol; TG, triglycerides; WC, waist circumference.
Participants to either the treatment or control groups.

All the studies analyzed the effect of either a cooking-based intervention or a multiple components intervention with cooking as one of the components. The duration of interventions ranged from 2 weeks to 1 year. The number of sessions in each intervention ranged between 5 and 40 sessions. Six studies in this review dealt with communities of low income.

Components of the Cooking Intervention

Cooking sessions were delivered by a public health expert/nutritionist/dietitian or Cooperation Extension staff. A common theme seen in all the intervention studies was that all these studies had cooking classes that emphasized (1) the inclusion of more fruits and vegetable-based recipes in the diet, (2) reduced usage of sugar and fat in cooking, (3) cooking using fresh raw ingredients rather than processed ones, and (4) the inclusion of the MyPlate concept. Popular recipes in these interventions were various types of salads, soups, stir-fry, baked and roasted vegetables, chicken or fish, sandwiches, fruit yogurt, and whole grain pasta.

Noncooking Components of the Multicomponent Cooking Intervention

This review paper deals mainly with cooking, but 8 of 9 studies had multicomponent interventions. These studies also focused on 3 major areas besides the cooking component. These were nutrition education workshops, gardening activities, and family meals or eating together with families. The nutrition education workshops were conducted for children and adolescents and were part of the parental sessions. Concepts dealt with in these workshops were increasing fruit and vegetable intake, eating local produce, eating a balanced diet, reducing sugar-sweetened beverages, and shopping for and cooking healthy foods.

Child and Parental Participation

All the studies had cooking sessions for children and adolescents. Other than the study conducted by White et al., the participation rate of children and adolescents was > 60% in all these studies throughout the study period. In 3 community-based studies, the intervention protocol was designed exclusively for parent-child dyads. The other 6 studies had 2–9 cooking sessions for parents in addition to the child’s cooking sessions. Among these, all were poorly attended by the parents except for the preschool study, which saw good participation by parents.

Tools Used to Measure Obesity-Related Parameters

The Centers for Disease Control and Prevention (CDC) age- and gender-specific BMI percentile was the most common tool used to identify children with overweight and obesity. Some studies used > 1 criterion to identify children and adolescents with obesity. Although 6 studies used percentiles, 2 used World Health Organization BMI z-score and 1 used BMI for assessment. Takacs et al. used the International Obesity Task Force classification, and another study used body weight measurements. In all the studies, researchers measured height and body weight to calculate BMI. Although almost all studies used some BMI cutoffs, a few other parameters were also used to study overweight and obesity. Among these, waist circumference was used in 6 of the studies. Five studies measured children’s blood pressure. Bioelectric impedance analysis was used in 3 studies to measure body fat percentage. A single study calculated the waist-to-height ratio for children.

Synthesis of Results

Based on the setting of the intervention, 4 out of 9 studies were conducted in community-based settings and had mixed associations between cooking interventions and obesity and weight management. White et al. reported a rise in BMI z-score after the intervention, whereas Castro et al. reported a decrease in CDC BMI percentiles in the study group. White et al. attributed the rise in BMI z-score to growth variation, highlighting that most female participants in the treatment group were in the prepuberty stage at the beginning of the intervention. In the Growing Healthy Kids intervention study by Castro et al., it was noticed that all children who belonged to the normal BMI category before the intervention remained in the normal BMI category postintervention as well. There was an improvement in the BMI category for 17% of overweight and obese children postintervention. The other 2 community-based studies did not show any statistically significant difference after the cooking intervention.

Five out of the 9 studies were conducted in preschool or school settings. Davis et al. and Gatto et al. reported a positive effect of the intervention on obesity among children and adolescents. In the overweight subsample of a pilot study, BMI was reduced compared with the control group participants, in which BMI was increased. Another RCT stated that children in the intervention group significantly reduced BMI z-scores and waist circumference more than in the control group. All the studies with a positive effect on obesity had a study duration of 7–12 weeks, with 1 session conducted per week. The other 3 preschool- or school-based studies showed no significant effect of the cooking intervention on the obesity parameters.

Based on the age of the participants. A single preschool study conducted by De Bock et al. reported no effect of the cooking intervention on preschool children’s BMI percentiles. Five out of 9 studies were conducted solely among elementary school students in school and community settings and reported mixed associations between cooking interventions and obesity parameters.

Two reported a positive effect of the intervention on obesity. observed no statistically significant difference in obesity parameters.
and a single study reported an increase in obesity among elementary school students.42 Two studies conducted among adolescents did not show any effect of the intervention on obesity or weight management.40,41 One study had participants aged 2–15 years and reported decreased CDC BMI percentiles across all age groups.34 Results in this study did not account for differences in children’s and adolescent age categories but studied all the participants as a common group.

Effect of Cooking on Diet-Related Parameters

Castro et al.34 found that the availability of fruits and vegetables significantly increased in the homes of the participants. A significant improvement in dietary fiber intake was observed in 2 studies.35,39 Three studies found a statistically significant increase in fruit intake,34,36,38 and 4 studies found a statistically significant increase in vegetable intake.34,36–38

Quality Assessment

The methodological quality was assessed using the tool developed by EPHPP.43 The results for each of the 6 domains for all the studies are presented in Figure 2. Selection bias was prevalent in a study with a < 60% participation rate.42 Five studies36,38–41 had a good representation of the target population and had a > 80% participation rate, whereas the other 3 studies were rated as moderate because 2 of them had a 60% to 79% participation rate35,47 and 1 article had no mention of the participation rate.34 Study design was rated as strong for all RCTs36–39,41,42 and controlled clinical trial,35 and the 2 prepost-intervention studies34,40 were designated moderate. The third domain addresses dealing with confounders. A majority of the studies accounted for potential confounders.34–40,42 One study was rated moderate because not all confounders were controlled.41 The fourth domain, blinding, was rated weak for 1 study,42 in which participants were aware of the research question, and the outcome assessors were also aware of the intervention status of participants. The rest of the studies were rated moderate because either they did not describe blinding or masking in the published article34,35,38,40,41 or the participants were unaware of the research question.36,37 or the outcome assessors were unaware of the intervention status of the participants.39 Most studies used valid and reliable tools to collect data.34–39,41,42 One study was rated weak as it lacked a description of the validity and reliability of the tools used.40 For the last domain (withdrawals and dropouts), 2 were rated weak as < 60% of participants completed the study,40,42 and the rest with good follow-up were rated strong.34–39,41 A global methodological quality assessment of the articles included in this review showed that 7 studies had an overall strong34–39,41 methodology. The other 2 had an overall weak methodology.40,42

DISCUSSION

Nine articles were identified and included in this systematic review that explored cooking among children and adolescents and its subsequent effect on obesity and weight management.34–42 Although more than half of the studies reported no association between cooking interventions and weight management or obesity,36–38,40,41 one-third of the studies stated that cooking interventions among children and adolescents could reduce the prevalence of obesity.34,35,39 Studies that reported a positive effect of the intervention saw children having significant reductions in BMI z-scores and moving toward a normal weight category from overweight and obese categories. Studies conducted in school settings among elementary school students showed a promising reduction in obesity after a cooking intervention. Interestingly, the single study that reported increased obesity after the cooking intervention had poor methodological quality.42 This is also the lone intervention study in this systematic review with a more than a year follow-up.

Two of the 9 articles were published between 2000 and 2010, and the other 7 articles between 2011 and 2021. This highlights the gradual rise in interest in studying the effect of cooking on obesity among children and adolescents. Interestingly, almost all studies included both boys and girls, breaking gender stereotypes of associating cooking with a woman’s skill. However, not all studies analyzed the effect of cooking on obesity for male and female participants independently.

The active participation of family members in any school-based intervention increases its effectiveness.13 Most of the interventions in this review that involved parents as part of the study reported poor participation by parents and caregivers during the additional sessions. This could be
due to work commitments or a lack of time, and thus these studies reported difficulty in involving parents as volunteers or helpers in interventions designed for children.45,46 Parents and caregivers are role models for children and adolescents in cooking behavior and dietary habits.45 This highlights the huge scope for behavior modification among children to reduce obesity.

Though most of the studies in this review observed significant improvements in diet-related factors, such as an increase in fruit and vegetable intake, increased dietary fiber intake, and reduced blood pressure, not all observed improvements in BMI or other related parameters. Cooking classes for children and adolescents may be accompanied by nutrition education to increase awareness and help them make better choices with meal preparation, emphasizing different means to achieve a balanced meal.47 Dwindling rates of secondary school students (both boys and girls, especially boys) being offered classes on home economics, cooking, and home science, along with predicted poor cooking skills among adults, might lessen access to healthy meals.48 Similarly, active cooking classes among adults have also significantly reduced body weight.49 A RCT conducted among fourth-grade school students found that cooking interventions emphasized and taught recipes to children and adolescents that focused on healthy recipes and good dietary practices in general. The effect of cooking as an activity and the food types are often not studied independently. It is difficult to delineate the effect of cooking alone from other components, such as nutrition education or gardening activities, as individual research studies included in this review did not measure the effect of each component separately on obesity or weight management. It is usually impossible to draw inferences for each component in multi-component interventions in public health research.50

This review adds to the literature by systematically describing the current understanding of the relationship between cooking interventions and obesity among children and adolescents. The strength of this systematic review lies in the use of PRISMA methodology in the conduct and reporting of the review, the use of the EPHPP tool to evaluate the methodological quality of the eligible articles, and the wide year range used to identify articles for the review. Although the EPHPP tool helped to ascertain the quality of methods used, there are inherent complexities in public health research that make it difficult to blind or mask the participant from intervention and might be prone to selection bias. Another limitation is the use of 2 databases for the literature search. The incorporation of additional databases could have identified more studies. There is also a lack of data on the effects of childhood cooking on obesity holistically. The findings of this review suggest that further studies with a longitudinal design, repeated measurements, and sensitive measures of adiposity are needed in the current literature to assess the associations between cooking interventions and children’s obesity risk or BMI.

**ACKNOWLEDGMENTS**

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**SUPPLEMENTARY DATA**

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jneb.2023.06.004.

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35. Davis JN, Ventura EE, Cook LT, Gyllenhammer LE, Gatto NM. LA Sprouts:


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