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Amber D. Ford

Sarah E. Colby

Marissa McElrone

Lisa Franzen-Castle

Melissa D. Olfert

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Amber D Ford[1], Sarah E Colby[1], Marissa McElrone[1], Lisa Franzen-Castle[2], Melissa D Olfert[3], Kendra K Kattelmann[4] and Adrienne A White[5]

[1]Department of Nutrition, University of Tennessee, Knoxville, TN, USA. [2]Deparment of Nutrition and Health Sciences, University of Nebraska -Lincoln, Lincoln, NB, USA. [3]Human Nutrition and Foods, Division of Animal and Nutritional Sciences, Davis College of Agriculture, Natural Resources and Design, West Virginia University, Morgantown, WV, USA. [4]Department of Health and Nutritional Sciences, South Dakota State University, Brookings, SD, USA. [5]School of Food and Agriculture, University of Maine, Orono, ME, USA.

ABSTRACT

BACKGROUND: Increased intakes of ready-made and fast foods paralleled with decreased homemade food consumption have been associated with increased rates of obesity. Researchers have shown associations between cooking self-efficacy (SE) and cooking frequency (CF) with dietary quality and weight status. Some cooking interventions have shown positive associations with dietary outcomes, such as increased fruit and vegetable intake and decreased fast food consumption. There is still much unknown about SE and CF, especially among youth.

OBJECTIVE: Determine baseline SE and CF and the associations with dietary quality and body mass index (BMI) of youth enrolled in iCook 4H.

METHODS: Youth (n = 228, ages 9-10 years) completed online surveys assessing SE, CF, dietary quality, and demographics. Anthropometrics were collected to calculate BMI-for-age percentiles and weight categories. Descriptive statistics were completed for CF, SE, BMI categories, and demographics. Differences in CF and SE by sex, race, and participation in government assistance programs were determined through independent-sample *t* tests. Pearson correlations were used to assess the association between dietary quality and CF and SE. Associations between CF and dietary quality were assessed further through 2-way analyses of variance (ANOVAs) that included CF and sex and CF and race as independent variables. Associations between SE and CF and BMI were assessed through ANOVAs.

RESULTS: Thirty-seven percent of youth were overweight or obese. Females reported significantly higher CF than males ($P = .042$). Cooking frequency was positively associated with dietary quality ($P < .001$), but BMI was not associated with dietary quality. SE was not associated with dietary quality or BMI.

CONCLUSION: Based on results, CF was positively associated with dietary quality among youth. More research is needed to assess how different types of cooking relate to diet and BMI. Interventions are needed to determine whether increasing CF leads to better diet outcomes.

KEYWORDS: child/adolescent health, obesity, nutrition, cooking, BMI, diet quality, education

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CORRESPONDING AUTHOR: Sarah E Colby, Department of Nutrition, The University of Tennessee, 1215 W. Cumberland Avenue, 229 Jessie Harris Building, Knoxville, TN 37996-1920, USA. Email: scolby1@utk.edu

Introduction

Rates of adult and childhood obesity have been increasing across the United States in recent decades.[1,2] Obesity is a serious health threat that is associated with numerous comorbidities, such as type 2 diabetes mellitus and heart disease, as well as increased financial burdens.[3-5] Youth are an especially vulnerable population because those who are obese are more likely to experience extreme obesity in adulthood.[6,7] Due to the negative outcomes associated with obesity, much effort has been employed to identify and understand the underlying causes of this trend.[3] A major change that has occurred in parallel with increasing obesity rates is an increase in ready-made and fast food consumption and a decrease in homemade food consumption.[2,8-18] These diet changes are associated with increases in energy consumption, leading many researchers to believe that this dietary transition is a substantial contributor to national caloric and related weight increases.[10,11]

A report from the United States Department of Agriculture (USDA), Economic Research Service provides key insights into these diet changes among youth and adult Americans.[10] From 1977 to 1995, the percentage of energy consumed at home declined from 82% to 66%, while the percentage of calories consumed away from home increased from 18% to 34%. The increase from 18% to 34% (a 16% increase) was mostly made up of increases in fast food and restaurant consumption (14%).[10]

Trends toward energy from away-from-home food sources have also been noted specifically among children.[11] From 1977 to 2003, calories consumed from home food sources decreased by 76 kcal/d, while calories from away-from-home food sources

increased by 255 kcal/d.[11] It appears that foods consumed away from home are substantial contributors to daily average energy consumption among youth.

Since 1994, one of the biggest changes in diet has been the source of foods eaten at home.[11] For children, foods eaten and prepared at home decreased from 62.1% of calories per day in 1994 to 57.6% in 2006, while foods eaten at home but prepared outside of the home increased from 5.2% of calories per day in 1994 to 8.5% in 2006.[11] Compared with the past, it seems that even when eating at home, youth are now more likely to eat low nutrient dense fast foods and ready-made foods.[11,18,19] These trends in dietary intake patterns highlight a potential link between cooking with diet and weight.

Researchers, reporting that ready-made and fast food usage is negatively associated with cooking frequency (CF) and cooking skills, support the possibility of this cooking-diet-weight relationship.[12,16,17,20] Larson et al[20] found that among Minnesota young adults who reported high food preparation frequency, the prevalence of consuming 5 servings of fruits or vegetables a day was 31% compared with 3% for young adults who reported low food preparation frequency. Van der Horst et al[12,16] found that participants who reported the fewest cooking skills and spent less time cooking were the most likely to consume fast food.

Furthermore, some cooking interventions have had positive outcomes on diet behaviors for youth and adults, such as increased fruit and vegetable consumption and decreased fast food consumption.[21-23] Garcia et al[21] found that hands-on cooking experience and nutrition classes with parents yielded increases in cooking confidence and in fruit and vegetable consumption along with decreases in use of ready-made meals. These increases in fruit and vegetable consumption are consistent with the findings of Brown and Hermann, who examined outcomes of a youth and adult cooking intervention in Oklahoma. They found that daily fruit and vegetable consumption increased from 1.1 to 2.3 and 1.4 to 2.4 servings, respectively.[22] In school-based cooking programs like the quasi-experimental Cookshop Program study, fruit and vegetable consumption increases have been reported.[23] Although some cooking interventions have shown positive results related to fruit and vegetables consumption and increases in cooking confidence, results are not always clear due to small sample sizes, nonrandomized study designs, and limited use of longitudinal follow-up assessments.[24,25]

Numerous characteristics have been examined to assess demographic associations with cooking skills and frequency.[12-15,20,26-31] Age and sex have been associated with cooking abilities and frequency, with older adults and women having higher abilities and more frequently cooking.[12-15,20,29-31] Younger adults are more likely than older adults to report lower cooking skills and frequency and to report utilization of ready-made and fast foods.[12,14] Some researchers have shown that the gender discrepancy gap with cooking skills and frequency seems to be narrowing.[14,26,27] However, much of this research has been done with adults, and research is limited on the cooking abilities and behaviors among youth and the association with diet and weight.

Because youth are vulnerable to the long-term effects of childhood obesity, this relationship warrants further exploration.[9] The iCook-4H program, grounded is social cognitive theory[32] and 4H experiential learning,[33] is an out-of-school program for youth and their main adult preparer of food using observational and hands-on learning focused on cooking, eating, and playing together for obesity prevention.[34,35] The objective of the current study was to determine cooking self-efficacy and frequency of 9- to 10-year-old youth at baseline of a 2-year intervention study program[36] and the associations of those factors with dietary quality and body mass index (BMI).

Methods

Study design

The study design was a cross-sectional assessment of youth at the beginning of a 2-year intervention. Youth were randomized into control or treatment group after meeting the study criteria of having no food allergies, dietary restrictions, or life-threatening medical illnesses, and having computer access to the Internet. Anthropometric measurements were taken and online surveys were completed using computers/laptops provided by the researchers. Questionnaires were uploaded into Qualtrics,[37] hosted on a secure server. The study was piloted-tested and implemented in the 5 states of Maine, Nebraska, South Dakota, Tennessee, and West Virginia.

Participants

Participants were 9- and 10-year-old youth. They were recruited over a period of 6 weeks via flyers, emails, and word-of-mouth in schools, after school programs, and other community outlets, such as recreation centers, by researchers and community stakeholders. Their main adult food preparer was recruited for the study, but only demographic data were used for the current study. The variety of recruitment methods and locations yielded youth-adult dyads from diverse, rural, and/or low socioeconomic status populations. In addition, control and treatment youth were treated as one singular data source, as only baseline youth measurements were used.

Measurements

Youth's (n = 228) online survey assessed their CF and self-efficacy, age, and sex. The survey questions about cooking self-efficacy were developed by nutrition experts during the pilot testing year and were related to specific skills addressed in the program curriculum. After pilot testing, questions were modified to reflect the skills covered in the modified curriculum and to better assess self-efficacy, which is an important predictor of

a behavior.[38] The modified questions were based on expert input and on a validated survey developed for adults.[39] In accordance with validated self-efficacy questionnaires for youth developed by Baranowski et al,[40] question wording was formatted to be more appropriate for the cognitive level of iCook-4H youth participants.[40] To test face validity of the modified questions, the primary researcher conducted cognitive interviews with 8 youth (4 males and 4 females). Based on results of cognitive interviewing, the selection of questions was produced and included self-efficacy to cook, follow a recipe, use a knife, use an oven, and use a stovetop. Questions were administered in the format "I am sure I can [insert cooking skill]." Participants rated each question on a 5-point Likert scale as strongly disagree (5), disagree (4), neither agree nor disagree (3), agree (2), or strongly agree (1). Responses were reverse coded for each question (strongly disagree = 1, strongly agree = 5) and were averaged for an overall self-efficacy score for each participant. Cooking frequency was assessed through a single question ("How often do you help cook family meals?") that was rated on a 5-point Likert scale as never (1), rarely (2), sometimes (3), most of the time (4), or always (5).

Dietary data of youth were collected through online administration of the Block Food Screeners for Ages 2-17, 2007.[41] Dietary quality was scored based on compliance with the Dietary Guidelines for Americans' recommended daily intake levels of protein, dairy, whole grains, fruits, vegetables, and empty calories for age and gender, using methods adapted from the 2005 and 2010 Healthy Eating Indexes.[42]

Standard anthropometric protocols were used for taking heights and weights of youth, University students were trained on all protocols and were approved to conduct physical assessments when they met an interrater reliability of >0.80%. These measurements along with age were used to calculate youth's BMI-for-age percentile ranking in accordance with Centers for Disease Control and Prevention growth charts.[43] Percentile ranking allowed for determination of each youth's weight category as underweight (less than the 5th percentile), healthy weight (5th percentile to less than the 85th percentile), overweight (85th to less than the 95th percentile), or obese (equal to or greater than the 95th percentile).

Statistical analyses

All analyses were performed using SPSS version 22.0. Cronbach's α was calculated to determine the internal reliability of the questions and descriptive statistics were completed. Mean cooking self-efficacy scores and frequencies for CF responses were calculated in addition to frequencies for weight categories (underweight, healthy weight, overweight, obese), sex (male, female), race (white, non-white), and participation in government assistance programs (yes, no). Due to the small sample of underweight participants (n = 4), underweight participants were excluded from further analyses. To determine whether there were significant differences in cooking self-efficacy and frequency by certain participant characteristics, independent-sample *t* test were performed. Independent-sample *t* tests were performed for independent variables race (white or non-white), sex (male or female), and participation in government assistance programs (yes or no) with the dependent variables cooking self-efficacy and frequency. Analyses were then conducted to determine how cooking self-efficacy and frequency related to BMI and diet. Analysis of variance (ANOVA) was used to determine whether there was an association between cooking self-efficacy and BMI category and between CF and BMI category. Because no associations were noted between mean cooking self-efficacy and dietary quality or weight category, no further analyses were completed for self-efficacy. Associations between CF and dietary quality and between cooking self-efficacy and dietary quality were examined through calculation of Pearson correlations. Because statistical significance was seen for the association between CF and dietary quality, 2-way ANOVA was used to test this relationship by sex and by race, as in the independent-sample *t* tests.

Results

Sample characteristics

Sample characteristics of the iCook-4H youth are summarized in Table 1.

Cooking frequency

Youth (n = 228) indicated moderate participation in helping cook family meals with reports of 11% never, 23% rarely, 44% sometimes, 17% most of the time, and 6% always helping cook family meals (Table 1). Based on independent-sample *t* tests, significant differences were seen between male and female youth in CF ($t = -2.045$, $df = 215$, $P = .042$) with females reporting higher mean CF than males (Table 2). Females reported an average of 2.92 ± 1.03 and males reported an average of 2.63 ± 1.01 of the possible 5-point Likert scale. Cooking frequency was unrelated to race or use of government assistance programs.

Cooking self-efficacy

Cronbach's α for the cooking self-efficacy questions was 0.85, indicating sufficient internal consistency for the 5 cooking self-efficacy questions that were averaged for the cooking self-efficacy score. Overall, youth's mean cooking self-efficacy score was 3.78 ± 0.81 of a possible 5.00, indicating they reported they were between neutral and agree that they were sure they could perform selected cooking skills. Self-efficacy in cooking did not differ by sex, race, weight status, or participation in government assistance programs (Table 2).

Table 1. Demographics of iCook-4H youth participants at baseline.

	N = 228[a] (%)
Sex[b]	
Male	97 (44)
Female	124 (56)
Race[c]	
White	142 (67)
Non-white	69 (33)
Weight category[d]	
Healthy weight	120 (63)
Overweight	31 (16)
Obese	40 (21)
Participate in government assistance programs[e]	
No	121 (59)
Yes	83 (41)
How often youth help cook family meals[f]	
Never	21 (11)
Rarely	42 (23)
Sometimes	81 (44)
Most of the time	31 (17)
Always	11 (16)

Abbreviations: BMI, body mass index
[a]Sample size varies due to missing responses and rounding of weighted frequencies.
[b]Youth were asked via survey "Are you a boy or a girl?"
[c]Adults were asked via survey to "Select one group that best represents your child's race." Response options were white, black, Asian, Hispanic, Native American, and other. All but "white" were classified as "non-white."
[d]Youth height and weight were collected by trained researchers and used to calculate youth's BMI-for-age percentile ranking in accordance with Centers for Disease Control and Prevention growth charts. Percentile ranking was used to classify youth as healthy weight (> 5th and < 85th percentiles), overweight (≥ 85th and < 95th percentiles), or obese (≥ 95th percentile).
[e]Adults were asked via survey "Do you or any members of your family participate in any of the following: Families with Dependent Children (AFDC)/Temporary Assistance for Needy Families (TANF), Expanded Food and Nutrition Education Program (EFNEP), free/reduced price school meals, Medicaid, Welfare to Work (WTW), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), Supplemental Nutrition Assistance Program (SNAP), Supplemental Security Income (SSI)?"
[f]Questions were administered to each youth participant in the format "How often do you help cook family meals?"

CF and self-efficacy with BMI category

Overall, neither cooking self-efficacy nor CF was associated with BMI category. Analysis of variance testing revealed no significant association between BMI category (healthy weight, overweight, obese) and frequency of helping cook family meals ($P = .242$) and self-efficacy in cooking ($P = .822$). Associations of CF and cooking self-efficacy with BMI category are outlined in Table 3.

CF and self-efficacy with dietary quality

Pearson correlations revealed a significant positive association between CF and dietary quality ($r = 0.314$, $P \leq .001$). Youth who reported higher involvement in family meal preparation were more likely to have better dietary quality than youth who reported lower involvement. Two-way ANOVA testing showed that this association did not differ by race and sex. Pearson correlations yielded no significant association between cooking self-efficacy and dietary quality ($r = 0.031$, $P = .662$). Results from the Pearson correlation and 2-way ANOVA testing are outlined in Table 3.

Discussion and Conclusions

At the initiation of the iCook-4H program, youth reported being somewhat involved in home food preparation, which is consistent with previous research with the young adult population.[20] Although no association was found between CF and BMI, CF was positively associated with dietary quality. These findings are consistent with those reported by Larson et al[20] who found positive association between CF and dietary quality in young adults. However, it is important to note that these associations may not be carried from childhood or adolescence into adulthood. Laska et al[44] found that food preparation engagement during emerging adulthood was associated with improved dietary quality later in life; however, no relationship among food preparation engagement during adolescence and dietary quality in adulthood was found. A better understanding of the relationship between CF and dietary quality among youth overtime is warranted.

As shown in previous studies, significant differences in CF were found between sexes with females reporting significantly greater CF than males.[13] Although males and females were statistically different in their reported CF, the association of CF with dietary quality did not differ by gender in the 2-way ANOVA testing despite previous research that has shown that females are more likely to report preparing and consuming healthy foods than are males, who are more likely to consume and use processed foods.[13,20]

This study is not without limitations. For one, CF was assessed somewhat subjectively. Researchers have shown that usage of processed food products in cooking is associated with poorer diet and increased weight and that definitions of what constitutes cooking vary broadly.[11-13,15,16,20] Therefore, it would be important to also assess the type of "cooking." However, the question "How often do you help cook family meals" did not define the type of cooking; it left the interpretation to the participants, and social desirability may have influenced youth responses to this question. As more specific measures of CF were not included in this study, this may partially explain why CF was not associated with BMI. It is possible that there might be differences in BMI category between youth who practice more scratch-based cooking and youth who cook with highly processed, pre-prepared ingredients.

Table 2. Differences in mean cooking frequency and mean cooking self-efficacy ratings by sex, race, and participation in government assistance programs.

	MEAN COOKING FREQUENCY[a]	*P* VALUE[b]	MEAN COOKING SELF-EFFICACY[c]	*P* VALUE[b]
Sex[d]		.042		.485
Male	2.63		3.73	
Female	2.92		3.81	
Race[e]		.096		.103
White	2.88		3.82	
Non-white	2.61		3.61	
Participant in government assistance programs[f]		.710		.733
No	2.83		3.76	
Yes	2.77		3.79	

[a]Youth were asked via survey "How often do you help cook family meals?" Responses were never (1), rarely (2), sometimes (3), most of the time (4), or always (5). Mean responses are above.
[b]*P* value determined through independent-sample *t* tests with sex, race, and participation in government assistance programs as independent variables and mean cooking frequency and self-efficacy as dependent variables.
[c]Youth were asked 5 questions via survey. Questions were administered in the format "I am sure I can [insert cooking skill]." Responses were strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), or strongly agree (5). The average means are reflected in this table.
[d]Youth were asked via survey "Are you a boy or a girl?"
[e]Adults were asked via survey to "Select one group that best represents your child's race." Response options were white, black, Asian, Hispanic, Native American, and other. All but "white" were classified as "non-white."
[f]Adults were asked via survey "Do you or any members of your family participate in any of the following: Families with Dependent Children (AFDC)/Temporary Assistance for Needy Families (TANF), Expanded Food and Nutrition Education Program (EFNEP), free/reduced price school meals, Medicaid, Welfare to Work (WTW), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), Supplemental Nutrition Assistance Program (SNAP), Supplemental Security Income (SSI)?"

Table 3. Associations of cooking frequency and cooking self-efficacy with BMI category and dietary quality.

VARIABLE	COOKING FREQUENCY	COOKING SELF-EFFICACY
BMI category[a]	n = 191	n = 183
F	1.429	0.20
df	2	2
P value	.242	.822
Dietary quality[a]	n = 211	n = 204
R	0.314	0.031
P value	<.001	.662

Abbreviation: BMI, body mass index.
[a]Associations determined via Pearson correlations.

In addition, youth were asked to rate how often they help cook family meals on a Likert scale that did not indicate the number of times they were involved in food preparation per week. Instead, they rated themselves on a scale that ranged from never to always helping cook family meals, which could be a more subjective measure than a numerical scale. The rating used for this study would be largely based on the number of family meals offered per week. For instance, if only 2 family meals a week were prepared at home and a child helped with both of those meals, they would report always helping cook family meals. However, if family meals were prepared at home every day of the week and a child only helped twice, he or she would report minimal involvement in helping cook family meals. Although youth would have the same numerical CF, it would appear that they have a different CF based on this scale. Lacking the ability to fully discern CF may have resulted in the failure to detect relationships between CF and BMI category. In future projects, it would be beneficial to consider the type of cooking being done and include more objective assessments of frequency to determine whether varying degrees of cooking and involvement has stronger or weaker associations with diet quality and BMI.

Generally, youth had positive self-efficacy in each of the assessed cooking skills. Failure to see associations between youth's self-efficacy in cooking with weight and dietary quality may be the outcome of limited self-efficacy variation. Only 24 of 181 youth, who provided data for every self-efficacy question part of the self-efficacy score, averaged below 3 (neither agree nor disagree), falling more closely to strongly disagree and agree. Conversely 145 of 181 youth, who provided data for every self-efficacy question part of the self-efficacy score, averaged a self-efficacy score above 3 (neither agree nor disagree), falling more closely to agree and strongly agree. The limited variability among participants indicates that objective assessment may be a better strategy to determine cooking abilities of

youth than self-reported self-efficacy. In the future, researchers seeking to assess the relationship between cooking skills and health outcomes should consider incorporation of direct observation of youth's skills by trained research personnel rather than relying solely on self-efficacy reports. Direct observation should be done at baseline to allow individual assessment of youth to compare each participant's observed skill with his or her diet and weight. In addition, although the dietary data of youth were collected through validated tools, social desirability bias may place limitations on self-reported dietary assessments, therefore placing limitations on the overall dietary quality measures.

Generalizability of these results may be limited, as youth interested in participating in a cooking program may differ in CF and self-efficacy from youth who lack interest to participate. To determine cooking behavior of the youth population at large, further research is needed outside of cooking programs. Overall, the finding that CF is positively associated with dietary quality warrants further research to determine whether encouraging home food preparation is an effective strategy to improve dietary quality and ultimately assisting with healthy weight maintenance.

Author Contributions

ADF was involved in the conception and design of study; contributed to acquisition, analysis, and interpretation of data; drafted the article; revised the article critically for important intellectual content; and approved the version of the article to be published. SEC, LF, MDO, KKK, and AAW were involved in the conception and design of study, contributed to acquisition of data, revised the article critically for important intellectual content, and approved the version of the article to be published. MM contributed to the analysis and interpretation of data, revised the article critically for important intellectual content, and approved the version of the article to be published.

Ethical Approval

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the Institutional Review Board for Protection of Human Subjects at each state university. Written informed consent was obtained from all subjects.

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