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Research report

Involving children in meal preparation. Effects on food intake ☆

Klazine van der Horst *, Aurore Ferrage, Andreas Rytz

Nestlé Research Centre, Vers-chez-les-Blanc, PO Box 44, CH-1000, Lausanne 26, Switzerland

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ABSTRACT

The question of how to promote healthy eating habits in children is relevant because most children do not meet the recommended vegetable intake. Involving children in food preparation could be an opportunity to develop healthy eating behaviors and to increase vegetable consumption. The purpose of this study was to examine the effect of children's involvement in meal preparation on their food and vegetable intake. A between-subject experiment was conducted with 47 children aged 6 to 10 years. In condition 1 (n = 25), children prepared a lunch meal (pasta, breaded chicken, cauliflower, and salad) with the assistance of a parent. In condition 2 (n = 22), the meal was prepared by the parent alone. Independent samples t-tests were conducted to compare intake in the "child cooks" and "parent cooks" conditions. Children in the child cooks condition ate significantly more salad 41.7 g (76.1%), more chicken 21.8 g (27.0%), and more calories 84.6 kcal (24.4%) than children in the parent cooks condition. Between before cooking and directly after cooking the meal, children in the child cooks condition reported significantly increased feelings of valence (feeling positive) and dominance (feeling in control). This study confirms that involving children in meal preparation can increase vegetable intake. Because of the potential effect on energy intake, parents need to be made aware of appropriate portion sizes for their children. Taking this into account, encouraging parents to involve their children in the preparation of healthy and balanced meals could be a valuable intervention strategy to improve the diets and vegetable intake of children.
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Introduction

The promotion of healthy eating habits and especially vegetable consumption in children is considered of high importance as many children fail to meet the recommendations in Europe and the USA. Several review studies on the evaluation of factors that might impact children's fruit and vegetable consumption have consistently reported that parents play a crucial role in establishing good eating behaviors through behavioral modeling and making fruit and vegetables available and accessible for their children (Krolner et al., 2011; Pearson, Biddle, & Gorely, 2009; Rasmussen et al., 2006; van der Horst et al., 2007). Alongside more direct parental influence, existing school-based interventions moderately improve fruit consumption but have a minimal impact on vegetable intake (Evans, Christian, Cleghorn, Greenwood, & Cade, 2012). According to Evans et al. (2012), cooking, school gardening, and tasting were identified as potential areas to explore in the future (Evans et al., 2012) and the first evidence appears promising (Caraher, Seeley, Wu, & Lloyd, 2013; Gatto, Ventura, Cook, Gyllenhammer, & Davis, 2012; Gibbs et al., 2013; Marshall, Golley, & Hendrie, 2011; Mustonen & Tuorila, 2010; Robinson-O'Brien, Story, & Heim, 2009). These programs are highly appreciated by children; they enjoy the hands-on activities, which give them a feeling of ownership and pride (Heim, Stang, & Ireland, 2009).

Benefits of involving children in cooking activities

The idea of allowing children to participate in food preparation as a means to increase a liking for food is not new. For instance, in a study conducted in 1989, Casey and Rozin found that parents chose "help with food preparation" as a method that could very likely create vegetable liking in children (Casey & Rozin, 1989). Anliker, Laus, Samonds, and Beal (1992) used US data from the early 1980s to examine 3.5 year old children's involvement in food related activities (Anliker et al., 1992). They showed that more than 75% of the children helped with food related activities such as setting the table, helping to prepare baked goods, and serving spreading butter or peanut butter. Children who were more involved in food related activities were found to score higher on various aspects of nutrition awareness, such as the origin of foods, food values, and the role of foods in the energy balance. Children's involvement in food related

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* Corresponding author.
E-mail address: klazine.vanderhorst@rdls.nestle.com (K. van der Horst).

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activities was also found to significantly correlate with intakes of protein (r = .18) and vitamin C (r = .26) (Anliker et al., 1992). Also, more recently, there have been published studies addressing the beneficial effects of cooking. A cross-sectional survey among 305 Swiss parents of 6–12-year-old children showed clear positive associations between the children's cooking enjoyment (e.g., "my child loves to cook", "my child likes to try new recipes") and eating enjoyment; the survey also revealed an inverse association with picky eating behaviors (van der Horst, 2012). The frequency of helping with food preparation in the home was also found to be associated with higher fruit and vegetable preferences and higher self-efficacy for selecting and eating healthy foods in Canadian children (Chu et al., 2013). Cross-sectional findings from project EAT (Eating Among Teens and Young Adults) in the US showed that being engaged in home food preparation activities was associated with healthier intake (Larson, Perry, Story, & Neumark-Sztainer, 2006; Larson, Story, Eisenberg, & Neumark-Sztainer, 2006).

Cooking as a component of nutrition education programs

Until now, research on cooking with children has been surprisingly limited, and no existing experimental research confirms the association between cooking and fruit and vegetable intake. Most research focuses on school-based nutrition education programs in which food preparation is one part of a set of activities, such as tasting lessons, gardening, and classroom education (Robinson-O'Brien et al., 2009; Seeley, Wu, & Caraher, 2010). Research suggests that these educational programs are an engaging and effective strategy to teach healthy eating behaviors in children (Liquori, Koch, Contento, & Castle, 1998), adolescents (Wang et al., 2010), and young adults (Levy & Auld, 2004). Two systematic reviews were conducted to evaluate these multi-component interventions. The first focused solely on the impact of practical cooking initiatives in schools, and only included four papers on children between 5 and 12 years old (Seeley et al., 2010). Cooking lessons were part of an intervention package, which included activities like computer games, adapted school lunches, and nutrition education. Two out of three studies demonstrated an increase in fruit and vegetable intake (Cullen, Watson, Zakeri, Baranowski, & Baranowski, 2007; Perez-Rodrigo & Aranceta, 1997). The third study reported higher food preference scores and lower plate waste of targeted foods (Liquori et al., 1998).

The second review evaluated the effect of interventions in the United States that used gardening as a hands-on activity on fruit and/or vegetable intake, willingness to taste fruits and vegetables, preferences for fruits and vegetables, or other nutrition-related outcomes (Robinson-O'Brien et al., 2009). In many of these garden projects, fruit and vegetable preparation activities and/or taste sessions were included. Eleven studies were reviewed. Studies included youth ranging between 5 and 15 years old. Of these eleven studies, four evaluated changes in fruit and vegetable intake while the others focused on changes in preferences and willingness to taste. One of the four studies on intake did not find an effect on fruit and vegetable intake, but preferences for vegetables increased (Lineberger & Zajicek, 2000). The other three studies found significant increases in fruit and/or vegetable consumption, with increases of 2.5 servings per day (Hermann et al., 2006; Lautenschlager & Smith, 2007a; McAleese & Rankin, 2007). Seven studies included fruit/vegetable preference or willingness to taste as an outcome, and three studies reported a significant increase in preference or willingness to taste scores (Robinson-O'Brien et al., 2009). One of the main limitations in the quality of these intervention studies is that as they did not always include a control group, and sometimes had major limitations in the assessment of fruit and vegetable intake. Therefore, it is difficult to draw conclusions on the effect of these gardening programs on intake. Moreover, the combination of activities makes it impossible to evaluate the separate effects of the different components on outcomes, such as the effect of the preparation lessons on food intake (Wang et al., 2010). On the other hand, these interventions indicate that comprehensive fruit and vegetable exposure programs might have positive effects on vegetable preferences and intake.

Cooking and meal preparation programs could have other positive effects, as indicated in some qualitative studies. For instance, it evokes feelings of independence and pride (Bowen & Devine, 2011); children seem to enjoy cooking programs; they or their teachers report high levels of enjoyment; they like to eat what they cook; and want to help their parents and teach them what they learned (Dougherty & Silver, 2007; Lautenschlager & Smith, 2007b).

Objective

The research presented above indicates that involving children in cooking at home or at school could be an opportunity to teach healthy eating behaviors and to increase vegetable consumption. Until now, evidence has been based on overall evaluations of multi-component interventions or cross-sectional surveys. Therefore, the purpose of this study was to examine the effect of children's involvement in meal preparation on their food intake, especially vegetable intake, in an experimental setting. Furthermore, we also wanted to explore the role of emotions, such as positive feelings and pride, because based on the evaluations of cooking programs, this appears to be an important consideration.

Methods

To investigate the influence of children's involvement in meal preparation on subsequent food intake, 47 parent-child pairs were invited to come to the Research Center in Lausanne, Switzerland, one pair at a time, to prepare and consume a lunch meal.

Meal and recipe selection

Three criteria were applied to develop the recipe that was used in the experiment: 1) it should present a lunch meal consisting of a vegetable, meat and starch component, and a salad as side dish; 2) the vegetables should not be too easily accepted by children (no carrots or tomatoes) and they should be available during the summer and autumn at the time of the experiment; 3) the recipe should include sufficient hands-on activities/exposure for the child.

The vegetable selection was also based on the results of an additional screener questionnaire that included liking questions for 10 vegetables (see following section for further description). The entire cooking process and potential safety hazards for three meal combinations were evaluated, and decisions were made on tasks the child was allowed to perform. In nine feasibility tests with parent-child pairs, various recipes were tested on the level of child involvement in the cooking process. Based on the outcomes of the feasibility tests and the additional screener survey including vegetable liking, a meal of cooked cauliflower, pasta, breaded chicken strips and a salad as side dish was selected.

Participants

A market research company recruited the parent-child pairs, and children were between 6 and 10 years old. Parent-child pairs were excluded from participation if they followed a medically prescribed diet, if they followed a vegetarian diet, were prone to allergies or had food-related diseases, if the parent worked in psychology, marketing, or food-related jobs, and when they had previously participated in other food related studies. All eligible parent-child pairs (n = 171) received a questionnaire that was used as an

additional screener and to examine parents' cooking behaviors and children's liking for vegetables, including vegetables selected for the lunch meal (cauliflower, lettuce, bell pepper, and cucumber). The response rate for the survey was 75%, with 129 returned questionnaires. Based on the responses, parent-child pairs were excluded from participation if the child showed high levels of picky eating, if the parent had no confidence in cooking with the child, if the child already had a high participation in meal preparation (more than once a week), and if the child showed very high or very low liking for cauliflower, the main vegetable in the experiment. It was foreseen that no improvement in liking or intake could be expected when children had very high or low liking scores for cauliflower. Based on the survey responses, 71 parent-child pairs were eligible for recruitment in the experiment, of which 14 declined to participate, 7 pairs participated in the pilot tests, and 50 were enrolled in the main experiment, which was conducted in 2012. Participants were all recruited independently of the condition to attend. They were allocated to a condition based on their availability. As a result of safety measures that were necessary in the kitchen as the child cooked (e.g., locking drawers with sharp knives, and, adding an additional step so that children could reach the counter), the conditions alternated on a weekly basis. Three parent-child pairs did not show up for the experiment. Data for 47 participants (23 boys, 24 girls; 25 children in the experimental group and 22 in the control group) were analyzed. Written informed consent was obtained from all parents. Parents received monetary compensation, and children received an apron after the experiment. The study was carried out in accordance with the Declaration of Helsinki.

Procedures

In the experimental group, the child prepared the meal with help from the parent; in the control group, the parent prepared the meal while the child was present in the kitchen doing something else (reading a comic book, magazine, coloring, or playing with Lego) to simulate an in-home situation. A recipe booklet was designed to give the parent and child instructions on how to cook the meal as well as instructions on safety and hygiene. In both groups, the children or parents prepared pasta with breaded chicken strips and cauliflower. The preparation method and the amount to be prepared were fixed for this part of the experiment. However, for the mixed salad, the children or parents had more freedom to choose. The children or parents could choose one or two ingredients out of three options (lettuce, bell pepper, and cucumber) to prepare a salad. They could also decide how much they would like to prepare. In the experimental group, children could perform the following activities, with or without the help of the parent: wash and cut cauliflower; prepare the breaded chicken strips (preparing 4 bowls containing beaten eggs, crushed cornflakes, grated cheese, and flour and dip each piece of chicken in the bowls); select, wash, and cut the salad ingredients; and weigh the pasta. After preparing the meal, the parent and child were brought to a room with a dining table so that they could have the meal together. The experimenter prepared the plates by weighing all the foods in order to standardize the plates for all participants. All children received approximately 170 grams of cauliflower, 100 grams of pasta, and 120 grams of chicken. The salad portions were decided by the child/parent during meal preparation. A 1.5-liter bottle of water was provided. Intake of all meal components, with the exception of water, was measured, and the meal preparation and lunch were video recorded for behavioral observations.

Measurements

Food intake

All food items were weighed before and after (leftover food items on the plate) the lunch meal in order to calculate intake. Energy intake was calculated using data from a standard nutrient composition database (NEVO-table online version, Dutch food composition table, Netherlands Nutrition Center, The Hague (2006)).

Emotions

The Self-Assessment Manikin (SAM) was used to assess children's emotions (Bradley & Lang, 1994). The SAM is a validated nonverbal pictorial assessment technique that directly measures the pleasure, arousal, and dominance associated with a person's affective reaction to a wide variety of stimuli and is an easy method for quickly assessing reports of affective response in various contexts. The SAM scale has been successfully used with children in an extreme emotional setting (4–7-year-old disruptive children during dental treatment) (Greenbaum, Turner, Cook, & Melamed, 1990). Children were asked to rate their current state on each of the three dimensions on a 5-point pictorial scale. The pleasure dimension ranges from a smiling, happy figure to a frowning, unhappy figure. The arousal dimension ranges from an excited, wide-eyed figure to a relaxed, sleepy figure, and the dominance dimension represents changes in control with changes in the size of the SAM; a large figure indicates maximum control of the situation. The children can place an "x" over any of the five figures on each scale (Bradley & Lang, 1994). Children were asked to rate the emotions three times during the experiment without parent assistance: before cooking (BC), after cooking (AC), and after eating lunch (AL). When necessary, the children received help from the experimenter.

Behavioral observations

A coding scheme was developed and used by three coders to code the cooking sessions of the group in which the child prepared the meal with the help of a parent with an overall inter-rater reliability of 87%. The following behaviors were coded: preparation of ingredients and utensils (duration), cookbook reading (duration), food tasting (frequency), oral and physical assistance from the parent and experimenter (duration and frequency), verbal encouragement (frequency), time involved in cauliflower preparation (duration), time involved in salad preparation (duration), time involved in pasta preparation (duration), time involved in chicken preparation (duration), total time used to cook the meal, and the duration of the eating occasion. Observations of the time involved in the preparation of the foods as well as cooking and eating duration were used in the analyses to explore a possible exposure-response effect of the time involved in the preparation.

Other measures

As mentioned earlier, for the recruitment of subjects, liking, picky eating, and cooking involvement were assessed. Children answered the questions on vegetable liking twice: in the screener/recruitment questionnaire and after eating lunch. All vegetables used in the study (cauliflower, lettuce, bell pepper, and cucumber) were included in the questionnaire and assessed on a 5-point scale (1 = I do not like it at all; 5 = I like it very much). After lunch, children also answered a question on whether they liked eating the meal (1 = I did not like it at all; 5 = I liked it very much), and children who cooked were asked to evaluate how they liked cooking the meal on the same scale. Picky eating was parent-reported using three items from the Children's Eating Behavior Questionnaire (Wardle, Guthrie, Sanderson, & Rapoport, 2001), and cooking involvement was parent-reported based on one item, "how often does your child help you to prepare a warm meal?" on a 4-point scale (1 = once monthly or less; 4 = more than once a week). As mentioned before, children who cooked more than once weekly were excluded from participation.

Table 1
Differences in background and demographic variables of participants in the two experimental conditions.

	Total (n = 47)		Child cooks (n = 25)		Parent cooks (n = 22)		t	*P*-value
	mean	sd	mean	sd	mean	sd		
Age child (years; range: 6–10)	8.3	1.2	8.6	1.1	8.1	1.2	1.41	.16
Age parent (years ; range: 30–51)	40.0	4.6	39.8	4.5	40.1	4.7	–.22	.83
Liking cauliflower (range 1–5)	3.49	.72	3.52	.65	3.45	.800	.31	.76
Liking lettuce (range 1–5)	4.39	.93	4.40	.87	4.38	1.02	.07	.95
Liking bell pepper (range 1–5)	3.74	1.35	3.77	1.38	3.69	1.35	.19	.85
Liking cucumber (range 1–5)	4.24	1.04	4.28	1.10	4.19	.98	.29	.77
Picky eating score (range 1–5)	2.23	.68	2.15	.60	2.33	.77	–.93	.36
	n		n		n		Chi^2	*P*-value
Cooking involvement								
≤1 time/month	9		3		6		1.89	.39
2–3 times/month	25		15		10			
Once a week	13		7		6			

Statistical analysis

The data were analyzed using the SPSS statistical software package, version 16.0 (SPSS Inc., Chicago, IL, USA). To assess whether the two study conditions were successfully randomized by age, picky eating, and food preferences, t-tests were performed. A chi-square test was used for cooking involvement. MANOVA was used to examine whether overall intake was significantly increased between the groups. Independent samples t-tests were conducted to determine whether the two cooking conditions were associated with differences in the intake of the separate meal components. Pearson correlations were calculated to examine the association between the cooking duration variables and the intake of the meal components. Independent samples t-tests were conducted to determine whether emotions differed between the two experimental groups. Emotions were further analyzed with paired samples t-tests to examine whether emotions significantly differed before cooking, after cooking, and after eating lunch. All tests were based on a .05 significance level unless otherwise stated.

Results

A total of 47 children participated in the present study, of whom 49% were boys (n = 23) and 51% were girls (n = 24) (Table 1). Seven children were accompanied by their fathers and 40 children by their mothers. Independent samples t-tests did not show any significant differences between the experimental groups in terms of the age of the child (M = 8.34; SD = 1.15), the age of the parent (M = 40.0; SD = 4.55), cauliflower liking (M = 3.49; SD = .72), lettuce liking (M = 4.39; SD = .93), bell pepper liking (M = 3.74; SD = 1.35), cucumber liking (M = 4.24; SD = 1.04), picky eating (M = 2.23; SD = .68), and cooking involvement ($\chi^2 = 1.83$; $P = .39$).

Intake

To test whether cooking involvement affected the children's food intake, the means of grams intake and kilocalories for all meal components were compared between the experimental groups (Table 2). Independent samples t-tests revealed a significant effect of meal preparation on the intake of salad, chicken and energy. Children in the child cooks condition consumed more salad (d = 41.7 g; 76.1%, $P = .008$), more chicken (d = 21.8 g; 27.0%, $P = .025$), and had a higher calorie intake (d = 84.6 kcal; 24.4%, $P = .007$). The MANOVA analysis of the grams intake of salad, chicken, pasta, and cauliflower confirmed that overall intake was significantly higher in the child cooks condition (Wilks' Lambda = .760; F = 3.18; *P*-value = .023). These results confirm that in the child cooks condition, overall intake increases, but the intake of salad increased more (+76.1%) than that of chicken (+27.0%).

A review of the videos of parents and children having lunch, revealed that nine parent-child pairs shared some food from each other's plates. We also had two incidents during meal preparation (e.g., one mother accidentally added vinegar to the cauliflower). To examine the stability of the results, we analyzed the data, excluding these 11 pairs (n = 36; 18 pairs per condition). The results showed no effect for pasta (d = 12 g; 15%, $P = .151$) and no effect for chicken (d = 21 g; 26%, $P = .075$). In the case of salad, a significant effect was found (d = 51 g; 97%, $P = .007$), and for cauliflower, a borderline significant effect was found (d = 32 g; 37%, $P = .064$). This indicates that the results of the limited sample led to essentially the same conclusions.

Interesting trends appeared when descriptive subgroup analyses were used to further explore the data for gender and age effects (Table 3). As the sample sizes were too small to draw final conclusions, all effects with the trend ($P < .10$) were reported in order to guide hypothesis generation for future confirmatory studies.

Boys in the child cooks condition showed a higher intake of salad (d = 62 g; 124%; $P = .015$) and calories (d = 94 kcal; 27%; $P = .077$) compared to boys in the parent cooks condition. Girls in the child cooks condition showed a higher intake of cauliflower (d = 53 g; 74%; $P = .014$), chicken (d = 21 g; 26%; $P = .083$), and calories (d = 74 kcal; 21%; $P = .051$) compared to girls in the parent cooks condition.

Younger children (aged 6–8) in the child cooks condition had significantly higher intakes of salad compared to younger children in the parent cooks condition (d = 35 g; 76%; $P = .079$). Older children

Table 2
Mean differences in intake between the child cooks and parent cooks conditions (independent samples t-test).

	Total Mean (sd)	Child cooks Mean (sd)	Parent cooks Mean (sd)	Mean difference (%)	t	P-value
n	47	25	22			
Cauliflower (gram)	100.7 (51.2)	110.5 (50.1)	89.7 (51.3)	20.8 (23.2%)	1.40	.167
Mixed salad (gram)	76.9 (54.7)	96.4 (61.5)	54.8 (35.4)	41.7 (76.1%)	2.80	.008
Pasta (gram)	84.7 (24.2)	89.2 (20.0)	79.6 (27.7)	9.7 (12.2%)	1.38	.173
Chicken (gram)	92.3 (33.6)	102.5 (33.1)	80.7 (31.1)	21.8 (27.0%)	2.32	.025
Total energy (kcal)	391.8 (110.3)	431.4 (105.7)	346.8 (99.5)	84.6 (24.4%)	2.82	.007

Table 3
Mean differences in intake between the child cooks and parent cooks conditions according to gender and age ($P < .10$).

	Child cooks Mean (sd) Boys	Parent cooks Mean (sd)	t	*P*-value	Child cooks Mean (sd) Girls	Parent cooks Mean (sd)	t	*P*-value
n	13	12			12	12		
Cauliflower (gram)	97 (53)	111 (44)	–.64	.530	125 (44)	72 (52)	2.66	.014
Mixed salad (gram)	112 (71)	50 (24)	2.66	.015	79 (47)	59 (43)	1.11	.279
Pasta (gram)	93 (18)	80 (33)	1.25	.225	85 (22)	80 (24)	.60	.553
Chicken (gram)	103 (36)	81 (38)	1.48	.163	102 (31)	81 (26)	1.82	.083
Total energy (kcal)	443 (113)	349 (127)	1.86	.077	419 (100)	345 (75)	2.06	.051
	6–8 years old				9–10 years old			
n	10	13			15	9		
Cauliflower (gram)	92 (49)	82 (61)	.43	.671	123 (49)	101 (33)	1.18	.252
Mixed salad (gram)	81 (54)	46 (37)	1.85	.079	106 (66)	67 (31)	1.68	.106
Pasta (gram)	85 (24)	82 (28)	.24	.816	92 (17)	76 (29)	1.77	.091
Chicken (gram)	95 (36)	90 (27)	.37	.718	108 (31)	68 (33)	3.01	.006
Total energy (kcal)	390 (104)	370 (84)	.50	.621	459 (100)	313 (115)	3.27	.004

(aged 9–10) in the child cooks condition were showed to have higher intakes of pasta (d = 16 g; 21%; $P = .091$), chicken (d = 40 g; 59%; $P = .006$), and calories (d =146 kcal; 47%; $P = .004$) than children of the same age in the parent cooks condition.

Time spent cooking

Pearson correlations were calculated between the time the children were involved in cooking the various meal components and the intake of these components (n = 24) to explore a possible exposure-response effect. No significant correlations were found. Significant correlations were found between the total time the child spent cooking with eating duration (r = .046; $P = .02$) and overall meal liking (r = .38; $P = .07$). Time spent on cauliflower preparation was related to a higher likelihood of preferring this meal component (the most liked from the four components) (r = .40; $P = .05$), and the more time children spent on salad preparation, the more they liked preparing the meal (r = .36; $P = .08$). The results suggest that the time invested in cooking relates to meal outcomes.

Emotions

Changes in emotions (before cooking (BC), after cooking (AC) and after lunch (AL)) were compared with paired samples t-tests (Table 4) and between the experimental groups with independent samples t-tests (Table 4). Children who cooked increased their levels of positive valence ($d_{\text{valence BC-AC}} = .40$; $P < .05$) and dominance ($d_{\text{dominance BC-AC}} = .56$; $P < .05$) when BC was compared with AC. Children who cooked also showed significantly higher levels of valence after cooking compared to the children who did not cook. Children who did not cook showed an increase in arousal when BC was compared with AC and AL ($d_{\text{arousal BC-AC}} = .73$; $P < .05$, $d_{\text{arousal BC-AL}} = .46$; $P < .05$). This might be due to the relatively quiet activities they could do during the cooking session: coloring, Lego, reading, etc. After one hour, they might have been excited about going to the lunch room to have the meal with their parents.

Discussion

The present study shows that involving children in a single session of meal preparation has effects on the subsequent intake. There was a significant increase in meal intake when the child was involved in the meal preparation. The increased intake of salad and chicken was significant. Because of caloric density, the higher intake of breaded chicken strips (21.8 grams) largely contributed to the higher calorie intake. Future studies could explore whether the effect on intake would be similar for products containing less calories and less easily accepted by children, such as fish. Also, compensation effects, such as a lower intake of (unhealthy) snacks in the afternoon and evening, are worthwhile to explore especially because the lunch contributed only 22.7% to 30.8% of the daily estimated energy requirement (1,400 to 1,900 kcal) (DGE, 2013), which can be considered normal or even low for the main meal of the day. Nevertheless, the increased intake warrants further attention and highlights the importance of communicating child-appropriate serving sizes and meal compositions to parents.

A similar relationship between increased energy intake and meal preparation was recently reported in a survey with children and in a study with adults. In the study of Chu and colleagues, children (aged 10–11) who were involved in meal preparation at home, more often reported higher energy intake (Chu, Storey, & Veugelers, 2013). Children helping at least once a day with meal preparation consumed 245 more kcals more compared to children who were never involved. Children involved in meal preparation ate more of all food groups and had healthier diets (Chu et al., 2013). In an experimental setting, adults who prepared themselves a milkshake consumed more of it than from a milkshake prepared by the experimenter following the same recipe (Dohle, Rall, & Siegrist, 2014).

Table 4
Mean differences in emotions within and between experimental conditions.

		Before Cooking (BC) Mean (sd)	After Cooking (AC) Mean (sd)	After Lunch (AL) Mean (sd)	Paired samples t-test ($P < .05$)
Valence	Child cooks (n = 25)	4.52 (.51)	4.92 (.28)**	4.92 (.28)	BC<AC,AL
	Parent cooks (n = 22)	4.45 (.74)	4.64 (.58)	4.73 (.55)	NS
Dominance	Child cooks (n = 25)	4.00 (.58)	4.56 (.65)*	4.44 (.77)	BC<AC,AL
	Parent cooks (n = 22)	4.23 (.81)	4.18 (.85)	4.41 (.67)	NS
Arousal	Child cooks (n = 25)	3.12 (.73)	3.32 (1.31)	3.12 (1.17)	NS
	Parent cooks (n = 22)	2.77 (1.07)	3.50 (1.26)	3.23 (1.19)	BC<AC,AL

*Independent samples t-tests showed a significant difference between the groups child cooks and parent cooks for this variable $P < .10$.
**Independent samples t-tests showed a significant difference between the groups child cooks and parent cooks for this variable $P < .05$.

Participants consumed more of the self-prepared shake because they liked it more. Research has shown that people like objects they have created themselves, and labor increased the valuation of the self-created objects (Franke, Schreier, & Kaiser, 2010; Norton, Mochon, & Ariely, 2012). The same phenomenon could be valid for children and suggests another explanation than the familiarity effect that is often used to explain the effect of meal preparation (Aldridge, Dovey, & Halford, 2009; Heath, Houston-Price, & Kennedy, 2011). Children between 6 and 10 years old are already familiar with many foods in their raw and prepared forms and especially with the common foods, such as lettuce and cauliflower, used in the current study. Even though the familiarity could have been increased with food preparation, this effect could be less relevant for older children.

Meal preparation & choice

In this study, the strongest effects on intake were found for salad and chicken. Children could more actively participate in performing the various tasks for the preparation of these two meal components compared to the activities for pasta and cauliflower. However, in the child cooks condition, we did not find significant correlations between the time involved in cooking the various meal components and the intake of these components, but the overall measure of cooking duration was positively associated with eating duration and overall meal liking. The sample size (n = 24) might have been too small to capture the effects between the actual time involved in cooking a meal component and the intake of the component, or the autonomous involvement in the preparation of the meal was too low to establish an overall effect on intake or an effect on certain meal components. It might also be that other factors, such as doing an activity with the parent, freedom, autonomy, choice, and emotions might be more important in explaining the effect than the actual time spent cooking.

Especially large effects on salad intake were found in this study. First, in this part of the experiment, children had more freedom and choice (ingredients and quantities), which could strengthen the effect on intake (Rohlfs Dominguez et al., 2013; Zeinstra, Renes, Koelen, Kok, & de Graaf, 2010). Second, all children, younger and older, who cooked had sufficient skills to prepare the salad completely independently, which could have increased feelings of being in control (dominance). A higher degree of control and a consequent level of intrinsic motivation is also hypothesized to underline the effect of choice (Rohlfs Dominguez et al., 2013). For the salad component, it can be hypothesized that feelings of autonomy and pride were increased because of the combination of choice and independence in meal preparation, which could have led to increased salad intake. Independence in meal preparation could also partly explain the age-related differences found in the experiment. For instance, for younger children, we found only an effect on salad intake ($P = .08$), and they were skillful enough to prepare the salad on their own. For all other meal components, the younger children needed more help from parents, for example, in breaking eggs, grating cheese, and weighing foods.

Positive context of meal preparation and eating

Another possible explanation for the results of the present study is the positive context that is created when parents and children cook together. In this study, spending time together was the most frequently reported benefit of cooking together (reported by 84% of the parents). In the development of food likes and dislikes, the context or atmosphere in which the food exposure takes place is mentioned as an important factor (Aldridge et al., 2009). High levels of parental control around eating can create a negative environment, impairing food enjoyment and intake (Birch, McPhee, Shoba, Steinberg, & Krehbiel, 1987; Faith & Kerns, 2005; Galloway, Fiorito, Francis, & Birch, 2006; van der Horst, 2012; Webber, Cooke, Hill, & Wardle, 2010). Cooking with children might be a child-centered approach in which children are exposed to foods in a positive environment. Children report that they enjoy cooking because it gives them the opportunity to spend time with their parents and to try foods (Borgfeld, Janke, Kreuzer, Sturm, & Thurn-Frähmke, 2011), and cooking stimulates positive feelings such as ownership and pride (Dougherty & Silver, 2007; Heim et al., 2009). These qualitative evaluations were confirmed in the present study as the children who cooked reported significantly increased valence and dominance after the cooking experience.

Limitations

The main limitations of this study are the controlled setting of the experiment, and it consisted of a single cooking session. One of the strengths of the controlled setting is the possibility of video recordings, which enabled observational measures as well as a second control on how the experiment was conducted (e.g., sharing food between parent and child). Even though the experiment was set up to be as natural as possible, parents and children had to cook and eat in an unfamiliar environment. The recipe was controlled in a way that parents and children had to use the same ingredients and were served standardized quantities, except for the salad and seasoning. Even though participants could ask for an additional serving off the lunch meal, nobody did. To need to request additional servings might have been a barrier that limited intake in both groups. Because of the limitations of an experimental setting, the results of this study would need to be confirmed with studies that include more cooking sessions over a longer time-span in a natural in-home environment. However, to get an impression of the sustainability of the effect, a follow-up questionnaire was sent to the participants of the experiment at the end of 2012, with a response rate of 91% (n = 43). This survey showed that parents of children who cooked were more likely to report that they changed their behaviors around involving their child in cooking than parents who cooked without their children (52% vs 20%), that they increased the time spent cooking with their child (61% vs 25%), and that the child showed more interest in cooking (78% vs 40%). This indicates that one cooking session can impact beyond the intake of the subsequent meal in increasing interest and awareness in both children and parents. Because our control group of children performed an activity without parents mimicking an in-home situation, we could not explore whether the increased intake was a result of meal preparation or because of spending time with the parent. Adding a third group could have been useful to explore this. Similarly, freedom of choice in the salad and seasoning could have been stronger than the effects of meal preparation; this is also an interesting topic for further research.

Other limitations of the experiment relate to the sample selection and the recipe. In our sample, we included only children with a moderate liking for cauliflower and a moderate-to-high liking for the salad ingredients. It would also be interesting to examine whether involvement in meal preparation is an effective strategy for less liked foods, such as fish instead of the highly liked breaded chicken strips, or for a vegetable that is disliked. If meal preparation increases liking because of the effort, spending time with the parent, or because of choice, it can also be hypothesized as a means to influence consumption of less liked foods. However, it is likely that more preparation sessions are needed to establish a significant and long-term increase in liking and intake. Therefore, future studies could also further explore whether involvement in meal preparation can be seen as a strategy that positively impacts on picky eating behaviors (van der Horst, 2012).

Conclusion

This study gives a first indication that encouraging parents to involve their children in the preparation of healthy and balanced meals could be a promising intervention strategy to improve the diets and food intake of children. Because intake of energy was increased in children who participated in cooking, parents might need advice on how to involve children in the preparation of a healthy and balanced meal and on appropriate portion sizes. Longer-term effects in a school or an in-home setting, as well as the usefulness of cooking as a strategy for the increase in intake off disliked foods, need to be explored further.

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