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# Exploring food preparation practices in families with and without school-aged childhood cancer survivors

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## Abstract

*Objective:* Survival rates for paediatric cancers have increased dramatically since the 1970s, but childhood cancer survivors (CCS) are at increased risk for several chronic diseases throughout life. Nutrition interventions promoting healthy family meals may support wellness for survivors, but little research has explored CCS family food preparation habits. The goal of the present study was to describe and compare food preparation practices of CCS and non-CCS families.

*Design:* Observational.

*Setting:* Typical evening meal preparation events were observed and recorded in participant homes. Recordings and notes were analysed using the Healthy Cooking Index (HCI), a measure of nutrition-optimizing food preparation practices relevant to survivor wellness. Demographics, BMI and nutrient composition of prepared meals were also collected.

*Participants:* Forty parents with a CCS or non-CCS child aged 5–17 years were recruited.

*Results:* There were no major differences between the CCS and non-CCS families with regard to summative HCI score or specific food preparation behaviours. Meals prepared by CCS and non-CCS families had similar nutrient compositions.

*Conclusions:* The study revealed areas for practical nutrition intervention in CCS and non-CCS families. Future studies should consider adopting and tailoring nutrition intervention methods that have been successful in non-CCS communities.

**Keywords**
Food preparation
Childhood cancer
Survivorship
Nutrition

The overall 5-year survival rate for childhood cancers has improved significantly over the last several decades and is currently at 84 % in developed countries[1]. Consequently, there has been an increased focus on the long-term health and wellness of childhood cancer survivors (CCS). CCS are at increased risk for several late-effects of treatment including CVD, obesity and secondary cancers[2,3]. CCS, in particular those with a history of leukaemia[4], tend to gain weight during the course of treatment and remain at a higher weight into survivorship, emphasizing the need for nutrition interventions throughout the cancer care continuum[5]. CCS have been shown to eat inadequate amounts of whole grains, fruits, vegetables and fibre while consuming an excess of meat and sodium[6–9]. This finding is mirrored in non-CCS children, who demonstrate similarly low adherence to national dietary guidelines[10]. In particular, both CCS and non-CCS have inadequate intakes of total vegetables, whole grains, greens and beans[6,10].

Several strategies to promote a healthier diet have shown promise among non-CCS including family-based multicomponent interventions[11]. Given that CCS and non-CCS have similar dietary intake inadequacies, survivors may benefit from interventions similar to those developed for the general population. However, current CCS practices and needs must be objectively examined in order to reveal similarities and differences between CCS and non-CCS families.

The stress of treatment and the emotions associated with a diagnosis of cancer may negatively impact food choices and dietary patterns of the entire family and patient[12,13]. After completion of treatment, children and parents may struggle to break unhealthy habits from before and created during this period[5]. CCS parents may demonstrate

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overprotective or 'spoiling' feeding practices, lack boundary setting, and are more likely to use monitoring and restrictive food parenting practices with their CCS[14–17]. How parents of CCS translate these feeding practices and coping mechanisms into actual food preparation practices is unknown.

Nutrition intervention for CCS is a relatively new research area, and programme efficacy and best practices for this population are still under investigation[12,18]. Understanding the similarities and differences between CCS and non-CCS family food preparation practices will help support the development of family-based nutrition resources for CCS populations. The present study describes food preparation practices of CCS and non-CCS families. Our intent is that the results of the study contribute to tailored, nutrition programming for this high-risk population.

## Materials and methods

### *Setting and study participants*

The present study used an observational, cross-sectional, mixed-methods design. Participants were parent–child dyads recruited between October 2017 and June 2018. CCS were recruited from the MD Anderson Children's Cancer Hospital. Research staff identified eligible survivors through the MD Anderson Survivorship Network, providers and hospital events. The convenience sample of parent–child dyads included one parent with a CCS off all treatment for at least 1 year (*n* 11). Non-CCS families were recruited through paper and digital flyers posted in the greater Houston and Austin areas, TX, USA. Non-CCS (*n* 29) and their parents were also recruited for comparison. All participants met the following eligibility criteria: (i) child was aged 5–17 years; (ii) parent could read and speak English; (iii) parent self-reported preparing meals for the child at least one time per week on average; and (iv) no one in the home had food allergies. The study was reviewed and approved by the Institutional Review Board of the University of Texas MD Anderson Cancer Center (PA16-0995).

### *Procedure*

*Video observations of cooking events*

Each participating dyad scheduled and completed a video observation session during a normal evening meal preparation event. Video sessions were scheduled according to participant availability. Prior to video session scheduling, parents were asked to report their most commonly made dishes. Upon scheduling, parents were asked to select and prepare one of the commonly reported dishes or something similar. Parent informed consent and child assent were completed in the home before filming. Equipment was arranged in a participant's kitchen and included: (i) a wide-angle camera on a tripod positioned to capture the entire kitchen area; (ii) a wireless, lapel-worn microphone placed on the parent participant; and (iii) a small, chest-worn body camera (Sun eButton) to provide another angle on cooking behaviours[19,20]. Parents were instructed to prepare their planned meals and to explain what they were doing and why into the microphone during food preparation. One to two observers were present to take notes and ask for clarification as needed during the session. Prior to beginning preparation tasks, all parents were asked to state what dish they were making and why they chose to make the dish. Parents were also encouraged to talk about their general cooking practices and any factors impacting their cooking habits. Video session recordings were analysed using the Healthy Cooking Index (HCI), based on a previously developed conceptual framework of healthy cooking[21].

*Healthy Cooking Index*

The HCI is an index of food preparation practices that registers points for specific behaviours, which are summed to create a composite score of cooking behaviour. The HCI coding system registers a simple +1 for the demonstration of healthy behaviours and −1 for the demonstration of unhealthy behaviours. The construction of the conceptual framework underpinning the HCI has been detailed elsewhere[21]. The items in the HCI are relevant to CCS given their generally poor diet quality and increased risk of CVD, unhealthy weight gain and secondary neoplasms[13,17,22]. Specific healthy and unhealthy behaviours from the index are detailed in Fig. 1.

*Study measures*

During video sessions, observers estimated the ingredient amounts used in meals and clarified the contents of certain ingredients with participants as necessary. Participants were asked to report the number of servings yielded from each recipe. Nutrient composition of final meals was analysed using the Nutrient Data System for Research software (NDSR 2017; University of Minnesota, Minneapolis, MN, USA). Immediately after completion of cooking, parents completed a demographics and family characteristics questionnaire which included items on parent age, gender, education, ethnicity, income level, marital status, and child age and gender, as well as family meal habits. Time off treatment and diagnosis information were collected from CCS parents. Also, a scale and stadiometer were brought to participants' homes and anthropometric measurements were collected by trained project staff. Raw BMI was calculated according to the formula weight/height$^2$ and BMI percentiles obtained through comparison with the Centers for Disease Control and Prevention growth charts[23].

### *Data analysis procedures*

Demographic and family characteristics, as well as cooking habits, were examined by CCS status. Differences between categorical characteristics of the two groups were examined

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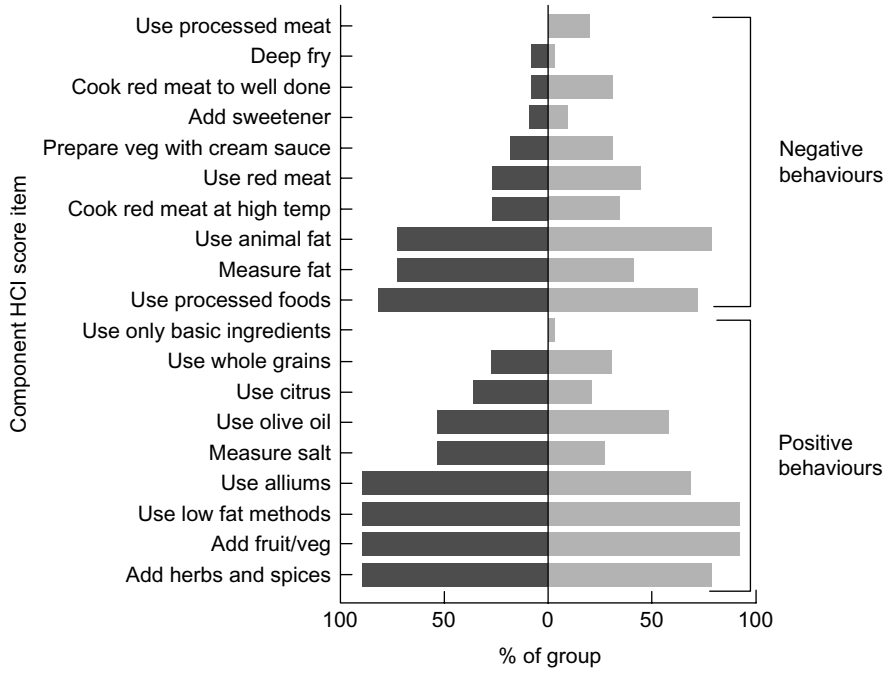


**Fig. 1** Healthy cooking practices based on component score items of the Healthy Cooking Index (HCI), by group (■, childhood cancer survivors (CCS); ■, non-CCS), among dyads comprising a parent and their 5–17-year-old child (CCS, *n* 11; non-CCS, *n* 29), greater Houston and Austin areas, TX, USA, October 2017–June 2018

using $\chi^2$ tests. Nutrient values of meals including carbohydrate, fat, saturated fat, protein, sugar, fibre, energy and energy density were examined. Resulting videos were coded for healthy cooking practices using the HCI. HCI scores in CCS and non-CCS families were compared using one-way ANCOVA controlling for dissimilarities between the two groups. Frequencies of individual behaviours from the HCI score were examined by group. Comparative and descriptive statistics were performed with the statistical software package IBM SPSS Statistics for Windows version 25.0.

## Results

### *Participant demographic and family meal characteristics*

Characteristics of participants are shown in Table 1. Differences between the CCS and non-CCS group included child race, with the non-CCS group being more racially diverse ($P = 0{\cdot}041$), and number of children in the household, with CCS households more likely to have only one child (CCS = 50·0 %; non-CCS = 10·3 %, $P = 0{\cdot}021$). Most families in both groups owned their homes and earned more than $US 60 000 per year (Texas average is $US 59 206)[24]. Parents in both groups reported having dinner together as a family on four or more evenings during a typical Monday–Friday (CCS = 72·7 %; non-CCS = 68·9 %). With regard to number of days the parent cooked the child's evening meal, the majority of both groups reported cooking five or more days (CCS = 63·7 %; non-CCS = 55·2 %).

### *Participant healthy cooking practices*

CCS summative HCI scores (possible range = −9 to +10) ranged from −1 to +7 (mean = 3·55, SD = 2·876). Non-CCS scores ranged from −4 to +7 (mean = 1·90, SD = 2·677). No significant difference was detected between the groups, even when controlling for major between-group differences ($F = 1{\cdot}902$, $P = 0{\cdot}175$). Items from the HCI score coding system were explored by group (Fig. 1). Both groups demonstrated higher use of animal fats (CCS = 72·7 %; non-CCS = 79·3 %) and processed foods (CCS = 81·8 %; non-CCS = 72·4 %), and lower use of whole grains (CCS = 27·3 %; non-CCS = 31·0 %) and basic ingredients (CCS = 0 %; non-CCS = 3·4 %). Overall, CCS and non-CCS participants demonstrated similar healthy cooking practices based on both the summative and component HCI score items.

Nutrient analysis of the meals prepared during the video sessions revealed comparable meal nutrient compositions between the CCS and non-CCS prepared meals. Both samples were comparable to US averages, and all groups demonstrated dinners with more sugar, fat, saturated fat, carbohydrate and protein content per serving than nationally (US) recommended dietary intakes (Table 2).

## Discussion

The present study examined the food preparation habits of eleven CCS and twenty-nine non-CCS parent–child dyads through audio/video observation and questionnaires.

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**Table 1** Demographics and family characteristics, by group (childhood cancer survivors (CCS) and non-CCS), among dyads comprising a parent and their 5–17-year-old child (CCS, *n* 11; non-CCS, *n* 29), greater Houston and Austin areas, TX, USA, October 2017–June 2018

| | CCS | | Non-CCS | | |
|---|---|---|---|---|---|
| | % (within group) | *n* | % (within group) | *n* | *P* value |
| Parent gender | | | | | |
| Male | 9·1 | 1 | 3·4 | 1 | 0·465 |
| Female | 90·9 | 10 | 96·6 | 28 | |
| Parent age (years) | | | | | |
| ≤35 | 18·2 | 2 | 17·2 | 5 | 0·984 |
| 36–45 | 63·6 | 7 | 62·1 | 18 | |
| ≥46 | 18·2 | 2 | 20·7 | 6 | |
| Child gender | | | | | |
| Male | 36·4 | 4 | 34·5 | 10 | 0·911 |
| Female | 63·6 | 7 | 65·5 | 19 | |
| Child age (years) | | | | | |
| 5–8 | 18·2 | 2 | 51·7 | 15 | 0·159 |
| 9–13 | 63·6 | 7 | 37·9 | 11 | |
| 14–18 | 18·2 | 2 | 10·3 | 3 | |
| Child race | | | | | |
| White | 45·5 | 5 | 37·9 | 11 | **0·041** |
| Hispanic | 36·4 | 4 | 24·1 | 7 | |
| Black | 0·0 | 0 | 24·1 | 7 | |
| Asian | 18·2 | 2 | 0·0 | 0 | |
| Other | 0·0 | 0 | 13·8 | 4 | |
| Child BMI | | | | | |
| Healthy | 63·6 | 7 | 69·0 | 20 | 0·421 |
| Overweight | 18·2 | 2 | 17·2 | 5 | |
| Obese | 9·1 | 1 | 0·0 | 4 | |
| Number of children in house | | | | | |
| 1 | 50·0 | 5 | 10·3 | 3 | **0·021** |
| 2 | 20·0 | 2 | 55·2 | 16 | |
| ≥3 | 30·0 | 3 | 34·5 | 10 | |
| Parent married | 90·9 | 10 | 69·0 | 20 | 0·349 |
| Income > $US 60 000 | 63·6 | 7 | 75·9 | 22 | 0·515 |
| Owns home | 100·0 | 11 | 69·0 | 20 | 0·111 |
| Highest household education | | | | | |
| <College graduate | 9·1 | 1 | 6·8 | 2 | 0·61 |
| ≥College graduate | 81·8 | 9 | 86·2 | 25 | |

*P* values represent $\chi^2$ tests examining significant differences between the two groups. Significant *P* values ($P < 0·05$) are indicated in bold.

In this small sample, CCS families did not show substantial differences from non-CCS families with regard to cooking frequency, family meal frequency, meal nutrition or cooking practices. Our findings offer exploratory data of CCS family cooking practices and elucidate key areas for consideration when developing or adapting practical nutrition interventions for this population.

An important influence shaping a child's diet is the family food environment and family meals[25,26]. In the present study, parent participants reported commonly eating dinner together during the week at home and cooking meals at least five days per week. This suggests home cooking practices and family meals may be an important target for nutrition interventions in the CCS population as home-prepared foods represents a large portion of eating events. Interest in cooking as a nutrition intervention target has increased in the past several decades, although the impact of interventions has varied[27,28]. In particular, a large randomized trial focusing on family meal frequency showed limited effects on nutrition and dietary outcomes in children[29].

Nutritional interventions for CCS that incorporate cooking components should be carefully designed to maximize acceptability and efficacy in this population. Previous survey studies have suggested CCS are interested in healthy eating programmes, in particular computer-delivered interventions, and interventions with parents[30,31]. Previous research suggests online cooking videos have the potential to improve eating habits among adults[32]. Digitally delivered cooking interventions that engage both parents and CCS may be of particular interest and benefit to CCS. Our group has developed an online cookbook specifically for CCS that may be utilized in future interventions[33]. The HCI used in the present study provides a guide for developing online cooking education module content, as we have demonstrated these practices are relevant to CCS.

**Table 2** Mean meal nutrient profile (per serving of evening meal), by group (childhood cancer survivors (CCS) and non-CCS), and comparison with national average and nationally recommended dietary intakes, among dyads comprising a parent and their 5–17-year-old child (CCS, *n* 11; non-CCS, *n* 29), greater Houston and Austin areas, TX, USA, October 2017–June 2018

| Nutrient | CCS | Non-CCS | US mean* | USDA RDI† |
|---|---|---|---|---|
| Total energy (kJ) | 3090·85 | 2678·47 | 3135·28 | 2929 |
| Total energy (kcal) | 738·73 | 640·17 | 749·35 | 700 |
| Energy density (kJ/g) | 6·07 | 6·95 | N/A | N/A |
| Energy density (kcal/g) | 1·45 | 1·66 | N/A | N/A |
| Sugar (g) | 10·33 | 9·44 | 25·53 | 5·75 |
| Total fat (g) | 34·78 | 30·20 | 30·67 | 28·78 |
| Saturated fat (g) | 9·91 | 9·02 | 9·88 | <8·14 |
| Fibre (g) | 9·61 | 7·35 | 6·33 | 10·36 |
| Carbohydrates (g) | 71·38 | 61·36 | 78·43 | 40·3 |
| Protein (g) | 37·16 | 32·40 | 35·95 | 19·78 |

USDA, US Department of Agriculture; RDI, Reference Dietary Intake; N/A, not applicable.
Mean nutrient amounts are reported per serving of dinner. Ingredients and amounts were taken from observer notes.
*Publicly available data from the USDA, Agricultural Research Service (2016) Nutrient Intakes from Food and Beverages: What We Eat in America, NHANES 2013–2014 (https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/1314/Table_21_DIN_GEN_13.pdf).
†US Department of Health and Human Services and USDA (2015) 2015–2020 Dietary Guidelines for Americans, 8th ed. (https://health.gov/dietaryguidelines/2015/guidelines/).

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Limitations include the limited sample size and use of a convenience sample. Recruitment of CCS for the study was challenging due to a recent hurricane in the region, discomfort with home observations among survivors and changing contact details as children transitioned to survivorship care after treatment. Participants may differ from the general population given their willingness to have researchers enter their homes and record their behaviours. Our sample was more educated and earned higher incomes that the average family in the area. Age ranges and inclusion criteria were kept broad to maximize recruitment potential for the study. The present study was not powered to identify significant differences between the CCS and non-CCS groups; therefore findings are exploratory. Finally, height and weight were collected from children, but ancillary data on conditions/medications that may influence weight were not collected.

The present study is the first to explore food preparation practices in CCS families. Strengths of this project include the use of objective observational cooking data collected from participant homes, meal nutrient composition data, inclusion of a comparison group, and an evidence-based index to identify key cooking practices relevant to CCS long-term well-being[21]. The study provides rich formative data for the development of future nutrition interventions among CCS.

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