IMPACT OF FOOD DEMONSTRATION INTERVENTIONS ON CHRONIC DISEASE-ASSOCIATED RISK FACTORS IN PEDIATRIC CANCER SURVIVORS: A LITERATURE REVIEW

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Abstract:

Research has shown that pediatric cancer survivors have an increased risk of developing chronic diseases. Evidence has shown that consuming a healthy diet can reduce risk factors related to chronic disease. Because diet-related behaviors are shaped during childhood, it is theorized that early exposure to nutrition knowledge, nutritious foods, and cooking skills using food demonstrations can promote healthy eating behaviors and decrease this population's risk for developing chronic disease. A literature review of food demonstration interventions in young pediatric cancer survivors was conducted. Databases searched include PubMed, Medline, Cochrane Library, and CINAHL PLUS. Articles were included based on intervention design. The review yielded 8 articles, but only 1 fit the review criteria. This study did not measure outcomes that could contribute to the focus of this review. An additional review analyzed food demonstration use in obesity prevention programs for children. All but one study indicated that intervention goals were met. As food demonstrations have shown efficacy in childhood populations to prevent obesity, similar results could be achieved in young childhood cancer survivor populations. Given the lack of studies using this intervention for the target population, further research is needed to make conclusions regarding their efficacy for this at-risk population.

Background:

Pediatric cancer remains a leading cause of death for children in the United States. The American Cancer Society has cited that the incidence rate of childhood and adolescent cancers in the United States is 186.6 per 1 million children up to 19 years of age, and that one in every 285 children will have a cancer diagnosis before the age of 20 [1]. Since 1975, the incidence of pediatric cancer has been increasing at a rate of 0.6% for reasons that are unclear to researchers [1]. Fortunately, as treatments and therapies for this population have improved, survivorship among childhood cancer patients has also increased. Between 1975 and 2009, death rates for children with cancer have decreased by greater than 50% overall [1]. Additionally, 5 year survival rates have increased for childhood cancer patients and have been estimated to be 80% most recently, with 83.5% of those survivors being estimated to have surpassed 5 years of survival [2]. It has also been estimated that for every 750 individuals in the United States, one is a survivor of childhood cancer [3]. Unfortunately, most childhood cancer survivors are cited to develop at least one chronic disease by the age of 40 [3]. There is an abundance of evidence to suggest that pediatric cancer survivors have an increased susceptibility to developing chronic diseases. A review of the “Childhood Cancer Survivor Study” cohort found that survivors of childhood cancer demonstrated significant risks for several conditions such as cardiovascular disease, obesity, pulmonary disorders, renal disorders, and endocrine disorders [4]. A review of the available evidence indicated that among 10,387 childhood cancer survivor participants in the “Childhood Cancer Survivor Study” cohort, 62.3%, indicated they had at least one chronic condition, and 27.5% already had a severe or life-threatening condition [5]. Overall, it has been

demonstrated that cancer survivors are eight times more likely than their siblings to develop a severe or life-threatening chronic health condition [5].

The increased susceptibility to chronic disease development for this population can be attributed to a wide range of cancer therapies, with a multitude of chemotherapies and radiation therapy being reported to promote metabolic disturbances. Some of the most notable chemotherapies that contribute to later development of chronic diseases are anthracycline, which commonly cause cardiovascular complications, cisplatin, which is known to induce both nephrotoxicity and cardiac toxicity, and radiation therapies which can impose damage and dysfunction to multiple organs contributing to development of fibrosis, metabolic disorders like diabetes, hypertension, renal disorders, and many more chronic conditions [3,6]. Multiple areas can be affected by these cancer therapies, including but not limited to pulmonary, cardiac, gonadal, breast, musculoskeletal, CNS, renal, bladder, thyroid, liver, and gastrointestinal systems [3,7]. The stress of these therapies on the organ systems, especially during times of significant growth and development, result in overall underdeveloped and damaged tissues, leading to chronic health conditions development of neoplasms later in life [3,7].

Studies have cited that childhood survivors of cancer exhibit metabolic syndrome traits such as dyslipidemia, hyperglycemia, hypertension, and obesity, putting long-term cancer survivors at a significant risk for the development of chronic conditions when these traits are sustained [8,9]. Contributing factors to the development of these conditions in childhood cancer survivors are diet and lifestyle, which have the ability to influence

the management or exacerbation of the chronic conditions [10]. Many studies have established that diets that are low in calcium and vitamin D, high calorie and fat, and low in fiber, fruits, and vegetables contribute significantly to obesity, the development of type II diabetes, cardiovascular disease, and other chronic conditions [10]. Currently, adult childhood cancer survivors in the United States exhibit diets high in fat, and low in fruits, vegetables, and calcium [10]. Additionally, the diets for young childhood cancer patients after treatment in Australia have reflected excess calorie intake, as well as deficits in calcium, folate, and iron, with 20% of children shown to be overweight or obese [11]. Because of the significant risk for the development of metabolic syndrome traits and chronic diseases, which can significantly impact the quality of life and risk of mortality for this population, the connection between diet and chronic disease, and the understanding that eating behaviors are established early during childhood, it is theorized that early nutrition interventions in childhood cancer survivors could decrease the incidence of health-risk behaviors and traits associated with chronic disease development [11]. Studies have shown that cancer survivors who have a greater adherence to healthy lifestyle recommendations have an improved health-related quality of life [13].

As survivorship for pediatric cancer patients has increased, and the risk of chronic disease development remains, there is an urgent need to provide educational measures that target health-risk behaviors to decrease their susceptibility to chronic disease. An observational study of the barriers to healthy eating habits in childhood cancer survivors found that this population identified obstacles to eating calcium-rich

foods, whole grains, low fat foods, fruits, and vegetables due to a variety of lifestyle pressures [14]. This further demonstrates the need for an intervention that can effectively promote changes in lifestyle, eating behaviors, and attitudes towards foods like fruits and vegetables for this population. Because children's eating behaviors are established during childhood, early implementation of programs for childhood cancer survivors that promote healthy eating behaviors have the potential to decrease the incidence of unhealthy eating behaviors associated with the development of metabolic syndrome traits and chronic diseases. The use of cooking interventions to reduce risks related to chronic diseases has seen positive results in their ability to make improvements in health-risk outcomes in children. A literature review analyzing interventions to improve healthful eating in children with cooking interventions identified eight studies where all were able to show one or more significant improvements in health-related behaviors, preferences, or attitudes towards food [15]. This review also concluded that the question of whether cooking interventions can sustain long-term changes for children has not yet been well-established due to a lack of studies [15]. Still, their potential in promoting long-term changes for health-behaviors is probable, given that eating behaviors are established during childhood and lifestyle behaviors are found to play a role in influencing meal choices [12,14,15].

Provided the potential efficacy of food demonstrations in improving behaviors surrounding food in children, and the need to identify effective methods to address chronic disease risks in childhood cancer survivors, an examination of the literature investigating the utilization of cooking interventions with young childhood cancer

survivors could yield insight for an educational measure that could decrease risks for chronic diseases by addressing diet-related behaviors for the population of interest.

Objectives:

The primary goals of this literature review are to:

i) summarize the available literature on food demonstration interventions in young childhood survivors of cancer

ii) compile and discuss results of food demonstration interventions in young childhood survivors of cancer

iii) discuss the efficacy of food demonstrations in young childhood cancer survivor populations

iv) determine if food demonstrations are a viable option to promote health-behavior changes for young childhood cancer survivor populations

Methods:

Literature Review Search Methods

Databases searched: PubMed, Cochrane Library, Medline, CINAHL PLUS

Articles for this literature review were found using the following search terms:

- Food demonstrations OR Cooking classes OR Cooking interventions AND Pediatric cancer OR Pediatric oncology OR Children with cancer

Literature Review Inclusion and Exclusion Criteria

Articles were included if they had a food or cooking demonstration intervention and this intervention was conducted in a population of child or adolescent cancer

patients and/or survivors. Articles were excluded if they did not mention food demonstrations, cooking demonstrations, or cooking interventions and/or were not studies conducted in children or adolescents who had cancer or were survivors of cancer. If articles qualified, but did not have finalized results, they were also ruled out as they had no grounds to show the effectiveness of the intervention with pediatric cancer populations. However, these articles were noted since they are worth discussing as they pose interventions that could demonstrate effective methods of addressing risks for chronic disease in pediatric cancer populations.

Supporting Literature Search Methods

In addition to the literature review on food demonstration interventions in pediatric cancer survivor populations, a broader secondary review of the literature available regarding food demonstration interventions in childhood populations was conducted to gather supporting research for this topic.

Database Searched: PubMed

Supporting articles were found using the following search terms:

- Food demonstrations OR Cooking interventions OR Cooking classes AND pediatrics OR children OR adolescents

Inclusion and Exclusion Criteria

Articles were included if they were primary studies assessing the use of a food or cooking demonstration intervention in childhood, explicitly addressed obesity prevention as a concern for the population of study, were conducted in the United States, did not have a physical activity component, and were published within the last 10 years. If

studies incorporated a physical activity component, did not explicitly address the specific topic of obesity, were not conducted in the US, or were published earlier than 10 years ago, they were excluded.

Results:

Literature Review Results:

A review of the literature found only one study with published results that examined a cooking or food demonstration intervention in the specific population of pediatric cancer survivors.

The article “Healthy cooking classes at a children’s cancer hospital and patient/survivor summer camp: initial reactions and feasibility” examines a program in 3 different pediatric cancer centered environments: i) an inpatient food demonstration intervention for current pediatric oncology patients and parents, ii) a sleepaway camp-initiated food demonstration intervention for children who are pediatric cancer patients/ survivors or are siblings of the pediatric cancer patients/survivors, and iii) a day camp at the hospital which hosted food demonstration sessions for cancer patients/survivors [16]. The intervention used an evidence-supported model specifically designed to prevent chronic disease to develop the programming for this intervention. This original model was not designated for just childhood cancer populations, but was adapted for an audience of children and adolescents, and even further so depending on if children were considered inpatient cancer patients or cancer patients/survivors not admitted to the hospital [16]. Unfortunately, the goal the authors of the study were stated to be focused on overall implementation and development of food demonstration

classes for this population, not on outcomes related to health or health-risk behaviors [16]. Results for this intervention were not well-documented and were only observational. Field notes of each class recorded information about the participants, as well as general attitudes and reactions of the participants [16]. Results indicated that the intervention was largely well-received as indicated by overall documentation of attendance and positive engagement during classes, with the exception of the inpatient setting which had lower rates of attendance, likely due to health-related factors [16]. Whether or not the food demonstration interventions were able to promote behavior changes and reduce outcomes related to chronic disease development was not investigated. While observational results of the study seem to indicate that participating children were very engaged in this evidence-supported model meant to reduce chronic disease related behaviors, it is not clear that any desired health behaviors or outcomes were achieved. Classes were often very flexible as well, allowing personalization by children and instructors. Therefore, the correlation between one type of class having a specific effect is not able to be attained [16].

Because the available research regarding food demonstrations in pediatric cancer populations is extremely limited, as no study with published results has, to date, investigated the efficacy of food demonstrations as an educational method to prevent chronic disease for this at-risk population, this literature review could not establish whether this type of educational intervention is effective at preventing chronic disease in this population. While evidence from the study which utilized food demonstrations with this population does show that this type of educational intervention is well-received by

the pediatric cancer survivor population, the published evidence cannot make conclusions regarding its ability to prevent chronic disease.

Review of Literature on Food Demonstration Interventions for Obesity Prevention in Childhood Populations Results:

Due to the lack of evidence available, and to better understand if this type of educational intervention would be able to achieve results for chronic disease prevention in early childhood and adolescent cancer survivors, an investigation of the literature available examining the use of food demonstrations to improve health behaviors and outcomes in children was conducted. This search identified primary studies that investigated the use of a food or cooking demonstration to address childhood obesity prevention in the United States, since obesity is a well-established risk factor for chronic disease, especially for childhood cancer survivors [16,17]. After ruling out studies which did not fit the inclusion criteria, 14 articles were found examining a variety of outcomes associated with food or cooking demonstrations for obesity prevention programs.

Results of Food Demonstration Obesity Prevention Programs and Outcomes in Children

A review of the literature found 14 studies with a major focus on food demonstration nutrition education to prevent obesity in children with their intervention [18-32]. These primary studies addressed the following common outcome themes that the articles established as being related to reducing obesity incidence and risk: consumption of a healthy diet, attitudes towards cooking and healthy eating, knowledge of nutrition, self efficacy to cook and to eat healthy, and finally, anthropometric

outcomes. These identified outcomes are directly related to children's behaviors and health. Outcomes not directly related to the effect of the food demonstration intervention on the participant were not analyzed in this review. All 14 studies utilized questionnaires or surveys before and after interventions to assess the various outcome themes. Most studies had total population sizes greater than 100, although two were smaller in participant size with 89 and 42 total participants. Also, 11 of the 14 studies were conducted in school settings to implement their interventions, while three took place in the community.

Nine of the 14 studies that used a food demonstration-based education as part of a obesity prevention program and included a control group to compare outcomes [18-31]. The range of students participating in these primary study programs were students in kindergarten through grade 12. Out of the 14 studies, 5 had a gardening component during half of the intervention sessions [21, 28-31]. Four had parent or caregiver involved as part of the intervention, although only three of those four demonstrated adequate parent/caregiver participation. The remaining programs had interventions focused on food and cooking demonstrations with tasting sessions, or had a food and cooking demonstration focus with other nutrition education components incorporated.

Food Demonstration-Focused Interventions

Of the 14 studies reviewed, nine encompassed interventions that were food or cooking demonstration-focused with various nutrition education components included in their sessions [18-20,22-27]. These studies examined many outcomes focused on improving nutrition knowledge, attitudes towards food, nutrition, or cooking, intake of healthy food

items, preferences for fruit or vegetables, self efficacy regarding healthy eating or cooking, and anthropometric measurements. A review of the five food demonstration-focused articles that examined dietary intake in their questionnaires, four studies indicated that participants exposed to the intervention reported significantly different intake changes such as increased fruit, vegetable, whole grain, and protein consumption, as well as variability in vegetable intake [18,22,24,25,27]. Increased vegetable intake was reported in two of those four studies [18,22,24,25]. In addition to those noted positive results related to intake, three studies which examined both, or did not examine dietary intake changes, but examined instead youth participants' preferences for fruits and vegetables, which are cited to reflect actual intakes of fruits and vegetables, found a significant increase in vegetable preferences, with one also showing significant increases in fruit preference from baseline responses [18-20].

Another outcome demonstrated in these studies was the reported increase of cooking, nutrition, and food-related knowledge- all of which are factors associated with influencing dietary intake [18-31]. Five of the nine articles focused on food demonstrations reported improvements in knowledge-related outcome themes; three studies significantly increased reporting of knowledge regarding food and nutrition such as identification of vegetables, and one found an increased reporting of knowledge related to cooking [18,22,23,26,27].

Next, the outcome theme of attitudes towards foods and cooking was assessed in eight out of nine food demonstration-focused studies [18-20,22-26]. Positive attitude-related outcomes found in these studies included trying new foods or recipes, attitudes towards

nutrition, healthy eating, cooking or communicating with family about healthy foods [18-20,22-26]. All eight studies found at least one of these attitude outcomes to be improved as a result of their intervention [18-20,22-26]. Two studies found a significant change in attitudes towards trying new foods or recipes [18,25]. For attitudes towards cooking, three of the four articles which assessed this outcome found a significant change for their participants [19,20,23]. All three of the articles which assessed changes in attitudes toward nutrition, healthy eating, or communication with family about healthy foods, found a significant positive change in this health-behavior outcome [22,24,26].

An assessment of behavior-intent outcomes such as self efficacy to cook or changes in involvement in food preparation and cooking activities, as well as self efficacy to eat more nutritiously was conducted in eight of the nine food demonstration-focused studies [18-20,22,23,25-27]. Two of the eight studies investigated changes of self efficacy related to food and eating more nutritiously, but only one of the studies found a significant positive change in behavioral intent related to food choices of participants [26,27]. The other six studies assessed changes in child participants' self efficacy to cook as an outcome of the intervention; all six reported significant improvements in participants' self efficacy to cook [18-20,23,25].

Finally, this set of articles only had 1 study which assessed anthropometric measurements as an outcome of their intervention . This 6-week intervention focused on food demonstrations and nutrition education for children found that body mass index percentiles were significantly decreased overall [27].

Multi-component Food Demonstration and Garden Education Interventions

Five primary studies with multiple components, including a food demonstration component and a garden component, were found to have significant outcomes related to intake of healthy foods, anthropometrics, and nutrition and food knowledge [21, 28-31]. Because these studies have multiple components in addition to the cooking intervention, outcomes could also be related to the other interventions; however, they are still notable as implementation of a program with multiple components can also significantly improve outcomes related to risks associated with chronic diseases.

Of the five studies with a gardening component, four examined preferences for healthful foods [21,28,30,31]. Two of these four studies found significant positive outcomes in terms of improved preferences for fruits, vegetables, and/or healthful foods [21, 30]. Additionally, all five garden studies demonstrated a significantly increased intake of healthful foods such as fruits, vegetables, and/or other fiber sources for participants [21,28,30,31]. In addition, of the five garden component studies, two investigated outcomes related to knowledge of nutrition and food, but only one found significant results [18,28]. Next, four of the five articles assessed intervention outcomes related to anthropometric measurements [28-31]. Of those analyzing anthropometric data, two found significant decreases in body mass index percentiles [28,29,31]. Within the articles which had a garden component with a food demonstration, the outcome theme of attitude towards nutrition and food was commonly assessed by four studies. Three of the articles which assessed for positive changes in attitudes towards fruits and vegetables did not find any positive changes of significance [28,30,31]. One article which assessed attitudes towards nutrition and food also did not find any significant positive changes in this health-behavior

outcome [18]. Another article which assessed attitudes towards cooking did not find significant results for this outcome [28] . Finally, three of the five articles investigated self efficacy to eat fruits and vegetables; these studies did not find significant results regarding a positive change in self efficacy to consume fruits and vegetables [28,30,31].

One study with both a cooking demonstration and garden education component measured blood pressure as part of the intervention assessment and found a significant decrease in diastolic blood pressure for participants [31]. Another study with a garden component found a significant decrease in participants with metabolic syndrome compared to the control group [29]. While these are both notable outcomes, as they demonstrate improvements in factors that are correlated to chronic disease development, no other studies with food demonstration interventions were found to have investigated these outcomes, so it is difficult to say that all or most food demonstrations could promote these changes.

In addition, one study found a correlation of exposure to the intervention with more significant results [21]. While all the intervention groups (low exposure, medium exposure, and high exposure) were found to have significant changes in food behaviors, this study also found that the most significant change was in the group with the highest intervention exposure [21]. This finding, though not found in other studies, shows that there is a positive correlation of diet-related changes with exposure to interventions like food demonstration programs.

Discussion:

This literature review highlighted several articles where interventions were used for pediatric cancer survivors to reduce risk-factors associated with chronic disease, such as physical activity-based intervention for pediatric cancer survivors, and other studies using a nutrition-based education (non-food demonstration related) intervention but, as this review has highlighted, there is a definitive lack of studies available which analyze the use of food demonstrations for this at-risk population [32]. From this literature review, only one study with published results was found to use a food demonstration intervention with this population [16]. Unfortunately, the evidence collected from this study was very limited as it was based only on the observations made by several different class educators [16]. The study also indicated that documentation of class field notes were not always completed or completed in much detail since staff was limited for classes [16]. Interventions of the study were very flexible in how they were conducted, being adapted for different age groups and even individuals based on their personal preferences. Therefore, outcomes would not be able to be measured and correlated to a specific intervention, as interventions would be extremely varied [16]. The study did indicate, however, that the interventions were generally well-received, providing support for similar interventions in this population [16].

In addition, this review has yielded a Canadian study currently being conducted that could offer a very clear understanding of the use of food demonstrations for pediatric cancer survivors in influencing health outcomes and behaviors related to chronic disease risk, but final results will not be published until the year 2021 [33].

While the literature review conducted could not yield evidence to support the use of food demonstration education interventions, specifically in young pediatric cancer survivor populations, a general review of the literature available in PubMed on the use of food demonstrations in childhood populations for obesity prevention purposes was able to provide insight as to how effective this intervention could be in making a difference in terms of chronic disease risk for young pediatric cancer survivors [18-32]. Even though no one intervention analyzed from this secondary literature search provided the exact same nutrition education, and they did not all investigate the same outcomes, each study did incorporate a food demonstration as a means to prevent or reduce obesity-risk factors and each did measure common outcomes that are relevant to reducing obesity and chronic disease risk [18-32]. These outcomes included changes in diet intake or preferences for healthful foods, nutrition knowledge, attitudes toward cooking, healthy foods, and nutrition, self efficacy in terms of eating healthy or cooking, and lastly anthropometric measurements [18-32]. Review of these outcomes generally shows that food demonstrations that incorporate nutrition education are able to make modest, significant positive differences in health behaviors of children [18-32]. Each study was determined to have at least 2-6 significant positive outcomes in food behaviors, knowledge, attitudes, or health, and all but one study concluded that their interventions were feasible in influencing determinants of diet and diet-related behaviors in children and most indicated that their interventions were effective in promoting significant changes and fulfilling objectives, even if some results were modest or mixed [18-32]. Given that a majority of the literature regarding the educational intervention of food

demonstrations focused on obesity prevention demonstrated significant results related to improving diet behaviors and factors related to chronic disease in childhood populations, food demonstration interventions focused on improving similar diet behavior, knowledge, and health outcomes in pediatric cancer survivor populations may also have a similar significant benefit that can decrease their risk of chronic disease. Therefore, while direct evidence cannot support food demonstrations as a viable option for reducing the risk of chronic disease in young childhood cancer survivors due to the limited number of studies investigating the topic, current research has found that interventions using food demonstrations are generally a feasible educational method that can promote significant changes to help prevent obesity in children [18-32]. Because this educational intervention has been successful in other childhood populations, it is likely that it could be a feasible and effective intervention for young childhood cancer survivors.

Limitations:

There are several limitations for this investigation. Results of the study found from the literature review were purely observational and were conducted by the intervention provider, which means field note evidence was subject to the opinions of the participating educator and could be biased [16]. Since there were multiple educators, observations and opinions of the outcomes may differ, so evidence could be skewed based on the interpretation of the educator. Another notable limitation to this review is that, despite the definitive need to address chronic disease prevention for pediatric cancer survivors, there is a lack of available studies which investigate this interaction

with young pediatric cancer survivors. Even more so, it is clear that there are very few studies which attempt to experientially influence the diet-behaviors of young pediatric cancer survivors using food demonstration interventions to reduce their risk of chronic disease. Since food demonstrations have been determined to be a feasible tool to make significant influences in diet behaviors and health outcomes of participants, and it is likely that food demonstrations could show similar positive results in a different childhood population, further research is warranted to understand how to implement this intervention in young pediatric cancer survivor populations and its efficacy in preventing chronic disease.

Additionally, all of the outcomes investigated for the supporting studies were based on questionnaires with self-reporting, which means results are highly subject to being skewed due to participants' potential misinterpretation of questions, personal biases, or other influences such as when parents were assisting. The majority of data collected was qualitative and cannot be supported with physical evidence, so results could be inaccurate. In addition, while nine of the articles used to determine the success of obesity prevention-focused food demonstrations in children were controlled for, five were not, and are, therefore, less able to show strong evidence in outcomes.

Next, many of the articles used to identify if cooking demos are a suitable intervention for childhood cancer populations had one or more additional interventions that could also contribute to positive outcomes. Also, studies varied in the design of their interventions with factors like age group, demographics of the childhood populations, resources available for interventions, settings, and the nutrition education

content provided to participants possibly influencing outcomes [18-32]. As a result, outcomes could be skewed one way or another as a function of the study design. Therefore, results cannot be fully attributed to the use of the food demonstration. With the various types of interventions and populations which could be subject to unique barriers, it is difficult to fully compare each study effectively to make definitive judgments of their success; on an individual study basis- each article did show positive impacts, but the outcomes examined cannot be fully compared due to their differences. As some articles also incorporated other factors like parents/caregivers and gardening components into their interventions, positive differences could have been more established in those studies due to the nature of increased support from a parent figure or bias'/false reporting by caregivers, and also improved knowledge of food from gardening education. While changes in caregiver and gardening outcomes were not a focus of this literature review, they could have an influence outcomes, and should be considered a limitation of this review. However, these components could also be considered as a way to promote best practices when implementing food demonstrations, and further research could shed light on their use as being more successful than food demonstration components alone. In addition, different outcomes were measured among each of the studies, so some outcomes such as anthropometric measurements, metabolic syndrome traits, lipid labs, have less evidence as a positive outcome compared to others, such as the outcome of increased preference for fruit and vegetables. An additional limitation is that some outcomes are more directly associated with chronic disease risk than others, such as anthropometric or biochemical data, while

other outcomes like fruit and vegetable preference or self efficacy to cook are only able to reflect health-behaviors that have the potential to reduce chronic disease risk.

Another limitation of this investigation is that it uses studies of childhood populations that do not face the same health risks or barriers as young pediatric cancer survivors. Implementation of the interventions used in the studies for young pediatric cancer survivors were shown to have a need to be adapted for due to the specific health concerns or diet challenges cancer survivors, especially recently treated cancer survivors [16]. Therefore, a different implementation could mean different outcomes. Additionally, many of the interventions used in the studies were school-based programs, which childhood cancer survivor populations likely will not have their school direct a cancer survivor focused educational intervention and would more likely be community-driven programming. As a result, the outcomes found in school-based programs may not be necessarily able to be reproducible in non-school based programming.

A final limitation was the issue of how long will the study outcomes last. While evidence has found that dietary behaviors are established during childhood, no study has been able to determine if positive intervention outcomes are sustained long term.

Future Directions:

To determine if food demonstrations are an effective and viable option for young childhood cancer survivor populations that could achieve a reduction in risks for chronic disease if exposed to this intervention, further studies investigating this intervention in this at-risk population are necessary. Upcoming studies may provide further information

regarding the feasibility and efficacy of this intervention for this population. A Canadian study currently being conducted demonstrates the use of an evidence-based model for current childhood cancer patients. This intervention involves family members and uses food demonstration workshops which aim to improve eating habits to reduce the risk for chronic disease and cancer recurrence [33]. An additional study which has published an online web-based cookbook as a resource designed for pediatric cancer patients and survivors, plans to publish results of a food demonstration intervention using these recipes [34]. Once results are published, these study could provide better insight to the effectiveness of food demonstration interventions for this population.

If a food demonstration intervention is established as a useful intervention for young pediatric cancer survivors, parental involvement, barriers to healthy food access, and factors unique to this population should be taken into consideration. This population encompasses a wide range of demographics, meaning the population could face barriers to accessing healthy foods or learning about nutrition, health, and healthy foods. If populations face food access barriers, an adapted or altogether different intervention approach may be warranted. Further research on effective interventions for populations with unique socioeconomic barriers may be warranted to better implement studies for all pediatric cancer survivor participants. In addition, parental involvement in interventions which aim to improve diet quality and behaviors for children has been shown to be potentially beneficial in enhancing the intervention's effectiveness in achieving diet and behavior goals [35]. While the most effective type of parent and/or caregiver involvement still needs further investigation, parents and/or caregivers are

more than likely to play a large role in child eating behaviors and diets as they are usually meal providers and can shape eating behaviors [36]. Parenting feeding practices are believed to play a significant role in the eating patterns of children, and certain practices can further shape unhealthy eating behaviors [35,36]. Therefore, their incorporation into interventions such as food demonstrations could help promotion of feeding practices that foster positive diet behaviors for their children. For example, a study program which taught sessions on nutrition, cooking, grocery shopping, physical activity, and family communication to parents and children was found to increase meal planning and at-home cooking, improve grocery shopping purchases, and improved dietary intake [37]. This study demonstrates the potential impact that involving parents can have on at-home behaviors for both parents and children, which can drive a decreased risk of chronic disease for children.

Further investigation of this intervention is warranted to understand its success with this population; however, as the gathered evidence suggested, other educational components such as gardening programs and games do show potential to be used alongside food demonstrations to promote health outcomes in children (gardening/game articles). Additionally, to better determine if food demonstrations can help prevent chronic disease for pediatric cancer survivors, future studies should measure outcomes used to determine risks for chronic disease such as diet and diet behaviors, anthropometrics, and biochemical measurements. Finally, to understand if this type of intervention encourages long term compliance to healthy diet behaviors and fosters

prevention of chronic disease, which usually is onset later in life, long term follow ups should be included.

Conclusions:

Based on this literature review, it is clear that there are very few studies investigating the use of food and cooking interventions in childhood cancer populations, despite the particular need to educate this population. However, current studies which have used the food demonstration as an experiential nutrition education intervention to address obesity in childhood populations have demonstrated success in improving some diet and health related outcomes which can make a difference in the risk for chronic disease. While the ability for these types of interventions to make long term differences is still up for debate, it is a topic worth further studying in young childhood cancer survivor populations due to the established short-term success of current food demonstration interventions in general childhood populations. More research in young childhood cancer survivor populations is needed to conclude whether food demonstrations would be an educational intervention that is feasible and should be implemented, or if other interventions, or combinations of interventions could yield better outcomes for this population. In addition, further research of the pertaining to best practices for implementation of food demonstrations should be completed to maximize the intervention's efficacy.

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