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Spice and Herb Use Among Cancer Patients

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Eastern Illinois University

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Spice and Herb Use Among Cancer Patients

(TITLE)

BY

Mallory H. Krueger

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

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Abstract

Purpose: The purpose of this study was to examine cancer patients’ use of, perceived benefits, and beliefs about herbs and spices after their cancer diagnosis.

Methods: An online questionnaire was used to explore types of herbs and spices used by cancer patients and assess cancer patients’ experiences with, and perceived benefits of, and beliefs about spice and herb use. The online questionnaire included three sections: herb and spice use, herb and spice attitudes, and cancer characteristics and demographics. Participants were recruited through online cancer groups and registered dietitian nutritionists.

Results: The study included 135 cancer patients. Participants (71.9%) were likely to use herbs and spices as a CAM modality and (74.8%) were interested in learning more information about the health benefits of herbs and spices. Only half of the participants (47.4%) were concerned about herb/spice-treatment interactions, but participants were significantly more likely to be concerned about herb/spice-treatment interactions if the participant received diet information from a doctor (p = 0.018). There were no significant relationships between time since their cancer diagnosis, cancer stage, age, ethnicity, income level, gender, or education level and frequency (p = 0.618) or change in herb and spice use (p = 0.106).

Conclusions: Cancer patients may benefit from receiving information on the benefits and precautions of herbs and spices following their cancer diagnosis, but future research is needed to determine the perceived benefits and risks of specific herbs and spices.
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Chapter I

Introduction

Overview of Topic

The American Cancer Society (2018) estimates almost two million adults and children will be diagnosed with cancer in the U.S. in 2018. After a patient is diagnosed with cancer, they may undergo treatments such as surgery, radiation therapy, and/or chemotherapy. Unfortunately, many cancer patients experience harsh side effects from these treatments, including nausea, dysgeusia, diarrhea, constipation, edema, lack of concentration, and fatigue. For the past two decades, complementary and alternative medicine (CAM) has been gaining popularity among cancer patients as a means of limiting these adverse side effects with over 40% of cancer patients reported using some form of CAM in the current decade (Horneber et al., 2012). Boon, Olatunde, and Zick (2007) reported that 80% of breast cancer patients used CAM with 41% of those women used CAM to manage their breast cancer.

The safety and effectiveness of CAM modalities vary drastically. Commonly utilized CAM modalities by cancer patients include mind and body therapies (i.e., yoga and meditation), diet therapies (i.e., no-dairy diet, the macrobiotic diet, fruit and vegetable cures, and metabolic therapies) and diets including high dose vitamins, and herbal supplements (Cassileth & Deng, 2004). CAM forms, such as yoga and meditation, are safe and effective during cancer treatment (McCall, McDonald, Thorne, Ward, & Heneghan, 2015), whereas other CAM forms, such as herbal supplements and diet therapies, can have cytotoxic effects and/or decrease the efficiency of the patient’s cancer treatment (Cassileth & Deng, 2004). A noted limitation of many CAM modalities is the
lack of evidence-based studies and studies that confirm the safety and efficiency of their use during cancer treatment (National Cancer Institute, 2018).

The Academy of Nutrition and Dietetics advises against using herbal supplements during cancer treatment, as some can cause adverse reactions or reduce the effectiveness of cancer treatment. Patients should always discuss with their physician if they want to use or are currently using herbal supplements (Wyble & Dyer, 2014). However, Davis et al. (2012) reported in a systematic review of 21 studies that many patients perceive CAM modalities as safe because they are less invasive than traditional cancer treatments. Additionally, patients perceive negative connotations about CAM use from their physician (Davis, Oh, Butow, Mullan, & Clarke, 2012; Vickers, Jolly, & Greenfield, 2006). Therefore, patients may not always report CAM use to physicians (Davis et al., 2012).

**Significance of the Study**

Many researchers have examined the use of CAM in adults (Davis et al., 2012; Dy et al., 2004; Marinac et al., 2007; Maskarinec, Shumay, Kakai, & Gotay, 2000). However, there is limited research on the use of culinary herbs and spices as a form of CAM. CAM use has significantly increased in oncology patients throughout the past two decades with over 40% of cancer patients using some form of CAM in the current decade (Horneber et al., 2012). Patients want to use “natural” remedies to improve their health, enhance immune function, treat pain-related symptoms and psychological distress, and/or because traditional medicine was not working (Mao, Palmer, Healy, Desai, & Amsterdam, 2011). Previous studies analyzed the use of herbal supplements as a form of CAM; however, herbal supplements are more concentrated than culinary herbs and spices
and pose a higher risk of treatment interaction and toxicity than culinary herbs and spices (Clark, 2013). Patients taking herbal supplements need to consume less of the supplement to be at risk for a drug or treatment interaction. The Academy of Nutrition and Dietetics advises against taking herbal supplements during cancer treatment and consulting a physician before starting a supplement regimen (Wyble & Dyer, 2014).

Herbs and spices can play a role in cancer prevention as well as treatment. Individuals in cultures that consume more ethnic spices, or spices that originated outside of the U.S., are associated with decreased risk of metabolic disease and cancer (Kaefer & Milner, 2008). Herbs and spices often have multiple bioactive components that act as potent antioxidants and have anti-inflammatory, anti-tumorigenic, and antimetastatic effects (Guldiken et al., 2018; Isbill, Kandiah, & Khubchandani, 2018; Kaefer & Milner, 2008; Srinivasan, 2017). Additionally, many phytochemicals regulate growth and angiogenic factors, which play an essential role in tumor development and prevention (Guldiken et al., 2018; Kaefer & Milner, 2008; Srinivasan, 2017). Herbs and spices can be safer than herbal supplements because toxicity risk is minimal, and the FDA regulates them as food substances rather than supplements. However, patients who consume large amounts of culinary herbs and spices over a long period can be at risk for adverse reactions during cancer treatment. Thus, the Academy of Nutrition and Dietetics recommends consulting a registered dietitian during cancer treatment (Wyble & Dyer, 2014).

Unfortunately, current research shows that most cancer patients receive CAM information from their friends and family and may never consult a dietitian (Gupta, Lis, Birdsall, & Grutsch, 2005). Additionally, most cancer patients do not report CAM use to
their oncology team (Pihlak et al., 2014). Lastly, most cancer patients are interested in CAM because they want more “natural” treatments or the belief that their conventional treatment is inadequate (Pihlak et al., 2014). Little research has been done on herbs and spices as a form of CAM in cancer patients, with more research needed to understand the use of and attitudes towards the inclusion of culinary herbs and spices in cancer patients.

**Purpose of the Study**

The purpose of this study was to examine cancer patients’ use of, perceived benefits, and beliefs about herbs and spices after their cancer diagnosis.

**Research Objectives**

1. To explore types of herbs and spices used by cancer patients.
2. To assess cancer patients’ experiences and perceived benefits and beliefs of herb and spice use.

**Research Questions**

1. Is there a significant difference in herb and spice use by cancer characteristic?
2. Is there a significant difference in herb and spice use by demographic characteristic?
3. Is there a relationship between change in herb and spice use and cancer characteristic?
4. Is there a relationship between change in herb and spice use and demographic characteristic?
5. Do health professionals influence herb and spice intake after a cancer diagnosis?
Delimitations

In previous studies, food frequency questionnaires (FFQs) have produced mixed results (Carlsen et al., 2010). FFQs tend to over- or under-estimate food consumption and are susceptible to recall bias. Cancer patients may have difficulties recalling dietary or CAM information during their initial diagnosis due to time or memory or concentration loss during their cancer treatment. The current study utilizes a survey with FFQ components that was adapted from a previous study where reliability was tested (Isbill et al., 2018), and the survey was retested in a pilot study to further ensure the reliability of the survey. Additionally, the herbs and spices consumed in pre-made foods or restaurant items cannot be estimated, so they were not included in the consumption analysis.

Assumptions

The researcher assumed the participants answered the survey truthfully and were aware of the herbs and spices they were consuming.

Definition of Terms

**Complementary and alternative medicine (CAM):** nonconventional medicine such as dietary supplements, folk remedies, mind-body techniques, and manual healing methods used to treat or assist in the treatment of disease (Berretta et al., 2017).

**Registered Dietitian Nutritionist (RDN):** a nutrition expert who is trained in the science of nutrition and dietetics. A RDN must complete a formal, approved education program in dietetics, at least 1200 hours of supervised practice, pass a registration exam, and maintain his or her license to use RDN credential (Academy of Nutrition and Dietetics, 2017).
**Nutritionist**: A person who studies or practices nutrition. The term “nutritionist” is not legally protected through a professional licensing or registration organization (Sass, n.d.).

**Dietary supplements**: supplements used to enrich the diet, such as herbal supplements, vitamins, and minerals, or nutrients like protein or fat. For this study, a dietary supplement is also a supplement that is taken enterally (U.S. Food & Drug Administration, 2017).

**Herbal supplements**: dietary supplements that include parts of plants or botanicals (U.S. Food & Drug Administration, 2017).

**Herbs**: leaves of an edible fresh or dried plant used to add flavor to food (McCormick Science Institute, n.d.).

**Spices**: bark, buds, roots, seeds, or parts of an edible, dried plant used to add flavor to food (McCormick Science Institute, n.d.).
Chapter II

Review of Literature

This review of the literature provides background information on CAM use among cancer patients, herbs and spices as a form of CAM, and the phytochemical benefits and side effects of herbs and spices. The review will further investigate the influences of dietary intake during cancer treatment, herb and spice used as a CAM modality, dose-dependency of herbs and spices as a CAM modality, and CAM use practices.

Influences of Dietary Intake During Cancer Treatment

Dietary intake may be different in cancer patients than for people without a cancer diagnosis due to taste alterations, swallowing difficulties and dry mouth, and appetite changes with cancer progression and treatment. These symptoms can affect how patients use herbs and spices as a CAM modality. Cancer patients may not use herbs and spices due to these symptoms and side effects, or cancer patients may use extra amounts of herbs and spices to combat taste alterations, swallowing difficulties and dry mouth, and appetite changes.

Herb and spice intake may be influenced by taste alterations after chemotherapy or radiation. Boltong, Keast, and Aranda (2012) interviewed cancer patients who received chemotherapy in the last 6 months or were currently receiving treatment. Patients reported adding extra seasoning to food or sought out spicier foods because chemotherapy treatment decreased their ability to taste food. Additionally, patients were able to experience taste towards the end of their chemotherapy treatment and reported not receiving information from a dietitian regarding taste alteration after treatment (Boltong
et al., 2012). Similarly, a study by Marinho et al. (2017) reported that patients with breast cancer experienced an increase in appetite for spicy and salty foods following chemotherapy treatment. The increased appetite for spicy and salty food could be due to the patients experiencing an increased threshold for bitter taste (Murtaza, Hichami, Khan, Ghiringhelli, & Khan, 2017). Patients may add seasoning to their food because they have a lower sensitivity to the taste and are trying to add flavor back.

Some patients experience ageusia, the loss of taste, and may experience ageusia for 6 months to a year after treatment, or experience permanent ageusia (Murtaza et al., 2017). The ageusia could be due to chemotherapy targeting rapidly dividing cells, such as gustatory cells, or from radiation therapy damaging cells around the mouth and neck (Murtaza et al., 2017). Radiation can damage the taste receptors, mucosal cells, and salivary glands, leading to xerostomia, the condition of dry mouth (Murtaza et al., 2017). Xerostomia can cause taste alterations because fluid is needed to get into the pores of taste receptors, thick saliva is more concentrated in salt, and the low pH of dry mouth can intensify the sweet and sour tastes in the mouth (McLaughlin & Mahon, 2012). Some patients add herbs and spices to improve their food after cancer treatment. However, other patients may be hesitant to add seasoning to their food because they may not taste the spice or herbs they are adding, or the undertones of the spice and herb flavors may be amplified in the food.

Other studies reported intake complications due to dry mouth, nausea, and difficulty chewing during chemotherapy treatment (de Vries et al., 2017). Dry mouth can contribute to taste alterations (Murtaza et al., 2017; Shi et al., 2004), and make consuming food more difficult. Cancer patients may be put on a dysphagia diet to combat
the challenges associated with chewing and swallowing difficulties. Sometimes chopped or pureed foods are pre-made, and the patient or caregiver will not add herbs and spices to these foods. Additionally, patients may stick to bland foods if they are experiencing complications with nausea and vomiting because the smell of spicy or seasoned foods can increase nausea in these patients. However, herbs and spices may be a beneficial CAM modality for symptoms and side effects of cancer progression and treatment, but like other CAM modalities, the safety and efficiency must be considered.

**Herbs and Spices Commonly Used as a CAM Modality**

The phytochemicals in spices and herbs usually have antioxidant and anti-inflammatory properties. Inflammation is a natural process of the human immune system as a means of killing harmful pathogens. However, chronic inflammation can lead to cell damage and increased cell proliferation (Coussens & Werb, 2002). Inflammation and other natural processes lead to free radical formation, which causes damage to cells and DNA. Bioactive components in herbs and spices have an antioxidant effect that can prevent free radical damage.

Herbs and spices have been used for centuries for their phytochemical benefits, but there is limited research on herbs and spices as a CAM modality. Researchers have studied the benefits and toxicity of various herbs and spices and found many phytochemicals are anticarcinogenic at low concentrations but may cause adverse reactions at higher concentrations. Researchers have studied the effects of herbs and spices in various cancer cell cultures and in rodent models. Therefore, the benefits and risks must be considered when using herbs and spices as a CAM modality. The following section will outline the benefits and risks of various herbs and spices.
**Cinnamon.** Cinnamon contains cinnamaldehyde, known for its antioxidant, anti-inflammatory, antimicrobial, antitumor, and immunomodulatory effects (Butt, Naz, Sultan, & Qayyum, 2013). In a study by Schoene et al. (2005), cinnamon extract decreased cell proliferation in lymphoma and leukemia cells by disrupting the cell cycle and phosphorylation signals. In another study, cinnamon suppressed tumor growth and metastasis by inhibiting pro-angiogenic growth factors in melanoma cells (Kwon et al., 2009).

Safrole is a phytochemical found in cinnamon, nutmeg, black pepper, basil, and some flavoring agents, and is known as a weak hepatocarcinogen (Bode & Dong, 2015; Guldiken et al., 2018). However, studies addressing the genotoxic effect of safrole have yielded conflicting results. Safrole forms DNA-adducts, which can be the start of mutated DNA and carcinogenesis, if not repaired or eliminated by the immune system (Nestmann et al., 1996). Safrole exhibited anti-carcinogenic properties in lung cancer, prostate cancer, and leukemia by increasing cytosolic calcium levels in various studies (Bode & Dong, 2015). Conversely, the results from other studies indicated the increased calcium levels increased cell growth in oral cancer (Bode & Dong, 2015).

**Garlic.** Garlic contains allicin, an organosulfur component that is also known for its anti-inflammatory and antioxidant abilities, but also its ability to regulate angiogenesis, cell proliferation, and DNA mutation. Srinivasan (2017) reviewed murine studies (n = 12) involving garlic and cancer development and found that several studies (n = 10) showed an inhibition, suppression, or delayed onset of cancer development when mice were treated with garlic. A study by Ghazanfari et al. (2011) assessed the cytotoxic effects of garlic against malignant and nonmalignant cell lines, and cell
viability was measured for different concentrations (0.01 – 5 mg/ml) of garlic extract. Garlic had a cytotoxic effect against gastric cancer, showed antiproliferation effects and induced apoptosis in breast cancer, showed weak cytotoxic effects against colon cancer and did not show cytotoxic effects against nonmalignant cells (Ghazanfari et al., 2011).

Garlic is considered relatively safe, and most adults can safely consume two cloves of raw garlic per day (Tattelman, 2005). However, garlic can upset the gastrointestinal tract, cause gas, and alter intestinal microflora when consumed on an empty stomach (Tattelman, 2005). Additionally, large amounts (11.3 mg/ml) of raw garlic powder can cause damage and redden the mucosa of the stomach due to stomach acid denaturing alliinase, the enzyme that converts alliin to allicin (Hoshino, Kashimoto, & Kasuga, 2001). Allicin can act as a potent inhibitor of platelet aggregation (Ariga & Seki, 2006; Briggs, Xiao, Parkin, Shen, & Goldman, 2000; Rahman, 2007), patients need to cease taking garlic as a complementary medicine seven days before surgery due to the risk of postoperative bleeding (Bajwa & Panda, 2012; Tattelman, 2005).

**Ginger.** Ginger contains zingiberene, a compound known for its, anticarcinogenic, anti-inflammatory, and antioxidant properties, as well as inducing apoptosis, or controlled cell death. Many in vitro and in vivo studies confirm the anticarcinogenic properties of ginger (Kim et al., 2005; Srinivasan, 2017). Studies showed that ginger induced apoptosis in T-lymphocyte and human prostate cancer cells, suppressed cell cycle progression and induced apoptosis in pancreatic cancer cells, inhibited angiogenesis and interfered with metastasis in pancreatic cancer cells (Srinivasan, 2017). Similar results were found in studies involving gingerol, a derivative of zingiberene. Gingerol inhibited angiogenesis and tumor growth in vivo in mouse lung
tissue, but only inhibited angiogenesis in endothelial cell cultures in vitro (Kim et al., 2005).

Ginger is generally regarded as safe and is often used in herbal medicine; however, like garlic, ginger can cause digestive problems at higher doses. In a clinical trial with 12 healthy volunteers, participants had to consume 400 mg ginger three times per day for two weeks. One participant reported mild diarrhea, and researchers found that consuming more than 6g of ginger a day can cause heartburn, and gastric irritation (Ali, Blunden, Tanira, & Nemmar, 2008; Guldiken et al., 2018). Additionally, ginger can cause adverse effects during pregnancy, and studies in rats showed that ginger doubled the rate of embryo loss (Ali et al., 2008). Although pregnancy is less common in cancer patients, the toxicological effects of ginger during gestation is something to consider while using ginger as a form of CAM.

**Red peppers.** Capsaicin is a phytochemical found in hot peppers, including cayenne and chili pepper, which gives peppers their spicy flavor. Capsaicin targets chemokines, which are responsible for the migration of leukocytes, activation of inflammatory responses, and regulation of tumor growth (Aggarwal & Shishodia, 2006). Capsaicin can regulate cancer metastasis through the regulation of chemokines. Additionally, capsaicin inhibits oral cancer cell proliferation, cell cycle progression, and induces apoptosis through eliminating the stability of the cancer cell’s mitochondria membrane (Lin, Lu, Wang, Chan, & Chen, 2013). Similarly, capsaicin increased bladder cancer cell death through mitochondrial depolarization and reactive oxygen species production within the cells (Yang et al., 2010). Capsaicin also inhibited ER-positive and negative breast cancer cells by downregulating EGFR and HER-2, which resulted in
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decreased cell proliferation, angiogenesis, and metastatic spread of breast cancer (Thoennissen et al., 2010).

Capsaicin can have anticarcinogenic effects at low doses; however, some studies showed mixed results for the health effects of capsaicin and its possible carcinogenic effects at high doses (Bley, Boorman, Mohammad, McKenzie, & Babbar, 2012; Bode & Dong, 2015). Some studies showed a correlation between capsaicin consumption and gallbladder and stomach cancers (Bode & Dong, 2015; Guldiken et al., 2018).

In an early study by Notani and Jayant (1987), dietary patterns of cancer patients with various aerodigestive cancers (n = 819) were compared against the diet of non-cancer patients (n = 215) and healthy controls (n = 177). The results showed the use of chili powder had increased the risk for aerodigestive cancers by two to threefold risk related to its dose. Studies also show red pepper, such as paprika, and black pepper can induce gastric pain. Red peppers can induce effects similar to aspirin, such as parietal and pepsin secretion, and gastric cell exfoliation and mucosal micro-bleeding (Guldiken et al., 2018). Additionally, peppers disturb the wettability of gastric tissue and can increase the stomach’s susceptibility to irritants, for instance, hydrochloric acid and other stomach acids (Lichtenberger, Romero, Carryl, Illich, & Walters, 1998).

**Rosemary.** Rosemary contains carnosic acid and rosmarinic acid, polyphenols known for being potent antioxidants. Rosmarinic acid is also found in sage, thyme, oregano, and basil. Multiple in vitro studies showed rosemary extract decreased cell colony formation, cell proliferation, cell viability, and cell transformation, and increased cell cycle arrest, necrosis, and apoptosis in various colorectal cancer cell cultures (Moore, Yousef, & Tsiani, 2016). Additionally, rosemary decreases cell proliferation, cell
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viability, and cell transformation, and increased apoptosis in estrogen receptor positive and growth factor receptor 2 positive breast and pancreatic cancer cell cultures (Moore et al., 2016). Similar in vitro responses were also shown for prostate, ovarian, cervical, bladder cancers, liver, and lung cancers. Lastly, murine studies showed a decrease in tumor size, volume, incidence, and number, and increase the latency period when mice were orally treated with rosemary extract (Moore et al., 2016). Rosemary is generally regarded as safe, and researchers have yet to investigate the adverse effects of rosemary.

**Thyme.** Thyme has been used in traditional medicine for its antioxidant, anti-inflammatory, and antitumor properties (Nagoor Meeran, Javed, Al Taee, Azimuth, & Ojha, 2017), and its components have been studied for their antioxidant potential. Researchers investigated carvacrol, and γ-terpinene, the phytochemicals in thyme, ability to protect against DNA damaging substances in various cancer cells (Aydin, Başaran, & Başaran, 2005; Slameňová, Horváthová, Wsólová, Šramková, & Navarová, 2009). Results highlighted a dose-dependent relationship between the phytochemicals and DNA damage, and significantly reduced the amount of DNA damage at concentrations up to 0.1 mM, 0.05 mM, and 0.1 mM, respectively (Aydin et al., 2005; Slameňová et al., 2009). Lastly, a study by Archana et al. (2011) showed that thymol could protect healthy cells from radiation-induced genotoxicity. Radiation is commonly used in cancer treatment but can also cause comorbidities due to the radiation damage caused to healthy tissues surrounding the cancer site.

Various studies evaluated the genotoxicity of the phytochemicals in thyme and oregano. A study by Aydin et al. (2005) evaluated thymol, carvacrol, and γ-terpinene, and found that they protected against DNA damage at lower concentrations, but induced
DNA damage at higher concentrations (Aydin et al., 2005). Carvacrol appeared more genotoxic than thymol and γ-terpinene (Aydin et al., 2005). A study by Llana-Ruiz-Cabello et al. (2015) found similar results in human intestinal carcinoma cells. Thymol and carvacrol had antioxidant effects at lower concentrations (1-100 µM), and reversed oxidative damage when combined but acted as a pro-oxidant at higher concentrations (≥250 µM) (Llana-Ruiz-Cabello et al., 2015). Thus, patients may benefit from incorporating thyme in their diet but should be cautious using thyme in larger volumes.

**Turmeric.** Spices like turmeric contain curcumin, which is known for its anti-inflammatory and antioxidant effects. Several animal studies (n = 14) showed an inhibition, suppression, protective, and preventive effect when mice, rats, and hamsters were treated with turmeric or curcumin (Srinivasan, 2017). Additionally, turmeric and curcumin treatments in human experiments (n = 2) showed a reduction in cancer symptoms, complete and partial regression of cancer progression, and tumor regression (Srinivasan, 2017). Curcumin downregulated angiogenesis, resulting in a decrease in tumor growth, survival, and metastasis (Huang & Beevers, 2011), and inhibited growth receptors overexpressed in some cancer cells (Huang & Beevers, 2011). Curcumin regulated proliferation, autophagy, and apoptosis in gastric cancer cells by inhibiting PI3K, an oncogene, and activating P53, a tumor-suppressing gene (Fu et al., 2018). Thus, inhibiting the onset of gastric cancer.

Turmeric is generally regarded as safe in humans, but adverse reactions of turmeric have been studied in humans and mice. Multiple human and murine studies showed turmeric-drug interaction in rats and patients with breast cancer (Egashira, Sasaki, Higuchi, & Ieiri, 2012; Somasundaram et al., 2002). Turmeric can also pose a risk
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for patients who are prone to kidney stones due to its high oxalate content (Cervero et al., 2017). Additionally, cancer patients should be cautious consuming large amounts (2.8 g) of turmeric if they have gastrointestinal disorders or are predisposed to kidney stone formation (Memorial Sloan Kettering Cancer Center, 2018). Lastly, turmeric acts as an antioxidant at lower concentrations (0.18 g) but acts as a pro-oxidant at higher concentrations (3.6 g) (López-Lázaro, 2008). Therefore, patients may benefit from incorporating turmeric in their diet but should be cautious using turmeric in larger volumes or for a prolonged time.

While herbs and spices have many anticancer effects, there are also safeguards that need to be addressed regarding consuming herbs and spices in large doses. Additionally, the adverse effects are more dangerous when a patient is utilizing herbs and spices while undergoing cancer treatment. Herbs and spices can cause carcinogenic, neurotoxic, genotoxic, teratogenic, cytotoxic, nephrotoxic, hepatotoxic, and toxic effects to the gastrointestinal tract when taken in large doses for a prolonged period (Guldiken et al., 2018). Furthermore, some herbs and spices can be detrimental to one’s health when they are combined and taken with certain drugs (Guldiken et al., 2018).

**Dose-dependency of Herbs and Spices as a CAM Modality**

Herbs and spices have many benefits when they are incorporated into the diet but can pose a threat when ingested at high concentrations. Many of the phytochemicals mentioned have chemoprotective effects at lower concentrations and cause DNA damage or mutations at higher concentrations. A survey of free-living adults (n = 146) found that people consume about 3g, or about ¾ tsp, of herbs and spices a day and people often consumed the same herbs and spices (Carlsen, Blomhoff, & Andersen, 2011). The
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volume of herbs and spices consumed on average is not high enough to reach toxicity, but patients may experience toxicity if they increase their spice and herb intake to achieve therapeutic effects.

The Memorial Sloan Kettering Cancer Center and the Academy of Nutrition and Dietetics cautions against using herbs and spices at high concentrations for a prolonged period during cancer treatment (Memorial Sloan Kettering Cancer Center, 2018; Wyble & Dyer, 2014). Additionally, many herbs and spices contain shared phytochemicals (Vallverdú-Queralt et al., 2014), so patients can reach toxicity of a specific compound by consuming different spices or herbs. Herbs and spices can be helpful for cancer patients, for the health benefits and for those experiencing dysgeusia, but patients must be careful using herbs and spices as CAM because regularly consuming high amounts can lead to the patient reaching toxicity.

Consuming high amounts of herbs and spices can also lead to treatment interactions. Many herbs and spices influence the elimination of drugs within the body and in the metabolism of anticancer drugs (Kivistö, Kroemer, & Eichelbaum, 1995), and increase the side effects and toxicity of drugs due to the decrease in drug clearance (Busti & Herrington, 2015). Researchers recommend doctors monitor patients taking garlic or ginger and anticancer drugs for adverse reactions (Yap, See, & Chan, 2010). Lastly, breast cancer patients should watch turmeric consumption, as turmeric reduces the effects of Camptothecin, Mechlorethamine, and Doxorubicin, chemotherapies used for breast cancer (Somasundaram et al., 2002). Researchers and health care professionals should consider factors in CAM use because herbs and spices as a CAM modality can cause adverse reactions in therapeutic amounts.
CAM Use

CAM use varies between individuals with and without a cancer diagnosis, and between demographic characteristics, such as gender, socioeconomic status, level of education, and cancer characteristics, such as cancer type and cancer stage.

CAM use by cancer diagnosis or not. Mao et al. (2011) used the Complementary and Alternative Supplement component of the National Health Interview Survey (NHIS) from the CDC (n = 23,393). When compared to non-cancer individuals, cancer patients were significantly (p < 0.001) more likely to have tried a form of CAM in their lifetime (Mao et al., 2011). Similar results were found in a systematic review (n = 32) by Velicer and Ulrich (2008). Additionally, cancer survivors were significantly more likely to use CAM for wellness (p < 0.001), immune function (p = 0.003), pain-related symptoms (p = 0.010), and insomnia (p = 0.021) than non-cancer survivors (Mao et al., 2011). However, cancer patients were also significantly (p < 0.001) more likely to inform their primary care provider about CAM and herb use than non-cancer patients (Mao et al., 2011). This could be due to cancer patients visiting their doctor more often than their healthy counterparts. Additionally, cancer patients use CAM to treat or mitigate the symptoms of a disease, whereas healthy people tend to use CAM for preventative health.

In a study by Isbill et al. (2018), researchers surveyed 703 healthy adults, and half of the participants identified family and friends as sources of information for spices, and 48% of the participants were interested in learning more about spice use and health benefits. Older, college-educated women and participants who met with a dietitian or were advised by a health professional were more likely to use ethnic spices as a form of CAM. Participants were less likely to believe that unfamiliar spices were able to
influence health positively. The results on spice and herb use as a form of CAM were similar to results on dietary or herbal supplements as a form of CAM.

**Gender.** Women were more likely to use CAM than men (Greenlee, White, Patterson, & Kristal, 2004; Judson, Abdallah, Xiong, Ebbert, & Lancaster, 2017). Greenlee et al. (2004) surveyed 10,857 cancer survivors in a cross-sectional cohort study part of the Vitamin and Lifestyle (VITAL) study. Greenlee found females tended to use supplements more than men, but the difference was insignificant. Judson et al. (2017) surveyed approximately 84,000 cancer patients using a Total Cancer Care (TCC) questionnaire, including 40 multiple-choice questions on CAM use. Judson et al. found a significant difference (p < 0.005) between men and women who used CAM. However, the results that women are more likely to use CAM may be skewed because the studies included more female-related cancers such as breast, cervical, or ovarian cancers, making more of the participants female in the studies.

Women are also more likely to do the shopping in the household and more likely to talk about their condition with friends and family, which makes hearing about CAM information more accessible to them. Additionally, women are more likely to talk to a doctor about their condition and the medications or treatments they are using than men. Conversely, women may also be more likely to use CAM because of gender bias within medical treatment and decide to try nonconventional options as a response to healthcare providers neglected women’s healthcare needs (Kristoffersen, Stub, Salamonsen, Musial, & Hamberg, 2014). Men were more likely to use CAM in response to perceived poor health at all ages and education levels (Kristoffersen et al., 2014).
Level of education and socioeconomic status. CAM use was positively related to increased education and a higher level of socioeconomic status (Gupta et al., 2005; Judson et al., 2017). Gupta et al. (2005) surveyed newly diagnosed cancer patients with the McCune Questionnaire, a validated instrument used to assess the use of 56 dietary supplements in cancer at admission to the hospital. Gupta et al. (2005) found a significant (p = 0.02) relationship between education level and CAM use, and a nonsignificant (p = 0.53) increase in CAM with income level. Judson et al. (2017) found similar results with the TCC questionnaire but found a significant (p < 0.005) relationship between income and CAM use among cancer patients. Education and socioeconomic status can increase CAM use because that population has greater access to CAM. High-quality supplements can be expensive, so low-income patients may not be able to afford them. Conversely, the NHIS study by Mao et al. (2011) showed that patients might start CAM because conventional treatments were too expensive. Lastly, patients with higher education may be more likely to research alternative treatments or ask questions about CAM than less educated patients.

Type and stage of cancer. Researchers have examined supplement use by patients with various types of cancer. Gupta et al. (2005) found that breast, colorectal, and lung cancer was a predictor of CAM use. Velicer and Ulrich (2008) confirmed in a systematic review of 32 articles that patients with breast cancer (n = 3,008) were 11% to 20% more likely to use supplements after their cancer diagnosis and found that patients with breast cancer reported the highest use of CAM and patients with prostate cancer reported the least use of CAM. Additionally, there was a greater positive association
between breast or colorectal cancer and CAM use than or prostate cancer and CAM use. In addition to cancer type, researchers also evaluated cancer stage.

Gupta et al. (2005) also examined the stage of the patients’ tumors at diagnosis and whether the patient received chemo within the past 30 days of taking the survey. Patients who were diagnosed with stage II or stage III cancers were more likely to use CAM. Additionally, patients who received chemotherapy and used CAM simultaneously were at a higher risk for an adverse drug interaction (Gupta et al., 2005). CAM use may be less likely in stage I cancers because their cancer is easier to treat with conventional treatments, while stage IV cancer patients may not use supplements because of swallowing difficulties. Lastly, CAM use was associated with breast, colorectal, and lung cancers, and stage II and III cancer stages.

Source of CAM information. The source of CAM information also varied among cancer patients. Patients (n = 242) primarily found information on CAM from health food and nutrition stores (40.5%), friends and relatives (37%), naturopaths (28.2%), the internet (20.3%), newspapers and magazines (15%), an oncologist (7.9%), and the television (7.5%) (Gupta et al., 2005). In a systematic review of 33 articles by Wanchai et al. (2010), 11 articles indicated that women with breast cancer received CAM information from friends and family, conventional health professionals, CAM providers, media outlets, self-help groups, and health insurance companies. Contradictory to other studies, Mao (2011) found that there was a stronger relationship between CAM use and physician recommendation (p < 0.001) that recommendations from family and friends (p = 0.055). The association between CAM information and sources other than an oncology specialist or physician may be related to physicians stigmatizing CAM use (Saxe et al.,
Spice and Herb Use Among Cancer Patients

2008). Therefore, patients may be more likely to consult their physicians about CAM use if the patient perceived the physician to be open-minded about the use of CAM.

Summary

Cancer patients are more likely to utilize CAM than people without cancer, with educated females of higher socioeconomic status being the most likely to incorporate CAM modalities (Gupta et al., 2005; Wanchai et al., 2010), including the use of herbs and spices (Isbill et al., 2018). Similar to other forms of CAM, the primary sources of herbs and spices was friends and relatives, the internet, newspapers and magazines, the television, physicians, and dietitian nutritionists (Isbill et al., 2018). Many cancer patients did not report CAM use to their physicians, which can pose a severe risk for drug and treatment interactions.

Like other forms of CAM, herbs and spices can be beneficial, but can also pose serious side effects or adverse reactions during cancer treatment (Memorial Sloan Kettering Cancer Center, 2016). Various herbs and spices have anticarcinogenic properties at low concentrations but have cytotoxic effects at high concentrations and may interfere with drug clearance within the cells (Kivistö et al., 1995). Herbs and spices have anticarcinogenic and anti-inflammatory effects, as well as antioxidant properties at safe concentrations. However, herbs and spices can also have carcinogenic, hepatoxic, and neurotoxic effects when consumed in large amounts.
Chapter III

Methodology

Research Design

A mixed-method, survey design with purposive sampling was utilized in this study. The purpose of this study was to examine cancer patients’ use of, perceived benefits, and beliefs about herbs and spices after their cancer diagnosis. The study aimed to explore types of herbs and spices used by cancer patients, assess cancer patients’ experiences and perceived benefits and beliefs of herb and spice use, determine if there was a significant difference in herb and spice use by cancer characteristic, determine if there was a significant difference in herb and spice use by demographic characteristic, determine if there is a relationship between change in herb and spice use and cancer characteristic, and determine if there is a relationship between change in herb and spice use and demographic characteristic. The current study was approved by the Eastern Illinois University’s Institutional Review Board (IRB number 18-082).

Population and Sample

The population included cancer patients throughout the United States who were receiving cancer treatment or in remission. Men and women who were a part of an online cancer support group or saw a registered dietitian nutritionist in the Academy of Nutrition and Dietetics Oncology Dietetic Practice Group (DPG) were offered the opportunity to complete the online survey.

Selection of the sample. The selection of the study participants was nonprobable and purposive, as the sample was recruited through online cancer support groups. These support groups were found by the researcher by searching for cancer or cancer support
within social media groups. The researcher invited participants with a social media post that included a brief overview of the study and an anonymous Qualtrics link for the instrument. Patients who did not cook for themselves, received all their meals from the hospital, or relied solely on tube feeding or nutrition supplements for their meals were excluded because spice and herb use could not be estimated in those patients.

**Description of the sample.** Two hundred and thirty-five cancer patients completed the survey. Of the 235 participants, 55 surveys were excluded due to incomplete responses and 45 were excluded due to not cooking for themselves. Participants ranged from 18 to over 70 years old, and the largest age group was between 30 and 39 years old. There were balanced numbers of men (n = 48) and women (n = 51) who completed the survey, and participants lived throughout all regions of the continental U.S. Participants from all ethnicities answered the survey. The largest ethnic groups to complete the survey were Native American (23.7%) and African American (20.7%), which could be due to where the registered dietitian nutritionists work or from these participants sharing the survey with their family members (Table 1). Most of the participants completed some level of higher education or professional schooling. Approximately half of the participants were of lower socioeconomic status, and about 40% of participants worked full- or part-time (Table 2).
Table 1

*Sample Characteristics (N = 135)*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
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<tr>
<td>Gender</td>
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<tr>
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<tr>
<td>Male</td>
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</tr>
<tr>
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<td>13.3%</td>
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<td>18</td>
<td>13.3%</td>
</tr>
<tr>
<td>Age</td>
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<td></td>
</tr>
<tr>
<td>19-29</td>
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<tr>
<td>30-39</td>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
<td>Residence</td>
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</tr>
<tr>
<td>East South Central</td>
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</tr>
<tr>
<td>Mid-Atlantic</td>
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<td>12.6%</td>
</tr>
<tr>
<td>Mountain</td>
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<td>5.9%</td>
</tr>
<tr>
<td>New England</td>
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<td>7.4%</td>
</tr>
<tr>
<td>Pacific</td>
<td>15</td>
<td>11.1%</td>
</tr>
<tr>
<td>South Atlantic</td>
<td>15</td>
<td>11.1%</td>
</tr>
<tr>
<td>West North Central</td>
<td>20</td>
<td>14.8%</td>
</tr>
<tr>
<td>West South Central</td>
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<td>7.4%</td>
</tr>
<tr>
<td>Ethnicity</td>
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<td></td>
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<tr>
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<tr>
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<tr>
<td>Hispanic/Latino</td>
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<tr>
<td>Native American</td>
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<tr>
<td>Other</td>
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</tr>
<tr>
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<td>6</td>
<td>4.4%</td>
</tr>
</tbody>
</table>
Table 2: Sample Education and Income (N = 135)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
<tr>
<td>Less than a high school diploma</td>
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</tr>
<tr>
<td>Some high school</td>
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<td>7.4%</td>
</tr>
<tr>
<td>High school degree or equivalent</td>
<td>16</td>
<td>11.9%</td>
</tr>
<tr>
<td>Some college, no degree</td>
<td>18</td>
<td>13.3%</td>
</tr>
<tr>
<td>Associate's degree</td>
<td>17</td>
<td>12.6%</td>
</tr>
<tr>
<td>Bachelor's degree</td>
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<td>18.5%</td>
</tr>
<tr>
<td>Master's degree</td>
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<td>10.4%</td>
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<tr>
<td>Professional degree</td>
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<td>4.4%</td>
</tr>
<tr>
<td>Doctorate</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Prefer not to answer</td>
<td>25</td>
<td>18.5%</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$19,999</td>
<td>25</td>
<td>18.5%</td>
</tr>
<tr>
<td>$20,000-34,999</td>
<td>27</td>
<td>20%</td>
</tr>
<tr>
<td>$35,000-49,999</td>
<td>16</td>
<td>11.9%</td>
</tr>
<tr>
<td>$50,000-74,999</td>
<td>14</td>
<td>10.4%</td>
</tr>
<tr>
<td>$75,000-99,999</td>
<td>8</td>
<td>5.9%</td>
</tr>
<tr>
<td>&gt;$100,000</td>
<td>25</td>
<td>18.5%</td>
</tr>
<tr>
<td>Prefer not to answer</td>
<td>20</td>
<td>14.8%</td>
</tr>
</tbody>
</table>

Instrument Development

The instrument was adapted from Isbill et al.'s (2018) Consumer Usage of Ethnic Spices (CUES) survey, which was previously tested for reliability and validity. The stability-reliability was tested by having 50 Midwestern adults take the CUES survey twice within a 7-day period. The internal reliability for the three parts of the survey had reliability scores of $\alpha = 0.81$, $\alpha = 0.90$, and $\alpha = 0.63$, respectively (Isbill et al., 2018). The CUES survey has three parts: a 10-item subscale assessing individuals’ usage and familiarity with spices, a 10-item subscale assessing individuals’ perception about spices in promoting health and wellness, and the last subscale assessing consumers’ perceptions of the efficiency of spices in preventing 12 diseases. For the current instrument, the questions were adapted to include the beliefs about herbs and spices of adults diagnosed
with cancer by asking the participants about their beliefs after their cancer diagnosis. The current instrument included a section regarding the participant’s willingness and interest level in spice consumption, sources of information on spice benefits, eating habits in and out of the home, and whether the participant met with a registered dietitian nutritionist.

**Data Collection Instrument**

The online questionnaire (Appendix B) was used to quantitatively and qualitatively assess the use, beliefs, and attitudes of herbs and spices in cancer patients. The instrument started with the informed consent form (Appendix A) and two questions regarding how often participants cook for themselves and how often they eat outside of their homes, such as at the hospital or restaurants, to determine if the participant would be included in the study.

**Herb and spice use.** Adapted from the CUES survey, Likert-style questions on a scale of 1 (daily) to 5 (never) assessed patients’ frequency of herb and spice consumption. In addition to the CUES survey, Likert-style questions assessed the volume of herbs and spices used on a scale of 1 (never use) to 4 (more than 1 teaspoon), and two Likert-style questions assessed the change in herb and spice use after the participant’s cancer diagnosis on a scale of 1 (significantly decreased) to 5 (significantly increased). Herbs and spices were separated into two sections. Participants were also asked when they season their food during food preparation.

**Attitudes towards and beliefs of herbs and spices.** Ten questions assessed the patients’ attitudes towards herbs and spices; three of those questions were open-ended, and seven questions were multiple choice. The multiple choice questions adapted from the CUES survey included where the participants’ received their information on herbs
and spices, willingness to consume herbs and spices as a CAM modality, any diet changes made after their cancer diagnosis, and whether they received diet information from a doctor or registered dietitian nutritionist. Multiple choice questions that were added in addition to the CUES survey included the likelihood of trying herbs and spices recommended by their doctor and if they were concerned with herbs or spices interacting with their treatment. In addition to the CUES survey, the open-ended questions asked the participants about reasons for modifying their consumption of herbs and spices, reasons for not using herbs and spices on a weekly basis, and reasons for concern about herbs or spices interacting with their cancer treatment.

**Cancer and demographic characteristics.** Five multiple choice questions examined the patients' cancer characteristics, which include the type of cancer diagnosed, years since diagnosis, stage of diagnosis, current condition, and type of cancer treatment received. The last seven multiple choice questions examined the patients' demographics, which included age, gender, location in the US, ethnicity, education, income, and employment status.

**Pilot Study**

The current instrument was evaluated by five content matter experts, which consisted of oncology dietitians, dietetic professors, and a dietetic researcher, who had knowledge in survey development as well as the use of herbs and spices, to ensure the content validity of this survey instrument. Experts reviewed and rated each item on its relevance, clarity, simplicity, and ambiguity to evaluate use, perceived benefits, and attitudes of herbs and spices using a four-point Likert scale (1–4) representing poor to excellent agreement. For content validity, the items under review included the question
statement and its answer options. Scores on relevance were used to generate a content validity index, while clarity, simplicity, and ambiguity were used to pinpoint disagreement in the questionnaire’s structure. The experts made suggestions based on the relativity, clarity, simplicity, and ambiguity of the questions.

A few changes were made to the instrument based on content expert suggestions. Descriptions of food preparation, such as preparing meals and snacks, were included in the questions screening for the participant’s frequency of food preparation. Spice mixtures were added to the FFQ, such as Italian, adobo, and Greek seasoning. Herbs and spices were separated in the FFQ to have two separate questions instead of one large FFQ. More cancer types and treatments were added to the cancer characteristic section. Lastly, more options were added to the employment demographics. After the proposed changes were made, the instrument was piloted with a focus group at a local cancer center.

After the results from the content matter experts were organized and the instrument was revised accordingly, a pilot study (n=10) was conducted with cancer patients at a local central Illinois cancer center and online support groups to assess face validity and reliability of the instrument. Participants reviewed and rated each question, statement and answer options, of the modified instrument based on clarity (Yes ‘1’ or No ‘2’). The cancer patients provided reasons for the questions they indicated were not clear. The Content Validity Index (CVI) for questions was calculated based on the number of participants in agreement (i.e., clarity = ‘yes’) divided by the total number of participants. A CVI of 0.8 or greater is considered acceptable. The CVI was determined the herb and spice use and attitudes towards and beliefs of herbs and spices sections of the instrument.
The CVI was 0.97 and 0.98, respectively. Based on the pilot study, no changes were made to the instrument.

**Procedure for Data Collection**

After the pilot study, a Qualtrics survey link was shared through online cancer support groups, cancer groups on Facebook, and the registered dietitian nutritionists in the Oncology Dietetic Practice Group (DPG) of The Academy of Nutrition and Dietetics. All recruitment posts were public online and could be shared by the members of the support groups. The recruitment post was shared three times by Facebook members other than the researcher. The instrument took approximately 10-15 minutes for participants to complete and was composed of 33 questions. These participants resided within the US and outlying US territories. The participants completed the instrument through an anonymous Qualtrics link on the support group page to examine participants’ use of, perceived benefits, and attitudes towards herbs and spices. These groups were found by research cancer or cancer support on social media sites. The researcher reminded participants bi-weekly, a total of four times, to take the survey, and the survey was open for two months. The study procedure was approved by the Eastern Illinois University Institutional Review Board (18-082) prior to distributing the instrument.

**Data Analysis**

The responses of the questionnaire were analyzed with Excel and SPSS to determine relationships between demographic data, cancer characteristics, and herb and spice use, beliefs, and attitudes. Atlas TI was used to analyze qualitative data.

**Reliability.** Internal consistency reliability was used to determine the reliability of the instrument. Internal consistency is useful when developing a new instrument to
measure the inconsistency or nonequivalence of different questions that are intended to measure the same concept (Chen et al. 2001). Since the instrument is based on perceptions, beliefs, and attitudes, a Cronbach alpha of 0.5 and above was considered acceptable for reliability (Tuckman, 1999). A Cronbach alpha was determined for each survey section, herb and spice use, attitudes towards and beliefs of herbs and spices, and cancer and demographic characteristics. The Cronbach alphas were 0.78, 0.90, and 0.84, respectively. All Cronbach alphas were considered within acceptable range.

For the qualitative analyses, Atlas TI was used to identify the themes based on participants responses to the three open-ended questions. Once themes were identified, two coders determined interrater reliability using Krippendorff's Alpha (Hayes & Krippendorff, 2007). A Krippendorff's alpha greater than 0.80, indicated an acceptable level of coding reliability (Hayes & Krippendorff, 2007). The interrater reliability was $\alpha = 0.802$, $\alpha = 0.845$, and $\alpha = 0.926$, respectively. All Krippendorff's alphas were considered within an appropriate range.

**Research objective 1:** To explore types of herbs and spices used by cancer patients. This research objective was examined through descriptive statistics of the FFQ section, including the frequency of herb and spice use, volumes used, and change in herb and spice consumption after a cancer diagnosis, and the question regarding when participants season their food. The herbs and spices were analyzed by the number of participants who used the herb or spice on a regular basis to determine the herbs and spices cancer patients use the most often. Regular basis was determined by calculating the number of participants that used the herb or spice at least weekly. Change in herb and spice use was analyzed by calculating the average change in each herb and spice. To
determine the average change, the responses were assigned the following numbers: -2 = significantly decreased, -1 = decreased, 0 = remained the same, 1 = increased, and 2 = significantly increased. The numbers were then averaged to determine if the herb or spice was generally decreased, remained the same, or increased among participants.

To further assess this objective, open-ended questions regarding modifications in spice and herb use and reasons for not consuming herbs and spices on a regular basis were analyzed. Qualitative analysis was conducted via the content analysis method highlighted by Garrison et al. (2006). Following this methodology, two researchers, the author and a registered nurse, independently identified themes associated with attitudes towards spice and herb use. The coding scheme for the participants’ responses is described in Appendix C. Responses were omitted if the participants mentioned non-herb and spice modifications, such as herbal supplements and/or fruits and vegetables (n = 11). Some participants (n = 5) opted out of answering the open-ended questions.

**Research objective 2:** To assess cancer patients’ experiences and perceived benefits and beliefs of herb and spice use. This research objective was explored through the questions regarding participants’ willingness to use herbs and spices as a CAM modality and interest in learning more about herbs and spices were included in the investigated through descriptive statistics.

**Research question 1:** Is there a significant difference in herb and spice use by cancer characteristic? This research question was answered using the cancer characteristic questions including stage and years since diagnosis and the FFQ question on frequency of herb and spice use. The FFQ used a Likert-style scale. For the question on frequency of herb and spice use, 1 = Never, 2 = Yearly, 3 = Monthly, 4 = weekly, and 5 = Daily. The
sums of the questions were calculated to assess statistical significance between herb and spice frequency and cancer characteristics. Standard regression was used to determine if there was a significant difference between cancer characteristics and the sum of the frequency of herb and spice use. A statistical significance of p <0.05 was used.

**Research question 2:** Is there a significant difference in herb and spice use by demographic characteristic? This research question was answered using the demographic characteristic questions including age, gender, education, and income level, and the FFQ question on frequency of herb and spice use. Standard regression was used to determine if there was a significant relationship between age, education, or income level and the sum of the frequency of herb or spice used. An independent samples t-test was used to determine if there was a significant difference in frequency of herb or spice use between genders. A statistical significance of p <0.05 was used.

**Research question 3:** Is there a relationship between change in herb and spice use and cancer characteristic? This research question was answered using the cancer characteristic questions including stage and years since diagnosis and the FFQ question on change in herb and spice use. For the change in herbs and spices question, 1 = significantly decreased, 2 = decreased, 3 = remained the same, 4 = increased, and 5 = significantly increased. The sums of the questions were calculated to assess statistical significance between change in herb and spice use and cancer characteristics. Standard regression was used to determine if there was a significant relationship among cancer characteristics and the sum of the change in herb and spice use. A statistical significance of p <0.05 was used.

**Research question 4:** Is there a relationship between change in herb and spice use and demographic characteristic? This research question was answered using the
demographic characteristic questions including age, gender, education, and income level, and the FFQ question on change in herb and spice use. Standard regression was used to determine if there was a significant relationship among age, education, or income level and the sum of the change in herb or spice used. An independent samples t-test was used to determine if there was a significant difference in change in herb or spice used between genders. A statistical significance of \( p < 0.05 \) was used.

**Research question 5:** Do health professionals influence herb and spice intake after a cancer diagnosis? This question was answered by investigated the questions regarding the participants’ likelihood of trying herbs and spices recommended by their doctor, whether the participants received diet information from a doctor or registered dietitian nutritionist, and if the participant was concerned about herbs and spices interacting with their cancer treatment. A chi-square test was used to determine if participants were significantly more likely to be concerned about herb and spice interacting with cancer treatments after receiving diet information from a doctor or registered dietitian nutritionist. A statistical significance of \( p < 0.05 \) was used.

Additionally, reasons for concern about herbs and spices interacting with their cancer treatment was assessed if the participant stated they were concerned about herbs and spices interacting with their cancer treatment.
Chapter IV

Results and Discussion

The purpose of this study was to examine cancer patients’ use of, perceived benefits, and beliefs about herbs and spices after their cancer diagnosis through the use of an online questionnaire.

Participants’ Cancer Characteristics

Participants were asked about the type of cancer they were diagnosed, how many years have passed since their diagnosis, the stage they were diagnosed, their current cancer condition, and the type of cancer treatment they received. The most commonly diagnosed cancers within the participants were breast (19.3%), liver (11.1%), and other cancer types (19.3%), such as lymphoma, thyroid, and germ cell (Figure 1). Most participants were diagnosed 1-2 years ago (43.7%) and were diagnosed with stage II cancer (40.7%). Since diagnosis, 13.3% of participants are cancer-free, 25.9% of participants are in remission, 21.5% of participants increased in the stage, 20% of participants stage remained the same, and 19.3% participants were unsure of their condition (Table 3). The most commonly used treatments were radiation (31.1%) and chemotherapy (29.6%), followed by hormonal therapy, surgery to remove the tumor or part of an organ, and targeted drug therapy (Table 4).
Figure 1. Cancer Types Among Participants (N = 135). Other cancer types included lymphoma, thyroid, and germ cell cancers.

Table 3

<table>
<thead>
<tr>
<th>Cancer Characteristics Among Participants (N = 135)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic</td>
</tr>
<tr>
<td>Years since diagnosis</td>
</tr>
<tr>
<td>less than 1 year</td>
</tr>
<tr>
<td>1-2 years</td>
</tr>
<tr>
<td>3-4 years</td>
</tr>
<tr>
<td>5 years or more</td>
</tr>
<tr>
<td>not sure</td>
</tr>
<tr>
<td>Current condition</td>
</tr>
<tr>
<td>Cancer Free</td>
</tr>
<tr>
<td>In Remission</td>
</tr>
<tr>
<td>Not Sure</td>
</tr>
<tr>
<td>Stage Increased</td>
</tr>
<tr>
<td>Stage Stayed the Same</td>
</tr>
<tr>
<td>Stage at Diagnosis</td>
</tr>
<tr>
<td>Not Sure</td>
</tr>
<tr>
<td>Stage I</td>
</tr>
<tr>
<td>Stage II</td>
</tr>
<tr>
<td>Stage III</td>
</tr>
<tr>
<td>Stage IV</td>
</tr>
</tbody>
</table>
Spice and Herb Use Among Cancer Patients

Table 4

Cancer Treatments Among Participants (N = 135)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation</td>
<td>42</td>
<td>31.1%</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>40</td>
<td>29.6%</td>
</tr>
<tr>
<td>Hormonal Therapy</td>
<td>29</td>
<td>21.4%</td>
</tr>
<tr>
<td>Surgery to Remove Tumor or Part of an Organ</td>
<td>19</td>
<td>12.1%</td>
</tr>
<tr>
<td>Targeted Drug Therapy</td>
<td>9</td>
<td>6.7%</td>
</tr>
<tr>
<td>No Treatment</td>
<td>5</td>
<td>3.7%</td>
</tr>
</tbody>
</table>

Research Objective 1: To Explore Types of Herbs and Spices Used by Cancer Patients.

A FFQ was used to access herb and spice use among cancer patients. Spices and herbs were broken into two groups and accessed individually. Frequency, in addition to amount, can help determine if cancer patients are consuming herbs and spices safely.

Frequency of herb and spice use. Participants were asked about their frequency of herb and spice use (Table 5). Of the herbs and spices included on the FFQ, participants used sage (75.6%) and black pepper (83.0%) the most regularly. Basil (63.7%) and adobo seasoning (22.2%) were used the least regularly. Interestingly, spices like turmeric, which are more famous for their anti-cancer effects, were used less frequently (67.4%). Similarly, herbs that are known to relieve symptoms like nausea, such as mint, were also used less frequently (68.1%).
Table 5

Herbs and Spices Consumed on a Regular Basis\(^1\) (N = 135)

<table>
<thead>
<tr>
<th>Herb/Spice</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sage</td>
<td>102</td>
<td>75.6</td>
</tr>
<tr>
<td>Thyme</td>
<td>99</td>
<td>73.3</td>
</tr>
<tr>
<td>Curry Leaf</td>
<td>98</td>
<td>72.6</td>
</tr>
<tr>
<td>Oregano</td>
<td>98</td>
<td>72.6</td>
</tr>
<tr>
<td>Cilantro</td>
<td>97</td>
<td>71.9</td>
</tr>
<tr>
<td>Rosemary</td>
<td>95</td>
<td>70.4</td>
</tr>
<tr>
<td>Mint</td>
<td>92</td>
<td>68.1</td>
</tr>
<tr>
<td>Parsley</td>
<td>91</td>
<td>67.4</td>
</tr>
<tr>
<td>Italian Seasoning</td>
<td>90</td>
<td>66.7</td>
</tr>
<tr>
<td>Basil</td>
<td>86</td>
<td>63.7</td>
</tr>
<tr>
<td>Black Pepper</td>
<td>112</td>
<td>83.0</td>
</tr>
<tr>
<td>Ginger</td>
<td>107</td>
<td>79.3</td>
</tr>
<tr>
<td>Garlic</td>
<td>95</td>
<td>70.4</td>
</tr>
<tr>
<td>Greek Seasoning</td>
<td>94</td>
<td>69.6</td>
</tr>
<tr>
<td>Cumin</td>
<td>94</td>
<td>69.6</td>
</tr>
<tr>
<td>Chili Pepper</td>
<td>94</td>
<td>69.6</td>
</tr>
<tr>
<td>Cloves</td>
<td>92</td>
<td>68.1</td>
</tr>
<tr>
<td>Turmeric</td>
<td>91</td>
<td>67.4</td>
</tr>
<tr>
<td>Paprika</td>
<td>90</td>
<td>66.7</td>
</tr>
<tr>
<td>Fennel</td>
<td>89</td>
<td>65.9</td>
</tr>
<tr>
<td>Coriander</td>
<td>88</td>
<td>65.2</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>87</td>
<td>64.4</td>
</tr>
<tr>
<td>Curry Seasoning</td>
<td>80</td>
<td>59.3</td>
</tr>
<tr>
<td>Adobo Seasoning</td>
<td>30</td>
<td>22.2</td>
</tr>
</tbody>
</table>

\(^1\)Regular herb and spice consumption were based on weekly or daily use.

There were eight themes identified for not consuming herbs and spices on a regular basis (Table 6). Approximately 23% of participants (n = 31) indicated that they consume herbs and spices on a regular basis. The main reasons for not consuming herbs and spices on a regular basis was the inability to tolerate the taste of herbs and spices (n = 12), participants believed herbs and spices were harmful in excess (n = 11), and they were recommended by a health professional to not consume herbs and spices on a regular
basis (n = 10). Other themes included being unsure about the benefits and consequences of herbs and spices, feel herbs and spices cause adverse health effects, availability of herbs and spices, and the participants’ family does not enjoy herbs and spices.

<table>
<thead>
<tr>
<th>Theme</th>
<th>n</th>
<th>%</th>
<th>Sample comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot tolerate the taste</td>
<td>12</td>
<td>10.1%</td>
<td>&quot;Some of them are not in good in taste, so I don't want to use it.”</td>
</tr>
<tr>
<td>Harmful in excess</td>
<td>11</td>
<td>9.2%</td>
<td>&quot;Herbs on a daily basis can cause serious health problems.”</td>
</tr>
<tr>
<td>Recommendation of health professional</td>
<td>10</td>
<td>8.4%</td>
<td>&quot;Because I thought to consult with a doctor first.”</td>
</tr>
<tr>
<td>Unsure about the effects</td>
<td>9</td>
<td>7.6%</td>
<td>&quot;I am not sure about the side effects of herbs.”</td>
</tr>
<tr>
<td>Health effects</td>
<td>7</td>
<td>5.9%</td>
<td>&quot;Higher risk of high blood pressure and heart problems.”</td>
</tr>
<tr>
<td>Fatigue</td>
<td>7</td>
<td>5.9%</td>
<td>&quot;Stress, tiredness.”</td>
</tr>
<tr>
<td>Availability</td>
<td>2</td>
<td>1.7%</td>
<td>&quot;I don't find some of them normally.”</td>
</tr>
<tr>
<td>Family Preferences</td>
<td>2</td>
<td>1.7%</td>
<td>&quot;We don’t use such herbs and spices because some of the people in the family did not like to have these herbs in their food, so we don’t use some of the herbs.”</td>
</tr>
</tbody>
</table>

Black pepper is the most regularly used spice (83.0%), and ginger (79.3%) was the second most regularly used spice. Sage was the most regularly used herb (75.6%), and thyme was the second most regularly used herb (73.3%). The findings were similar to the results found by Isbill et al. (2018) in a study with healthy adults. Both studies found that black pepper was used the most regularly, which could be due to the availability,
affordability, and versatility of black pepper. Conversely, the current study found ginger to be used more regularly. However, the current study examined cancer patients, whereas the study by Isbill et al. studied healthy adults. According to the qualitative analysis, cancer patients may be more likely to use ginger for its antiemetic properties to manage side effects of cancer treatment. Lastly, participants may not have been consuming herbs and spices regularly because they are unaware of the possible benefits or adverse effects and want to discuss proper herb and spice consumption with their doctor or dietitian.

**Amount of herbs and spices used.** The spice used in the greatest amount was paprika and turmeric (Figure 2). The herb used in the greatest amount was parsley and oregano (Figure 3). Most participants used less than one teaspoon of a spice or herb per dish or did not measure the herbs and spices they use. Interestingly, more people used sage and turmeric in volumes greater than one teaspoon than other herbs and spices.
Spice and Herb Use Among Cancer Patients

Figure 2. Volumes of Spices Used Per Dish Among Participants (N = 135).

Figure 3. Volumes of Herbs Used Per Dish Among Participants (N = 135).
Black pepper and ginger were consumed in relatively smaller amounts than other spices, even though the spices were consumed more regularly. Spices such as paprika, turmeric, curry seasoning, coriander, and cumin were consumed in relatively higher amounts. Based on the qualitative analysis of participants’ modification of herb and spice use, the spices may have been consumed in lower volumes because the spices were more potent, and participants may not have been able to tolerate the taste of the spices. Conversely, strong spices such as paprika, turmeric, and cinnamon may have been consumed in greater volumes due to the spices’ popular anticancer or other health properties. Participants consumed herbs like parsley, oregano, and sage in relatively greater amounts than herbs like curry leaf, cilantro, and basil. Based on the qualitative analysis of participants’ modification of herb and spice use, the herbs consumed in greater amounts may have been more tolerable to the participants or more available.

**Change in herb and spice use after diagnosis.** On average, the spice that increased the most in consumption was garlic and turmeric. The spice that decreased the most in consumption was chili pepper and adobo seasoning (Figure 4). The herb that increased the most in consumption was parsley and mint. The herb that decreased the most in consumption was basil and rosemary (Figure 5). Interestingly, black pepper and sage were decreased after a cancer diagnosis, even though they were used the most frequently.
Spice and Herb Use Among Cancer Patients

Figure 4. Change in Spice Use Since Cancer Diagnosis Among Participants (N = 135).

Change in spice use was analyzed by calculating the average change in each herb and spice. To determine the average change, the responses were assigned the following numbers: -2 = significantly decreased, -1 = decreased, 0 = remained the same, 1 = increased, and 2 = significantly increased.
Figure 5. Change in Spice Use Since Cancer Diagnosis Among Participants (N = 135).

Change in spice use was analyzed by calculating the average change in each herb and spice. To determine the average change, the responses were assigned the following numbers: -2 = significantly decreased, -1 = decreased, 0 = remained the same, 1 = increased, and 2 = significantly increased.

There were ten themes identified for reasons to modify herbs and spice use (Table 7). Approximately one-third of the participants (34%) stated that they increased various herbs and spices because it could be used as a complementary treatment or a safer alternative for cancer. The second most identified theme was the use of spices and herbs for general health. Twenty percent of participants noted that they increased herbs and spices because herbs and spices improved overall health or help keep them healthy. Other
identified themes include increased herbs and spices to manage co-morbidities, such as heart disease, diabetes, and irritable bowel syndrome, boost the immune system, manage side effects of cancer treatment, improve the flavor of food, or because herbs and spices were used for centuries in traditional medicine, and because of the recommendation of a health professional. Some participants noted that they decreased herb and spice use because they experienced adverse side effects (n = 5) or because they made diet recommendations that involved reducing herbs and spices (n = 4).
Spice and Herb Use Among Cancer Patients

<table>
<thead>
<tr>
<th>Theme</th>
<th>n</th>
<th>%</th>
<th>Sample comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAM-Cancer Treatment</td>
<td>46</td>
<td>34%</td>
<td>“I started using cumin in more amount as I heard it could be more beneficial for cancer cure.”</td>
</tr>
<tr>
<td>Improve general health</td>
<td>21</td>
<td>15.6%</td>
<td>“Help us to recover and good for our health. Herbs always help us for good health.”</td>
</tr>
<tr>
<td>Manage co-morbidities</td>
<td>16</td>
<td>11.9%</td>
<td>“some spices reduce inflammation and lower blood sugar and blood triglyceride levels.”</td>
</tr>
<tr>
<td>Boost immune system</td>
<td>10</td>
<td>7.4%</td>
<td>“Holy Basil helps fight infections and boosts immunity.”</td>
</tr>
<tr>
<td>Improve flavor</td>
<td>10</td>
<td>7.4%</td>
<td>“…used fresh herbs and spices to add some flavor.”</td>
</tr>
<tr>
<td>Helps with side effects</td>
<td>8</td>
<td>5.9%</td>
<td>“At that time I thought spices could be harmful so started taking in less amount.”</td>
</tr>
<tr>
<td>Traditional medicine</td>
<td>6</td>
<td>4.4%</td>
<td>“Herbs used in traditional Chinese medicine may help reduce some side effects of chemotherapy, so I believe herbs have a good effect, so we should take them.”</td>
</tr>
<tr>
<td>Reduced due to adverse effects</td>
<td>5</td>
<td>3.7%</td>
<td>“At that time. I thought spices could be harmful so started taking in less amount.”</td>
</tr>
<tr>
<td>Recommendation of health professional</td>
<td>4</td>
<td>3.0%</td>
<td>“I changed as my physician suggested me to take more spices.”</td>
</tr>
<tr>
<td>Diet modifications</td>
<td>4</td>
<td>3.0%</td>
<td>“I did modifications in eating plan and the spices involved in it.”</td>
</tr>
</tbody>
</table>

On average, black pepper, chili pepper, adobo seasoning, fennel, curry seasoning, and cloves were decreased after cancer diagnoses. Sage and thyme were also decreased after a cancer diagnosis, along with curry leaf, cilantro, and basil. These seasonings tend to be spicier than other spices and herbs or may be less tolerated after taste alterations or
due to other side effects, such as nausea. Additionally, participants may have decreased
consumption of foods that usually contain these herbs and spices after their cancer
diagnosis. Conversely, spices like garlic, turmeric, and ginger were increased the most,
and these spices are more popular or well known in the media for their anticancer effects.
According to the qualitative analysis, most participants modified their herb and spice use
because they believed herbs and spices could prevent or treat cancer. Herbs like parsley,
Italian seasoning, and mint were the most increased after a cancer diagnosis. According
to the qualitative analysis, these herbs could be increased due to their mild flavors,
availability, and ability to manage the side effects caused by cancer treatment.

**Herb and spice timing in food preparation.** Approximately half of the
participants season their food during food preparation (n = 69), approximately 30% of
participants season their food after cooking their food (n = 39), and approximately 20%
of participants season their food before cooking their food (n = 27).

Most participants season their food during or after food preparation. Herbs and
spices can lose their phytochemical properties when herbs and spices are exposed to
excessive or prolonged heat (Opara & Chohan, 2014), and the flavor of herbs and spices
can become muted through the cooking process. Therefore, if participants are using the
herbs or spices for their flavor or health benefits, seasoning during or after food
preparation is advantageous. Alternatively, seasoning foods high in protein before
cooking may reduce the amount of advanced glycogenic end-products produced (AGEs)
by dry-heat cooking methods (Wang, Li, Guo, Wang, & Zhang, 2016). AGEs are known
to be potent pro-oxidants that should be avoided, especially for those concerned about
cancer.
Research Objective 2: To Assess Cancer Patients’ Experiences and Perceived Benefits and Beliefs of Herb and Spice Use

Questions regarding participants’ source of herb, spice, and cancer treatment and/or prevention of cancer information, willingness to use herbs and spices as a CAM modality, interest in learning more about herbs and spices were included in the investigation through descriptive statistics, and reasons for modifying herb and spice use. These questions were used to determine participants’ experiences with, perceived benefits of, and beliefs towards herb and spice use.

Source of herb, spice, and cancer treatment and/or prevention information.

Participants were asked to select all information sources they use for herb, spice, and cancer treatment and/or prevention information (Figure 6). The most used information source was the internet (n = 61), followed by health magazines (n = 53), friends and/or family (n = 50), dietitians (n = 41), nutritionists (n = 38), physicians (n = 31), books (n = 24), other (n = 22), and the television (n = 12). Other sources of herb, spice, and cancer treatment and/or prevention information included classes, peer-reviewed literature, and professional seminars.
The sources of information about herb and spice use for cancer treatment or prevention was similar to the findings in studies about CAM use in cancer patients (Gupta et al., 2005; Wanchai et al., 2010) and in studies on herb and spice use in healthy adults (Isbill et al., 2018). The current study found that most of the participants would be more likely to use herbs and spices if they were recommended by the participant’s doctor, which aligns with the findings of previous studies that indicated patients were more likely to use CAM if it were recommended by the patient’s doctor (Mao et al., 2011).

**Interest in herbs and spices.** The participants were asked how likely they were to use herbs and spices if the herbs and spices were recommended by their doctor, how
likely they were to use herbs and spices as a form of CAM, and their interest in learning more about herbs and spices. Approximately two-thirds of the participants (n = 91) indicated they were likely to consume herbs and spices if the herbs and spices were recommended by their doctor. About 20% (n = 26) were neither likely or unlikely to consume herbs and spices recommended by their doctor, and 13% (n = 18) were unlikely to use herbs and spices recommended by their doctor. Over 70% of participants (n = 97) indicated they were likely to use herbs and spices as a complementary treatment for cancer. Approximately 15% of the participants (n = 21) were neither likely or unlikely to use herbs and spices as a complementary treatment for cancer, and about 12% of participants were unlikely to use herbs and spices as a complementary treatment for cancer.

One of the reasons participants modified their herb and spice use was because they believed herbs and spices could be a beneficial treatment for cancer and/or that herbs and spices had anticancer effects similar to conventional cancer treatment without the adverse effects of conventional treatment. Participants also indicated consuming more herbs and spices to improve general health, manage co-morbidities, boost the immune system, and mitigate the side effects of cancer treatment (Table 7).

The results agree with previous studies on interest in and reasons for CAM use. Cancer patients have previously used CAM to manage symptoms and for overall general health (Vapiwala, Mick, Hampshire, Metz, & DeNittis, 2006). In a study on herb and spice use in adults, participants were likely to use herbs and spices to manage comorbidities and were more likely to use herbs or spices encouraged by their doctor (Isbill et al., 2018). However, a higher percentage of participants (70%) were willing to
use herbs and spices as a CAM modality in the current study than in the study with healthy adults (51%) (Isbill et al., 2018). The discrepancy could be due to the higher number of cancer patients seeking CAM, or the differences in sample size between the studies.

**Research Question 1: Is There a Significant Difference in Herb and Spice Use by Cancer Characteristic?**

This research question was answered using the cancer characteristic questions including stage and years since diagnosis and the FFQ question on frequency of herb and spice use. The sums of the questions were calculated to assess statistical significance between herb and spice frequency and cancer characteristics. Standard regression was used to determine if there was a significant relationship between cancer characteristics and the sum of the frequency of herb and spice use. According to the logistic regression analysis, there were no significant relationships between the independent variables, cancer stage and years since diagnosis, and frequency of herb and spice use (p = 0.618).

The results differ from previous study results on cancer patients and CAM use (Greenlee et al., 2004; Gupta et al., 2005; Judson et al., 2017; Kristoffersen et al., 2014). The difference between the relationships could be due to the difference in samples. Some studies looked at patients with breast cancer (Wanchai et al., 2010), whereas the current study included all types of cancer. Additionally, other factors influence herb and spice consumption in cancer patients, such as taste alterations and dry mouth, that do not influence other CAM modalities.
Research Question 2: Is There a Significant Difference in Herb and Spice Use by Demographic Characteristic?

This research question was answered using the demographic characteristic questions including age, gender, education, and income level, and the FFQ question on frequency of herb and spice use. Standard regression was used to determine if there was a significant relationship between age, education, or income level and the sum of the frequency of herb or spice used. According to the standard regression, there were no significant relationships between the independent variables, age, education, or income level, and frequency of herb and spice use ($p = 0.618$). An independent samples t-test was used to determine if there was a significant difference in frequency of herb or spice use between genders. According to the t-test, there were no significant differences in frequency of herb or spice use between genders ($p = 0.864$).

The results differ from previous study results on cancer patients and CAM use or healthy adults and herb and spice use (Greenlee et al., 2004; Gupta et al., 2005; Isbill et al., 2018; Judson et al., 2017; Kristoffersen et al., 2014). The difference between the relationships could be due to the difference in samples. The study by Isbill et al. (2018) looked at adults in the Midwest, whereas the current study included adults throughout the US. Additionally, the current study looked at cancer patients, whereas the study by Isbill et al. (2018) studied healthy adults, which could have different dietary patterns or reasons for consuming herbs and spices.
Research Question 3: Is There a Relationship Between Change in Herb and Spice Use and Cancer Characteristic?

This research question was answered using the cancer characteristic questions including stage and years since diagnosis and the FFQ question on change in herb and spice use. Standard regression was used to determine if there was a significant relationship among cancer characteristics and the sum of the change in herb and spice use. According to the logistic regression analysis, there were no significant relationships between the independent variables, cancer stage and years since diagnosis, and change in herb and spice use (p = 0.618).

The results differ from other studies that determined changes in CAM use after a cancer diagnosis. Previous studies found that cancer patients increased their CAM use after they were diagnosed with cancer (Velicer & Ulrich, 2008). Nevertheless, participants indicated that they increased herb and spice use because they believed the herbs and spices could be used to treat or prevent cancer, but they also stated that they decreased herbs and spices due to adverse effects or because they were advised to by a health professional. The results were calculated by adding the responses from the Likert-scale. Therefore, if a participant increased one herb and spice while decreasing others, the participants could have scores that reflect little or no change in herb and spice consumption. Lastly, the differences in the current study could be due to the smaller sample size.
Research Question 4: Is There a Relationship Between Change in Herb and Spice Use and Demographic Characteristic?

This research question was answered using the demographic characteristic questions including age, gender, education, and income level, and the FFQ question on change in herb and spice use. Standard regression was used to determine if there was a significant relationship between age, education, or income level and the sum of the frequency of herb or spice used. According to the standard regression, there were no significant relationships between the independent variables, age, education, or income level, and change in herb and spice use ($p = 0.106$). An independent samples t-test was used to determine if there was a significant difference in frequency of herb or spice used between genders. According to the t-test, there were no significant differences in frequency of herb or spice use between genders ($p = 0.951$).

The results differ from previous studies that investigated changes in CAM use after a cancer diagnosis. One study surveyed breast cancer patients ($n = 764$) on CAM use based on whether the patient was a continuous user, starter, or quitter, and found that education and socioeconomic status were predictors of whether cancer patients would start a CAM modality after a cancer diagnosis (Link et al., 2013). Additionally, another study surveyed cancer patients ($n = 604$) who initiated CAM after their cancer diagnosis and found women ($p = 0.004$) and patients with higher education levels ($p < 0.001$) were significantly more likely to initiate CAM use (Vapiwala et al., 2006). However, like the results on changes in herb and spice use and cancer characteristics, the results between change in herb and spice use and demographic characteristics could be skewed due to the participants increasing some herbs and spices while decreasing other herbs and spices.
Research Question 5: Do Health Professionals Influence Herb and Spice Intake After a Cancer Diagnosis?

Questions regarding the likelihood of trying herbs and spices recommended by their doctor, whether the participants received diet information from a doctor or registered dietitian nutritionist, and if the participant was concerned about herbs and spices interacting with their cancer treatment were used to determine if health professions influence herb and spice use after a cancer diagnosis.

Diet information and changes. Participants were asked if they received diet information from a registered dietitian nutritionist (RDN) or a medical doctor (MD). Approximately 55% of participants (n = 75) received diet information from a RDN after their cancer diagnosis, and approximately 58% of participants received diet information from a MD after their cancer diagnosis. Approximately 54% of participants (n = 73) made a diet change after their diagnosis.

Diet information and concern for treatment interactions. Approximately 53% of participants were concerned about herbs and spices interacting with their cancer treatment, and according to the chi-square test, there was a significant association between patients who received diet information from their doctor and patients who were concerned for herb/spice-treatment interactions (p = 0.018). According to the chi-square test, there was not a significant association between receiving diet information from a registered dietitian nutritionist and concern for herb/spice-treatment interactions (p = 0.444).

There were four themes for reasons to be concerned about herbs and spices interacting with cancer treatments (Table 8). Approximately 53% of participants (n = 71)
indicated they were concerned about herbs and spices interacting with their cancer treatment. Participants stated they were concerned about herb/spice-treatment interactions because of recommendations from a health professional (n = 17), they know a specific herb or spice is known to interact with various medications, the participants know some herbs and spices are harmful in excess, and because they experienced an adverse herb/spice-treatment interaction.

<table>
<thead>
<tr>
<th>Theme</th>
<th>n</th>
<th>%</th>
<th>Sample comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation of health professional</td>
<td>17</td>
<td>23.9%</td>
<td>“Taking medicines with herbs could be harmful, so I want to consult with my dietician first.”</td>
</tr>
<tr>
<td>Known for herb-drug interaction</td>
<td>10</td>
<td>14.0%</td>
<td>“Herbal remedies can affect the way drugs act on the body.”</td>
</tr>
<tr>
<td>Harmful in excess</td>
<td>6</td>
<td>8.5%</td>
<td>“Just because they are natural, doesn’t mean they’re safe at all levels.”</td>
</tr>
<tr>
<td>Experienced adverse effects</td>
<td>3</td>
<td>4.2%</td>
<td>“I felt some bad changes in my health.”</td>
</tr>
</tbody>
</table>

Over half of the participants received dietary advice from a doctor or dietician after their cancer diagnosis, and half of the participants made changes to their diet after their cancer diagnosis. Additionally, over half of the participants were concerned about herb/spice-treatment interactions, and there was a significant association between receiving diet information from a doctor and participant concern for herb/spice-treatment interactions (p = 0.018). Lastly, the most common theme for reasons the participants were concerned for an herb or drug interaction with their cancer treatment involved a
recommendation from a health professional. These results are interesting because previous research found that doctors rarely discuss herbal use with cancer patients (Yeung, Gubili, & Mao, 2018). However, doctors are advised to consider dietary or food forms of herbs when consulting cancer patients about herb-drug interactions (Yeung et al., 2018).

Summary

Frequency and amounts of and changes in herb and spice use was quantitively and qualitatively assessed to determine herbs and spices used among cancer patients after a cancer diagnosis. Participants’ willingness to use herbs and spices as a CAM modality and interest in learning more about herbs and spices were included in the investigated to assess cancer patients’ experiences and perceived benefits and beliefs of herb and spice use. Frequency and changes in herb and spice use and cancer and demographic characteristics were analyzed to answer research questions 1, 2, 3, and 4. The final research questions was answered through analysis of the participants’ likelihood of trying herbs and spices recommended by their doctor, whether the participants received diet information from a doctor or registered dietitian nutritionist, and the participants’ concern for herbs and spices interacting with their cancer treatment. The following section will summarize the study, conclude the discussion and results, and explore future implications for research and health professionals.
Chapter V

Summary, Conclusions, and Implications

Summary

The purpose of this study was to examine cancer patients’ use of, perceived benefits, and beliefs about herbs and spices after their cancer diagnosis. Since there is little research on herbs and spices used as a CAM modality in cancer patients, the instrument was designed based on previous research on CAM use in cancer patients and herb and spice use in healthy adults. The instrument used in this study was an online questionnaire that evaluated types of herbs and spices used by cancer patients and assessed cancer patients’ experiences and perceived benefits, and beliefs of spice and herb use. The current study utilized a mixed methods design with qualitative and quantitative questions. Participants were recruited through online cancer support groups and oncology dietitians.

Analysis of the data indicated no significant relationships between cancer or demographic characteristics and frequency or change in herb and spice use. Although types of herbs and spices differed from healthy adults, the sources of herb and spice CAM information was similar to sources utilized for CAM information by cancer patients and herb and spice information by healthy adults in other studies. Participants were likely to use herbs and spices as a CAM modality and were interested in learning more information about the health benefits of herbs and spices. Only half of the participants were concerned about herb/spice-treatment interactions, but participants were significantly more likely to be concerned about herb/spice-treatment interactions if the participant received diet information from a doctor (p = 0.018).
The results of the study found that many cancer patients do not measure the volume of herbs and spices used in their food, and many increased herb and spice consumption because they believed herbs and spices were beneficial to cancer treatment. Most cancer patients get herb and spice CAM information from the internet, friends and/or family, and nutrition professional, but they were more likely to be concerned about herbs and spices interacting with their treatment if a doctor consulted them. Therefore, cancer patients may benefit if they receive education on benefits and precautions of herb and spice use upon cancer diagnosis by a doctor, or if dietitians touched on spice/herb-treatment interactions during dietary consultations after a cancer diagnosis.

Conclusions

The current study explored the use of herbs and spices, and the attitudes, beliefs, and perceived benefits of herbs and spices in cancer patients. The findings of the study can be used by future researchers as a need’s assessment for future interventions or a basis for research in herb and spice use in cancer patients.

Herb and spice use. Cancer patients consume different herbs and spices regularly than healthy adults. They may consume these herbs and spices for their anticancer properties, to manage co-morbidities, and to mitigate the side effects of cancer treatment. Cancer patients may decrease their herb and spice intake because they cannot tolerate the taste of certain herbs and spices, changed their overall diet, are unsure about the benefits and safety of herbs and spices. Cancer patients may increase or decreased their consumption of herbs and spices based on recommendations from health professionals.
There were no significant relationships between cancer or demographic characteristics and herb and spice use.

Most participants added less than one teaspoon of a given herb or spice to their food. However, there was no way to assess the total amount of combined herbs and spices in each dish, if the participants use more than one spice in a particular dish. Additionally, about 25-42% of participants do not measure their herbs and spices, so it was impossible to determine if those participants were consuming a safe volume of herbs and spices. Some herbs and spices, such as turmeric, were used in larger volumes by more participants. These herbs and spices may be increased due to their gaining popularity for their anticancer properties.

**Experiences, perceived benefits, beliefs of herb and spice use.** Most participants were interested in learning more information about herbs and spices, and most participants were likely to use herbs and spices as a complementary treatment for cancer. Participants were significantly more likely to be concerned about herb/spice-treatment interactions if they received diet information from a doctor after their cancer diagnosis. Interestingly, doctors were utilized less often for herb and spice CAM information than other sources, such as the internet, friends, family, and nutrition professionals. Meaning that doctors may be able to reach more patients if they go over herb and spice used when the patient is receiving their initial diet consultation from the doctor.

Only half of the participants indicated they were concerned about herb/spice-treatment interactions, and the main reason for increasing herb and spice use was that the participant’s believed the herbs and spices were beneficial to the treatment of cancer, and
some participants indicated that herbs and spices were a beneficial cure for cancer without the harsh side effects of conventional cancer treatment. Cancer patients may believe that herbs and spices are safe because they are considered food items and get a lot of hype from the media as superfoods.

Many of the participants were likely to use herbs and spices recommended by their doctor and were interested in learning more about herbs and spices. Similarly, a common theme in all the open-ended questions included a recommendation from the participant’s doctor. Therefore, cancer patients may value their doctors’ opinions and information on herbs and spices, and doctors may be able to give the patients information on herb and spice use during cancer treatment to improve the safety of the patients’ herb and spice use.

**Limitations related to participants.** The current study had a few limitations. Based on a power calculation of 95% confidence level and 5% margin of error, a minimum of 385 participants was needed to complete the instrument (Qualtrics, 2018). The current study included 135 participants, which was not enough to generalize the results to all U.S. cancer patients. Additionally, the participants were recruited through online cancer support groups through social media platforms, so participants may be more likely to receive their CAM information from the internet and family and/or friends. These cancer support groups also post current, trending cancer research, which may include herbs and spices as a CAM modality, making the participants more likely to think about herbs and spices as a CAM modality. Lastly, participants were recruited through registered dietitian nutritionists, which could influence the number of participants who
received dietary information from a registered dietitian nutritionist or modifies their herb and spice consumption based on health professional recommendations.

**Limitations related to instrument.** The study also utilized a FFQ-like survey, which is prone to recall bias. Additionally, the questions regarding modification of herb and spice use or reasons for not regularly consuming herbs and spices explored herbs and spices in general, where the participant could be thinking about specific herbs and spices while answering these open-ended questions. Lastly, the volume of the total herbs and spices per dish could not be estimated based on the format of the FFQ. Therefore, the possibility of the participant consuming various herbs and spices with the same class of phytochemicals is unknown.

**Implications for future research and interventions**

The current study was unable to find significant relationships among herb and spice use, beliefs, attitudes, and perceived benefits after a cancer diagnosis, and the sample size was too small to generalize results to all U.S. cancer patients. However, to the best of the researchers’ knowledge, this study is the first to identify themes in herb and spice used as a CAM modality for cancer patients. Therefore, the results of this study can benefit future researchers by serving as the initial needs assessment for future studies and interventions.

The current study represented more minority groups than Caucasian participants, and while this sample does not represent the U.S. population, the results can be beneficial for addressing use and beliefs of herbs and spices in groups that are often underrepresented in other studies. The current study did not find a significant relationship between herbs and spice use and ethnicity, but the sample size was small. Other studies
have found significant differences in CAM use or herb and spice consumption among various ethnic groups. Therefore, future research should include minority groups and a larger sample size.

The current survey instrument was unable to assess the perceived benefits of specific herbs and spices or the total volume of herbs and spices utilized per dish. Future researchers may structure questions to evaluate the perceived benefits of various herbs and spices. For example, if a participant indicates they increased an herb or spice, the researcher can ask the participant why they increased those herbs and spices. Additionally, the researcher may ask the participant which herbs or spices they consume together and the total combined volume of herbs and spices per dish to better assess if the participant is consuming an unsafe level of certain phytochemicals.

Many of the participants were likely to use herbs and spices recommended by their doctor and were interested in learning more about herbs and spices. Therefore, future researchers may want to investigate the influence of education provided by health professionals and attitudes towards herb and spice use after a cancer diagnosis. Registered dietitian nutritionists were another valued source of herb and spice CAM information but were not significantly associated with concern for herb/spice-treatment interactions. Future interventions may include herb and spice interactions as a part of diet information provided by dietitian consultations after a cancer diagnosis.

Lastly, researchers may also want to investigate the efficiency of online education tools and attitudes towards herb and spice use since the internet was a primary source for herb and spice CAM information. Similarly, the second most common herb and spice CAM information source were health magazines. Patients may be afraid to ask their
doctors about herbs and spices as a CAM modality, which is common in other modalities (Saxe et al., 2008). Future interventions may want to include herb and spice information given in the format of an internet blog, magazine articles, or health newsletters.
Spice and Herb Use Among Cancer Patients

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Appendix

Appendix A: Informed Consent Form

As patients with cancer, you are invited to participate in an educational research study. Current research suggests that cancer patients use complementary and alternative medicine to manage side effects associated with their condition and treatment. US adults also use spices and herbs for its potential health benefits. You are being asked to share your thoughts towards spice and herb use after a cancer diagnosis. The information you share with us will be anonymous and presented in a poster session at a conference and written for a peer-reviewed journal.

Your participation in this study is entirely voluntary.

Purpose of the Study
The purpose of this study is to examine cancer patients’ use of, perceived benefits, and beliefs about spices and herbs.

Procedures
Activities. First, this study will use a virtual data collecting platforms (i.e. online questionnaires through Qualtrics). After agreeing to participate in this study, your results from the surveys will be included in the research study. If you volunteer to participate in this study, you will be asked to complete a 28-question survey. This survey will take about 15-20 minutes to complete.

Spice and Herb Use Questionnaire. The spice and herb questionnaire consists of 16 questions regarding spice and herbs use and attitudes towards spices and herbs, the following 5 questions will ask you about your cancer diagnosis (e.g., type, stage, time since diagnosis, cancer treatment, and current condition) and the survey will end with 7 demographic questions (e.g., age, gender, ethnicity, employment, and education).

Potential Risks and Discomforts
The risks of the study are minimal. The questionnaire probes into one’s attitudes towards spices and herbs and cancer characteristics. All survey responses will be anonymous and personal information will not be tied to survey results. However, if there is a breach in the system, you may potentially be identified.

Potential Benefits to Subjects and/or Society
The results from this study will help us to better understand cancer patients’ use and attitudes towards spices and herbs, which can help medical professionals provide better care to future cancer patients.

Confidentiality
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law.

All documentation of the questionnaires will be administered online via web links. Your responses will be coded and will not be associated with your name as there will be no means to identify your name on the web survey. Any publications or presentations of the results of this research will include information on group performances (e.g. means and standard deviations) and will not identify participants. The data collected through Qualtrics will remain on my computer and no one but myself will have access to the evaluation results.

**Participation and Withdrawal**

Participation in this research study is voluntary and not a requirement or a condition for being the recipient of benefits or services from Eastern Illinois University or any other organization sponsoring the research project. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind or loss of benefits or services to which you are otherwise entitled.

There is no penalty if you withdraw from the study and you will not lose any benefits to which you are otherwise entitled.

**Identification of Investigators**

If you have any questions or concerns about this research, please contact:

Dr. Jeanette Andrade by phone [redacted] or email [redacted].

If you have any questions or concerns about the treatment of human participants in this study, you may call or write:

Institutional Review Board
Eastern Illinois University600 Lincoln Ave.
Charleston, IL 61920
Telephone: (217) 581-8576
E-mail: eiuirb@www.eiu.edu

You will be given the opportunity to discuss any questions about your rights as a research subject with a member of the IRB. The IRB is an independent committee composed of members of the University community, as well as lay members of the community not connected with EIU. The IRB has reviewed and approved this study.

I have read the consent form and wish to participate in the study. By selecting this box, you confirm that you have read the consent form, understand that participation is voluntary, and are over the age of 18 years old.

I have read the consent form and DO NOT wish to participate in the study.
Appendix B: Online Spice and Herb Survey

Over the past month, how often have you prepared food (e.g., meals and snacks) for yourself?

- Less than once per week
- 1-3 times per week
- 4-6 times per week
- More than or equal to 7 times per week

Over the past month, how often did you eat a meal outside of the home (i.e., restaurant, friend or family’s house, hospital)?

- Less than once per week
- 1-3 times per week
- 4-6 times per week
- More than or equal to 7 times per week

Please indicate how often you use the following spices when preparing food at home.
<table>
<thead>
<tr>
<th>Spice/Herb</th>
<th>Never</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Yearly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adobo seasoning</td>
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<tr>
<td>Black Pepper</td>
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<tr>
<td>Chili Pepper</td>
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</tr>
<tr>
<td>Cinnamon</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Cloves</td>
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<tr>
<td>Coriander</td>
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<tr>
<td>Cumin</td>
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<tr>
<td>Curry seasoning</td>
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<tr>
<td>Fennel</td>
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<td>Garlic</td>
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<td>Ginger</td>
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<td>Greek seasoning</td>
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<td>Paprika</td>
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<td>Turmeric</td>
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<tr>
<td>Other (please specify)</td>
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</tbody>
</table>

Please indicate how often you use the following herbs when preparing food at home.
## Spice and Herb Use Among Cancer Patients

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Yearly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basil</td>
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<td>Cilantro</td>
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<td>Curry Leaf</td>
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<td>Italian seasoning</td>
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<td>Mint</td>
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<td>Oregano</td>
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<td>Parsley</td>
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<td>Rosemary</td>
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<td>Sage</td>
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<td>Thyme</td>
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<td>Other (please specify)</td>
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</table>

Over the past month, indicate how much of the following spices you used when preparing food at home. Please indicate the average volume per dish.
<table>
<thead>
<tr>
<th>Spice/Herb</th>
<th>Never</th>
<th>Do not measure</th>
<th>Less than 1 teaspoon</th>
<th>1 teaspoon</th>
<th>More than 1 teaspoon</th>
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<tbody>
<tr>
<td>Adobo seasoning</td>
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</table>
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<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Do not measure</th>
<th>Less than 1 teaspoon</th>
<th>1 teaspoon</th>
<th>More than 1 teaspoon</th>
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<td>Basil</td>
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Since your cancer diagnosis, has the consumption of the following spices decreased, increased, or remained the same?
Spice and Herb Use Among Cancer Patients

<table>
<thead>
<tr>
<th>Spice/Herb</th>
<th>Significantly decreased</th>
<th>Decreased</th>
<th>Remained the same</th>
<th>Increased</th>
<th>Significantly increased</th>
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<tbody>
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<td>Adobo seasoning</td>
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<tr>
<td>Cumin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curry seasoning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fennel</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Garlic</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ginger</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greek seasoning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paprika</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turmeric</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Since your cancer diagnosis, has the consumption of the following herbs decreased, increased, or remained the same?

<table>
<thead>
<tr>
<th>Herb</th>
<th>Significantly decreased</th>
<th>Decreased</th>
<th>Remained the same</th>
<th>Increased</th>
<th>Significantly increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cilantro</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curry Leaf</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italian seasoning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mint</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oregano</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parsley</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosemary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyme</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Do you season your food before, during, or after food preparation?

- Before
- During
- After
Spice and Herb Use Among Cancer Patients

Please briefly state some reasons you modified your consumption of certain herbs/spices?

________________________________________________________________________

Please briefly state some reasons you do not consume spices or herbs on at least a weekly basis?

________________________________________________________________________

Where do you get information regarding spice, herb, and cancer treatment/prevention? (Select all that apply)

☐ Books
☐ Dietitian
☐ Friends and/or family
☐ Health magazines
☐ Internet
☐ Nutritionist
☐ Physician
☐ Television
☐ Other _____________________________________________________________

Would you be more likely to try a spice or herb if it was recommended by your doctor?

☐ Likely
☐ Neither likely or unlikely
☐ Not likely
Spice and Herb Use Among Cancer Patients

How interested are you in learning more about the health benefits of spices and herbs?
- Interested
- Neither interested nor not interested
- Not interested

How likely would you be to consume spices and herbs as a complementary treatment to cancer?
- Likely
- Neither likely or unlikely
- Not likely

Did you change your diet after your cancer diagnosis?
- Yes
- No
- Not sure

Please briefly describe the changes you made to your diet.

___________________________________________________________________________________________

Since your diagnosis, have you received any nutrition education or diet information from a Registered Dietitian Nutritionist (RDN)?
- Yes
- No
- Not sure

Since your diagnosis, have you received any nutrition education or diet information from a Medical Doctor (MD)?
- Yes
- No
- Not sure
Are you concerned about spices or herbs interacting with your medications or cancer treatment?

○ Yes
○ No

Why are you concerned about spices or herbs interacting with your medication or cancer treatment?

Which type of cancer were you diagnosed with?

○ Breast
○ Colon
○ Esophagus
○ Liver
○ Lung
○ Myeloma
○ Prostate
○ Rectal
○ Skin
○ Stomach
○ Uterine
○ Other

How many years have passed since your diagnosis?

○ Less than 1
○ 1-2
○ 3-4
○ > 5
○ Not sure
Spice and Herb Use Among Cancer Patients

At what stage were you diagnosed?

- [ ] Stage I
- [ ] Stage II
- [ ] Stage III
- [ ] Stage IV
- [ ] Not sure

Which of the following best describes your current condition?

- [ ] Stage has remained the same
- [ ] Stage has increased
- [ ] In remission
- [ ] Cancer free
- [ ] Not sure
Spice and Herb Use Among Cancer Patients

What type of cancer treatment did you receive? (Select all that apply)

☐ Chemotherapy
☐ Hormonal Therapy
☐ Radiation Therapy
☐ Surgery to remove the tumor or any part of an organ
☐ Targeted drug therapy
☐ I have not undergone any cancer treatments
☐ Not sure

How old are you?

☐ 18-29 years old
☐ 30-39 years old
☐ 40-49 years old
☐ 50-59 years old
☐ 60-69 years old
☐ 70 years old or older
☐ Prefer not to answer

Which gender do you most identify with?

☐ Male
☐ Female
☐ Other
☐ Prefer not to answer

Please indicate where you live.

☐ New England (Connecticut, Maine, Massachusetts, Rhode Island, Vermont)
Spice and Herb Use Among Cancer Patients

- Mid-Atlantic (New Jersey, New York, Pennsylvania)
- East North Central (Illinois, Indiana, Michigan, Ohio, Wisconsin)
- West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota)
- South Atlantic (Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, Washington DC, West Virginia)
- East South Central (Alabama, Kentucky, Mississippi, Tennessee)
- West South Central (Arkansas, Louisiana, Texas)
- Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming)
- Pacific (Alaska, California, Hawaii, Oregon, Washington)

Please indicate your ethnicity.
- Caucasian
- African American
- Hispanic/Latino
- Native American
- Asian
- Other ________________________________
- Prefer not to answer

Please indicate your highest level of education.
- Less than a high school diploma
- Some high school
- High school degree or equivalent (e.g., GED)
- Some college, no degree
- Associate's degree (e.g., AA, AS)
- Bachelor's degree (e.g., BA, BS)
- Master's degree (e.g., MA, MS, MEd)
Spice and Herb Use Among Cancer Patients

- Professional degree (e.g., MD, DDS, DVM)
- Doctorate (e.g., PhD, EdD)
- Prefer not to answer

Please indicate your yearly household income.

- <$19,999
- $20,000-34,999
- $35,000-49,999
- $50,000-74,999
- $75,000-99,999
- > $100,000
- Prefer not to answer

What is your current employment status (check all that apply)?

- Employed full-time
- Employed part-time
- Unemployed for less than 6 months
- Unemployed for more than 6 months
- Full-time student
- Part-time student
- Disabled
- Prefer not to answer

Adapted from a research study entitled “Use of ethnic spices by adults in the United States: An exploratory study” by Jonathan Isbill, Jayanthi Kandiah, and Jagdish Khubchandani.
## Appendix C: Coding Schemes for Open-Ended Questions

### Table 9
*Coding Schemes for Open-Ended Questions*

**Question 1:** Please briefly state some reasons you modified your consumption of certain herbs/spices?

<table>
<thead>
<tr>
<th>Code label</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAM Cancer Treatment</td>
<td>Mentioned improving cancer treatment or safer alternative</td>
</tr>
<tr>
<td>Improve general health</td>
<td>Mentioned herbs/spices good for health</td>
</tr>
<tr>
<td>Manage co-morbidities</td>
<td>Mentioned improvement of condition other than cancer (i.e., diabetes, heart disease, IBS)</td>
</tr>
<tr>
<td>Boost immune system</td>
<td>Mentioned improving immune system, immunity, or decreasing illness</td>
</tr>
<tr>
<td>Traditional medicine</td>
<td>Mentioned traditional or Chinese medicine</td>
</tr>
<tr>
<td>Helps with side effects</td>
<td>Mentioned decreasing side effects associated with cancer treatment (i.e., fatigue, nausea, decreased memory or focus)</td>
</tr>
<tr>
<td>Reduced due to adverse effects</td>
<td>Mentioned harmful effects of herbs/spices or herb-drug interaction</td>
</tr>
<tr>
<td>Recommendation of health professional</td>
<td>Mentioned recommendation of MD or RDN</td>
</tr>
<tr>
<td>Improve flavor</td>
<td>Mentioned adding flavor to food or improving flavor after taste alterations due to cancer treatment</td>
</tr>
<tr>
<td>Diet modifications</td>
<td>Mentioned diet modifications that included reducing foods that needed seasoning or salt restriction</td>
</tr>
</tbody>
</table>

**Question 2:** Please briefly state some reasons you do not consume spices or herbs on at least a weekly basis?

<table>
<thead>
<tr>
<th>Code label</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmful in excess</td>
<td>Mentioned adverse effects of large amounts of herbs/spices</td>
</tr>
<tr>
<td>Recommendation of health professional</td>
<td>Mentioned avoiding herbs/spices per MD or RDN recommendation or only consuming herbs/spices if recommended by MD or RDN</td>
</tr>
<tr>
<td>Unsure about effects</td>
<td>Mentioned not knowing enough about the benefits and/or effects of herbs/spices</td>
</tr>
<tr>
<td>Cannot tolerate taste</td>
<td>Mentioned not liking the taste or experiencing taste alterations</td>
</tr>
</tbody>
</table>
Spice and Herb Use Among Cancer Patients

<table>
<thead>
<tr>
<th>Health effects</th>
<th>Mentioned having to avoid due to diet restrictions associated with health condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Mentioned lack of availability or inability to find herbs/spices</td>
</tr>
<tr>
<td>Family’s preferences</td>
<td>Mentioned family or significant other does not like herbs/spices</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Mentioned not having enough energy to cook elaborate meals</td>
</tr>
</tbody>
</table>

**Question 3: Why are you concerned about spices or herbs interacting with your medication or cancer treatment?**

<table>
<thead>
<tr>
<th>Code label</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation of health professional</td>
<td>Mentioned MD or RDN advised not to consume herb/spice with medication or treatment</td>
</tr>
<tr>
<td>Known for herb-drug interaction</td>
<td>Mentioned the herb or spice is known for interaction with multiple medications</td>
</tr>
<tr>
<td>Harmful in excess</td>
<td>Mentioned they know or heard herbs and spices can be harmful in large amounts</td>
</tr>
<tr>
<td>Experienced adverse effects</td>
<td>Mentioned personally experienced adverse effects when consuming herbs/spices with cancer drugs or treatment</td>
</tr>
</tbody>
</table>