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# A Systematic Review: Examining the Relationship Between Coffee Consumption and Breast Cancer

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# A Systematic Review: Examining the Relationship Between Coffee Consumption and Breast Cancer

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APPROVAL PAGE

A Systematic Review: Examining the Relationship Between Coffee Consumption and Breast Cancer

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## ABSTRACT

**BACKGROUND:** Breast cancer is the most common type of on cancer in women in both developed and developing countries. Breast cancer is the number one cause of death in women globally. Coffee is the world's leading consumed beverage after water. As the world's most widely consumed beverages, the association between coffee, its health benefits and risks are unclear. Hundreds of papers relating to the consumption of coffee and cancers have been published to this date. However, there is no up-to-date systematic review on the consumption of coffee and breast cancer. To address this gap in the literature, this review summarized the findings of papers on the relationship between consumption of coffee and the risk of breast cancer.

**OBJECTIVES:** This review examines all the literature on the consumption of coffee and the relationship with breast cancer and provides an up to date review on all published material in scientific journals.

**METHODS:** A literature search was conducted using PUBMED, EBSCO and MEDLINE databases using key word searches breast cancer, neoplasm and coffee. No restrictions were placed on study date and design of publication. The abstracts were examined, and any abstract that had male participants, alcohol, other countries and seven day adventist lifestyles were excluded from the review. Full text of articles for all remaining articles were retrieved. Six articles were retrieved in full text and all relevant information was placed in a standard data extraction form.

**MAIN RESULTS:** Six articles met all the criteria and were in included in the review. All except one study found no association between coffee consumption and breast cancer; however, the one study found no relationship between coffee consumption and breast cancer in postmenopausal women and a protective effect on premenopausal women.

**CONCLUSIONS:** This systematic review showed that there is no relationship between coffee consumption and breast cancer in Women in the United States.

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# Chapter I
# INTRODUCTION

## 1.1 Background

While breast cancer incidence rates in some developed and developing countries are on the rise breast cancer mortality rates in the United States are declining (Mettlin, 1999). "The estimated mortality for breast cancer rates in the world ranges from 6 to 29 per 100,000, resulting that breast cancer ranks as the fifth cause of death from cancer overall (458,000 deaths), but in spite of that, it is the most frequent cause of cancer death in women in both developing and developed countries." (Curado, 2011, P378). Some of the factors that influence the risks of breast cancer are genetics, BMI, reproductive factors, alcohol, physical activity, hormonal use and diet (Parkin, 2006). The consumption coffee as part of women's diet has been examined to determine the association between coffee and breast cancer. Evidence shows that coffee is consumed worldwide and is a large part of millions of peoples diet.

Coffee drinking is popular around the world because of its aromatic flavors and delightful taste (Dorea, 2004). Coffee is the second highest consumed beverage in the world, only second to water, and coffee has been consumed by millions of people across the globe for centuries (Butt, 2011). Coffee contains many chemical components such as caffeine and chlorogenic acids that have been suggested to have benefits including improving concentration, alertness and enhancing physical and mental performance (George, 2008). Over the years the most popular component of coffee, caffeine, received most of the credit for the effects coffee has on the human body. Studies of The health

benefits of coffee have been inconsistent. Recently, coffee consumption is associated with reducing Parkinson disease, type 2 diabetes, colorectal cancer and Alzheimer's (Yu, 2011, George 2008, Arab 2009, Butt, 2011) and raising serum cholesterol, affecting coronary health, insomnia, heart and problems (Butt, 2011). Clearly, a discrepancy in the health effects of coffee need to be investigated further.

Studies of the effect of consumption of coffee particularly on the risk of breast cancer has produced inconsistent results. The inconsistency in the scientific evidence may be attributed to a myriad of factors such as, limited number of studies and participants, and inadequate control of potential confounders such as the menopausal status of women.For example, Baker et al. found that coffee consumption has a positive effect on premenopausal women; however, the same study found that coffee consumption has no effect on the risk in post menopausal women.

Many studies have been conducted on the relationship between coffee consumption and cancer, with inconsistent results. Some studies show that there are health benefits associated with the consumption of coffee while others state that coffee has no effect on health and others say that coffee has detrimental health effects. Studies further show that coffee has different effects on different parts of the body, beneficial to certain organs and systems while harmful to others. This updated systematic review provides updated results on this topic, identifies gaps in the literature and demonstrates the need and areas for future research.

The purpose of this study is to gather all the literature pertaining to the relationship of coffee consumption and the risk of breast cancer in females in the United

States, examine and analyze the data and present it in a systematic review. Breast cancer is a global epidemic. According to the World Health Organizaion (WHO) and the International Agency for Research on Cancer (IARC), the overall incidence of breast cancer in women in 2008 and 2010 was 1.38 and 1.64 million respectively (Forouzanfar, 2012, Curado, 2011). These statistics describes the seriousness of the illness.

# Chapter II

# REVIEW OF THE LITERATURE

## 2.1 History

### Breast Cancer

Breast cancer is a global public health problem, and varies in different regions of the world. More than one million women, worldwide, are diagnosed with cancer each year, and over 410,000 will end up dying from the disease (Coughlin, 2009). Breast cancer is the most common and frequent type of cancer among women globally, both in developed and developing countries (Curado, 2011). In 2002 and 2008 respectively, it was estimated that an additional 1.15 million and 1.38 million new cases of breast cancer was diagnosed (Parkin, 2006 and Curado, 2011). This accounts for a astounding 23% of all cancers. The incidence rates of breast cancer vary from country to country, from 193 per 100,000 women in East Africa to 89.9 per 100,000 in western Europe, and 80 per 100,000 in developed countries and less than 40 per 100,000 in most of the developing countries. The incidence rates are higher in developing countries, particularly in Europe and are rising in the Latin America and Asian countries. The rise in Asian and Latin American countries are due to the increase in aging population and screening practices (Curado, 2011). The increase in incidence in developed countries may be due to the aggressive screening programs, which detect cancers which may not be detected in other countries that lack screening programs (Parkin, 2002). In developing countries the resources are not readily available and medical infrastructure is ill-equipped to provide

adequate care and treatment (Coughlin, 2009). For this reason, approximately 75 percent of the breast cancer cases are diagnosed during the later stages, usually clinical stage III and IV. In contrast, in developed countries like the US, approximately 70% of the breast cancer cases are diagnosed during stage 0 and 1. Consequently, the mortality rates are higher in developing countries compared to developed countries. In 2007, the incidence rates for breast cancer for all races within the US was 122 per 100,000, with white women in the lead with 22% of the cases between ages 45 and 54 years old, and 24% women were between the ages of 54 and 64 years of age. Black females have the second highest incidence of breast cancer in the US. In 1999, the incidence rates decreased in several countries including, Canada, Germany, Australia and the UK due to one or more of the following factors, screening, early detection and appropriate therapies (Curado, 2011). The incidence rates of breast cancer in the US decreased significantly between 2002 through 2007. Reduction in hormonal therapy use is another factor that is contributing to lower incidence rates (Curado, 2011).

The World Health Organization (WHO) estimated that in 2005 7.6 million people throughout the world died from cancer. Unless, cancer is addressed more than 80 million deaths from cancer will occur with the next 10 years (Coughlin, 2009). Several global health Initiatives by organizations such as Susan G Komen for the cure, US Centers for Disease Control and Prevention (CDC), the National Cancer Institute (NCI), and the American Cancer Society are addressing breast cancer globally (Coughlin, 2009). “The estimated mortality for breast cancer rates in the world ranges from 6 to 29 per 100,000, resulting that breast cancer ranks as the fifth cause of death from cancer overall (458,000

deaths), but in spite of that, it is the most frequent cause of cancer death in women in both developing and developed countries." (Curado, 2011, P378). From 1972 to 2007 in the US, breast cancer mortality decreased among all races from 31-23 per 100,000 deaths. In 2002, the mortality rates were higher for black women, 34 per 100,000 and lower for white women 25 per 100,000.

The survival rates vary in different parts of the world, with higher survival rates (73%) in developed countries and lower rates (57%) in developing countries (Parkin, 2002). Approximately 1.5 million women survived breast cancer in the US. Although breast cancer rates are decreasing in the US, it remains a public health issue in many countries around the world.

Some of the factors that influence the risk of breast cancer in women are reproductive factors, overweight/obesity, consumption of alcohol, physical activity, hormones and diet (Parkins, 2002). Cultural factors are considered to play a role in the risk of breast cancer (Coughlin, 2009). Other important risk factors for breast cancer include age, personal health history, family history of cancer, reproductive and menstrual history, race/ethnicity and lifestyle factors (Ruxton, 2009). The older a woman is the higher her risk is for breast cancer. A woman who has breast cancer in one breast has a greater chance of having cancer in the other breast and on any other part of her body. Breast cancer is genetic, especially if family members have been diagnosed prior to the age of 50. A woman's risk for breast cancer increases if she has her first child later in life, if she does not breastfeed and if she takes hormone therapy after menopause. Breast cancer , in the US is more common among white females compared to any other race.

Obesity particularly after menopause, inactivity and alcohol consumption increases the risk of breast cancer (Ruxton, 2009). The data collected demonstrates the severity of cancer for women in the world. Screening programs identify the public health issue sooner but does not disguise the enormity of the problem. Winning the war on breast cancer is a difficult task, which requires primary interventions such as modification of women's lifestyle. Women are not so willing to modify their lifestyles (Parkin, 2006). Many countries that have high breast cancer rates are experiencing better survival and lower mortality rates. This positive advancement is due to early diagnosis and screening efforts.

### 2.2 History of Coffee

Coffee is the second highest consumed beverage, after water, and approximately 500 billion cups of coffee are consumed throughout the world annually (Butt, 2011). Coffee has been around for many centuries, but became an economic crop in the 15th century. Currently, coffee is the second largest traded commodity in the global market, only second to oil, accounting for $10 billion per annum. More than 70 countries on different continents grow and cultivate coffee, with Brazil, Columbia, Ethiopia and India as the highest producers, and making up 39% of the world share (Butt, 2011).

Coffee drinking is not commonly considered a habit associated with a healthy lifestyle because caffeine is a stimulant. One of the key reasons many people around the world consume coffee is because of the stimulatory effect that coffee has on the body. The stimulatory effect is due to the phytochemicals found in the caffeine. (Freedman,

2012). Roasted coffee consists of more than a thousand chemicals. Components of coffee can potentially alter the risks associated with cancer (Yu, 2011). A regular cup of coffee (240ml) contains 100mg of caffeine (Belay, 2008). Caffeine, a white crystalline powder, was isolated for the first time in 1820, and naturally has a bitter taste (Butt, 2011). Caffeine is considered a major and active ingredient of coffee, but is not the only component of coffee that has played an impressive role in health care. Caffeine is known for improving alertness, enhancing sensation, stimulate and reduce tumors (Yu, 2011). Other components, such as chlorogenic acid, caffeic acid and hydroxyhydroquinone are well known antioxidants with several health benefits (Butt, 2011). The health benefits associated with decaffeinated coffee are credited to chlorogenic acid (Butt, 2011).

**Coffee Plant:**

The coffee plant is a member of the family Rubiaceae and genera Coffee. It is a perennial tree which grows in areas of higher altitudes. There are 70 different species of coffee, of which, Arabica is the most favored and popular coffee consumed. The processing of coffee entails, picking of the bean, followed by drying, roasting, grinding, and finally the brewing stage before the final product is produced. During the process the coffee beans go through physical and chemical changes that alter the flavor and antioxidant properties of the coffee (Butt, 2011).

Over the years the health benefits and risks associated with coffee and caffeine have been a concern. Previously there was a tendency to view coffee and caffeine as unhealthy and practitioners advised patients to avoid the consumption of coffee and other

products that contained caffeine. More recently, research shows that caffeinated beverages such as coffee is beneficial to health because of the polyphenol compounds, which contain naturally occurring plant antioxidants that exhibit anti-inflammatory properties and anti-carcinogenic effects (Ruxton, 2009). Recently coffee consumption has been considered as reducing the risk of several chronic disease including type 2 diabetes mellitus, Parkinson's disease and hepatocellular disease (Yu, 2011). Therefore, coffee consumption and cancer risks are drawing more attention. The complex nature of coffee, its multiple chemical components makes the association between coffee and breast cancer credible (Li, 2013) .

**Association of Coffee Consumption and Breast Cancer**

The results from the epidemiological studies over the past 3 decades have shown inconsistent results. According to the meta analysis conducted on the effects of coffee on various parts of the body, there is an apparent positive effect of coffee for colorectal cancer and no association with pancreatic, gastric, ovarian, prostate, kidney and breast cancer and an increased risk of bladder cancer for high consumers of coffee (Arab, 2009). A meta analysis including 40 prospective cohort studies found that coffee consumption does not have any harmful effect on the body and may reduce the risk of breast, bladder , colorectal, pancreatic, endometrial, heptocellular, leukemic and prostate cancers (Yu, 2011). Another meta analysis conducted specifically on the association of coffee and breast cancer including several cohort and case control studies showed that 7 studies conducted in the US revealed no association between coffee and breast cancer (Tang,

2009). In the most recent meta analysis the findings show that there is no significant association between risk of breast cancer and coffee consumption (Li, 2013).

A large, long term, prospective cohort study with 85,987 participants in the Nurses Health Study was conducted with a 22-year follow-up. The results of this study showed that overall there was no association between coffee and tea and breast cancer; however, there was a weak inverse association between caffeinated products and postmenopausal breast cancer (Ganmaa, 2008).

A prospective cohort study with 27,323 participants conducted in Netherlands initially showed that coffee intake increased the risk of breast cancer, after the results were adjusted using lifestyle and breast cancer risk factors the results depicted no relationship between coffee consumption and breast cancer ( Bhoo Pathy, 2009). Other studies showed no association between coffee consumption and breast cancer (Fagherazzi, 2011, Larrson 2009, Ishitani, 2008). Pozniak reviewed 18 years of literature on the carcinogenicity of caffeine and coffee and concluded that there was no scientific evidence showing the association of caffeine and coffee consumption with cystic fibrosis breast disease. The La Vecchia study showed no association between coffee consumption and breast cancer; however, there was a slight increase in the risk of breast cancer in women who drank coffee compared to those who never consumed any coffee (La Vecchia 1986).

The following are studies from 4 meta analysis conducted showing the relationship between the consumption and coffee and risk of breast cancer.

According to the meta analysis conducted on the effects of coffee on various parts of the body, there is an apparent positive effect of coffee for colorectal cancer and no association with pancreatic, gastric, ovarian, prostate, kidney and breast cancer and an increased risk of bladder cancer for high consumers of coffee (Arab, 2009).

**Limitations to this study**

- majority of the studies have recruited mainly post menopausal women; results may not be extrapolated for premenopausal women.
- the paper demonstrates disorganized mixture of study design and gender.

**Strength of this study**

- the study consisted of over 500 papers across Europe, Asia and North America.
- the large number of articles stretching over a few continents adds diversity to the study.

A meta analysis including 40 prospective cohort studies found that coffee consumption does not have any harmful effect on the body and may reduce the risk of breast, bladder , colorectal, pancreatic, endometrial, heptocellular, leukemic and prostate cancers (Yu, 2011).

**Limitations to this study**

- observational diet-disease study; therefore, diet and confounders can not be totally eliminated

- misclassification of coffee consumption, coffee type, cup size and brewing method may be inconsistent.
- only published articles were included; therefore, the possibility of publication bias is increased.

**Strength of this study**

- 59 studies including 40 prospective cohorts were included in the study with several thousand participants.

Another meta analysis conducted specifically on the association of coffee and breast cancer including several cohort and case control studies showed that 18 (9 cohort and 9 cases control) studies conducted in Europe and the US revealed a slight association between a high consumption of coffee and the risk of breast cancer (Tang, 2009).

**Limitations to this study**

- similar to all observational diet-disease studies where bias and confounders cannot be excluded totally.
- only published journal articles were researched
- misclassification of coffee consumption, varying interpretation of a cup of coffee
- small sample size
- study conducted in 4 countries, therefore generalizability is limited

**Strength of this study**

- this article showed that women who have the BRAC1 and BRAC2 breast cancer susceptibility gene and who consumed coffee have a lower risk of breast cancer. This

study shows that there is a need for more research in this area since there are limited articles addressing this specific topic.

In the most recent meta analysis the findings show that there is no significant association between risk of breast cancer and coffee consumption (Li, 2013).

**Limitations to this study**

- misclassification of coffee consumption due to self reported dietary intake
- confounding factors within the studies cannot be adjusted
- not generalizable due to limited locations that were covered in the studies

**Strength of this study**

consisted of 26 studies (16 cohort and 10 case control) with a large number of participants.

Studies have shown that women with a mutation in BRAC1 or BRAC2 are at a heightened risk of developing breast cancer. BRAC1 and BRAC2 are the 2 breast cancer susceptibility genes. Nkondjock et. al, studied the relationship between coffee consumption and breast cancer among women with BRAC1 and BRAC2 mutations. The findings from this study showed that women who consumed 6 of more cups of coffee per day and had the genetic mutation had a lower risk of breast cancer (Nkondjock, 2006). Jernstrom et al agreed with Nondjock's study and found that BRAC1 carriers with the CYPIA2*1F C-allelle who consumed coffee are at a reduced risk for breast cancer (Jernstrom, 2008). Kotsopoulos, 2007 study is in agreement, illustrating that women with the BRAC1 mutation who ever drank coffee before the age of 35 are at reduced risk of

breast cancer (Kotsopoulos, 2007). These 3 studies raise a significant and important factor for future studies. It is importance for future studies to consider genetic variability when studying diet and disease relationships. The 3 independent findings have shown a positive relationship between coffee and women with breast cancer with the BRAC1 genetic mutation; therefore, more research should be conducted in this arena. A case control study of postmenopausal Swedish women showed no association between coffee consumption and breast cancer; however, a positive association between high consumption of coffee among women with Estrogen-Receptor negative breast cancer (Li 2011). This studies demonstrates a need for future research in coffee consumption among different subtypes of breast cancer.

# Chapter III
# METHODS AND PROCEDURES

## 3.1 CRITERIA FOR CONSIDERING STUDIES FOR THE REVIEW

### Literature Search and Search Strategy

A literature search was conducted using PUBMED, EMBASE database searches using key word searches breast cancer, neoplasm and coffee. No restrictions were placed on study date and design of publication. Restrictions were placed on location; only studies conducted in the United States were included in the review. Publications in english only were included in the review. Other searches were conducted in EBSCO and MEDLINE and one other paper relating to the review was retrieved. The flowcharts below illustrated the search, key word search and the results retrieved for each search.

### Primary Outcome Measures

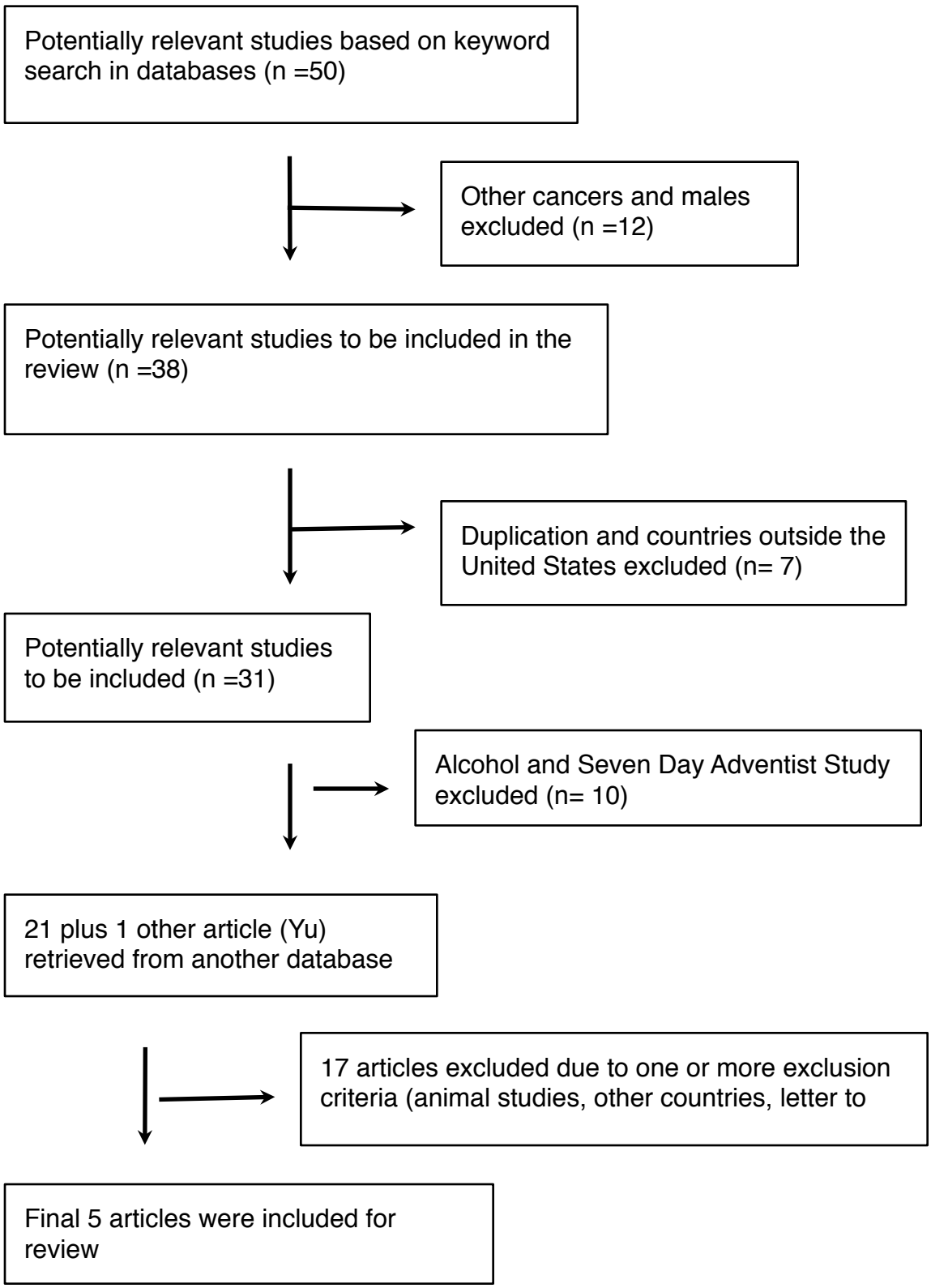
The primary outcome measure for this systematic review is the relationship of the consumption of coffee and risk of breast cancer.

### Inclusion Criteria

Eligibility criteria included peer-reviewed articles evaluating the relationship of coffee and breast cancer. All articles included in the study focused on breast cancer as the primary outcome.

**Exclusion Criteria**

participants with any type of cancer other than breast cancer were excluded from the review. Other excluded articles were those that focused on male participants, studies which included the impacts of alcohol on breast cancer, a study that focused on Seven Day Adventist population and studies outside the US. Male studies were excluded due to difference in the physiology of the body and hormonal effects of females. Alcohol studies were excluded because of the recall bias of alcohol consumers and individuals who consume alcohol may be at higher risk of breast cancer because of biological mechanisms associated with alcohol (Bissonauth, 2009). The Seven Day Adventist article was excluded because of their unusual and complex lifestyle including vegetarian diet;therefore, distinguishing a particular relationship between coffee and breast cancer was not evidence based.  Studies outside the US were excluded to limit the environmental exposures that may influence and impact the study.




**Flowchart of Progress through Review**

## Quality Assessment

It is essential to establish a a study design in order to provide quality evidence. Table 4.3 was used to determine the quality of the studies.

## Data Collection

Specific data within the studies and articles retrieved were used to determine the relationship of coffee on breast cancer. The data analysis was conducted by reading the abstracts of all the articles retrieved during the initial search, then narrowed using previously mentioned keywords. Once focus was narrowed, relevant information were retrieved from the full texts and synthesized to summarize the relationship between coffee and breast cancer.

# CHAPTER IV
# RESULTS

## 4.1 Results of Search

The systematic review initial electronic search conducted on 28 January 2013 yielded 50 abstracts, of which 21 were identified for further evaluation, and full text articles were collected (see Figure 1). Using another database on 30 January 2012, yielded 8 more articles, of which 7 were irrelevant due to duplication and studies outside the US. Therefore, 22 articles were included for analysis.

The 22 articles were retrieved in full text and read completely; thereafter, an additional 17 were excluded from the review because they met one or more of the exclusion criteria. A total of 5 articles were included in the systematic review. In 14 out of the 17 articles that were excluded, studies were conducted outside the US. One article was a letter to the Editor, in one there was no distinction between tea and coffee drinkers and one was a study that was conducted in a laboratory using water and different concentration of caffeine added to the water that was consumed by lab animals. The table below provides more information about the excluded articles. Finally, a total of 5 articles were accepted and included in the review. The following section will describe the findings of this evaluation study and address the following research question: Is there an association between coffee consumption and breast cancer.

Table 1: Excluded studies and reason for exclusion

| Author | Year | Title of Article | Reason for Exclusion |
|---|---|---|---|
| Baptista | 2006 | Coffee and breast cancer risk. | Letter to the Editor |
| Bhoo | 2010 | Coffee and tea intake and risk of breast cancer | Study conducted in Netherlands |
| Fagherazzi | 2011 | No association between coffee, tea or caffeine consumption and breast cancer risk in a prospective cohort study | Study conducted in France |
| Ganmaa | 2008 | Coffee, tea, caffeine and risk of breast cancer: A 22 year follow up | no distinction between tea and coffee |
| Isshiki | 2011 | Coffee induces breast cancer resistance protein expression in Caco-2 cells | Study conducted in Japan |
| Jernstrom | 2008 | Coffee intake and CYP1A2*1F genotype predict breast volume in young women: implications for breast cancer | Study conducted in Sweden |
| Kotsopoulos | 2007 | The CYP1A2 genotype modifies the association between coffee consumption and breast cancer risk among BRCA1 mutation carriers | Study conducted in Canada |
| La Vecchia | 1986 | Coffee consumption and the risk of breast cancer | Study conducted in Italy |
| Larrson | 2009 | Coffee and Black Tea Consumption and Risk of Breast Cancer by Estrogen and Progesterone Receptor Status in a Swedish Cohort | Study conducted in Sweden |
| Lawson | 1981 | Coffe and tea consumption and breast disease | No distinction between tea and coffee drinkers |
| Le | 1985 | Coffee consumption, benign breast disease, and breast cancer | Study conducted in France |
| Li | 2011 | Coffee consumption modifies risk of estrogen-receptor negative breast cancer | Study conducted in Sweden |
| Lubin | 1985 | Coffee and methylxanthines and breast cancer: a case-control study | Study conducted in Israel |
| Nkondjack | 2006 | Coffee consumption and breast cancer risk among BRCA1 and BRCA2 mutation carriers | Study conducted in 4 countries |

| Author | Year | Title of Article | Reason for Exclusion |
|---|---|---|---|
| Pozniak | 1985 | The Carcinogenicity of Caffeine and Coffee: A Review | No human cases. |
| Tang | 2009 | Coffee Consumption and risk of breast cancer: a metaanalysis | European studies included |
| Tavani | 1998 | Coffee consumption and the risk of breast cancer | European study and bladder cancer |

**Table 2: Prospective Cohort Studies that Examine the Relationship between Consumption of Coffee and Breast Cancer**

| Study Reference | Population Profile | Coffee Consumption Levels | Cases/ Controls/ participants | Relative Risk (95% CI) | Confounding factors accounted and adjusted for | Relationship |
|---|---|---|---|---|---|---|
| #1 Boggs et al[6] | black women in the US | ≥ 4cups/ day | 1,268 cases 27,525 participants | IRR =1.03 95% CI 0.77-1.39 premenopausal IRR =1.33 95% CI 0.83-2.11 postmenopausal IRR =0.85 95% CI 0.55-1.32 | age, energy intake, age at menarche, BMI at age 18, family history of breast cancer, education, geographic region, parity, age at first birth, oral contraceptive use, menopausal status, age at menopause, female hormone use, vigorous activity,smoking status and alcohol intake | no significant association in premenopausal and postmenopausal women |
| #2 Gierach et al[16] | AARP members from 8 states. 96% postmenopausal | ≥ 4cups/ day | 9,915 cases 198,404 participants | RR = 0.98 95% CI 0.91-1.07 | age, race/ethnicity, education BMI, smoking status and dose, alcohol, proportion of total energy from fat, age at first live birth, menopausal hormone therapy, history of breast biopsy and family history of breast cancer, | no significant association |

**Table 3 : Case Control Studies that Examine the Relationship between Consumption of Coffee and Breast Cancer**

| Study Reference | Population Profile | Coffee Consumption Levels | Cases/ Controls/ participants | Relative Risk (95% CI) | Confounding factors accounted and adjusted for | Relationship |
|---|---|---|---|---|---|---|
| #3 Baker et al[2] | patients and controls from hospital | ≥ 4cups/ day | premenopausal 262/328 post menopausal 1072/985 | OR = 0.62 95% CI 0.39-0.98 P for trend= 0.03 OR = 1.01 95% CI 0.81-1.26 P for trend 0.57 | age, residence, age at birth of first child | A protective effect on premenopausal and no association for post menopausal |
| #4 McLaughlin et al | New York State residents | ever drank coffee | 1,463 cases 1,459 controls | OR = 0.98 95% CI 0.76-1.26 | age, county of residence, race, menstrual status, age at first live birth, diagnosis of benign breast disease, family history of breast cancer, and alcohol consumption. | no significant association |
| #5 Rosenberg et al | Eastern US hospitals | ≤ 7cups/ day | 2,651 cases 1,501 non-cancer controls 385 cancer controls | RR = 1.0 95% CI narrow | age | no significant association |

**Tables 2 and 3 the study characteristics and results.**

The 5 studies that were included in the review consisted of 2 prospective cohort studies and 3 case control studies. Of the 5 studies, 4 studies showed no association between coffee consumption and breast cancer, and 1 study showed a protective effect in premenopausal women and no significant association in postmenopausal women. For 2 cohort and 2 case controls studies, no significant association was found between coffee consumption and breast cancer. In one case control study (Baker et. al.) a protective effect in premenopausal and no association for post menopausal women was found.

The Baker et. al. case control study demonstrated a difference in association between premenopausal women and post menopausal women. For premenopausal women who consumed $\geq$ 4cups/day (OR 0.62 95% CI 0.39-0.98 and P for trend= 0.03), a protective effect or negative effect existed for breast cancer. Baker et al showed no significant relationship between coffee consumption and breast cancer in postmenopausal women (OR = 1.01 95% CI 0.81-1.26 and P for trend 0.57). The findings are in agreement with Gierach et al's prospective cohort study, which consisted of AARP members from 8 states in the US, and of which 96% of the study population was postmenopausal. This study showed no significant association (RR = 0.98 95% CI 0.91-1.0) between coffee consumption and breast cancer. The study conducted by Boggs et al, a large prospective cohort study of African American women, showed that there was no significant association between coffee consumption and breast cancer in the entire study population (IRR =1.03 95% CI 0.77-1.39), in premenopausal women (IRR =1.3395% CI 0.83-2.11), and in postmenopausal women (IRR =0.85 95% CI 0.55-1.32).

McLaughlin et. al. conducted a case control study in 18 contiguous counties New

York among women who ever consumed coffee. The results of this study showed no association between the consumption of coffee and breast cancer (OR = 0.98 95% CI 0.76-1.26). Rosenberg et. al. conducted a case control study in community and teaching hospitals in the Eastern part of the US. The study compared coffee drinkers and non-coffee drinkers odds of breast cancer. The findings demonstrated that there was no relationship (RR = 1.0 95% CI 0.7-1.2).

In the Baker study, the study participants were treated at the Roswell Park Cancer Institute between 1982 and 1998, and each participant agreed to complete the questionaire. There were 1932 in the case group with breast cancer and 1895 in the control group, these women were treated for non-cancer conditions, they were randomly selected. The particpants were 98% caucasian, ranging from 21 to 94 years. All results were stratified by menopausal status (Baker, 2006).

McLaughlin, 1992, case control study conducted in 18 contiguous counties in eastern New York State, 1,617 female patients between 20 to 79 years with breast cancer were selected from the area between 1982 and 1984 and another 1,617 randomly selected from the same area. Data such as reproductive, contraceptive and lifestyle from a questionaire was collected telephonically.

Boggs et. al., for the very first time studied exclusively African American women, a 12 year follow up (1995-2007) study conducted through a postal questionnaire. Data retrieved from the questionnaire included, demographic information, medical history, lifestyle information and dietary intake. Questionnaires were mailed out every 2 years to

59,000 women between the ages of 21-69 years, over 6 cycles. Finally, 52,062 females were included in the survey after exclusions disqualified some.

Gierach et. al., questionnaires were mailed out to 3.5 million members of AARP, ages 50-71year, living in 8 states in the US. The questionnaire include questions on personal height, weight, demographics, dietary intake, smoking status, physical activity, medical history, hormonal use, menopausal status and family history of cancer. After some exclusion 567,169 questionnaires were accepted.

Rosenberg et. al.'s case control study took place from 1975 to 1982 by interview at teaching and community hospitals in the eastern part of the US. 2,651 respondents had breast cancer, 1,501 controls without cancer and 385 controls with cancer. Information retrieved during the interview included personal demographics, drug use, medical history and dietary intake.

Four out of the 5 articles included in this systematic review showed no association between coffee and breast cancer, and one article showed a protective effect on premenopausal women and no association in postmenopausal women.

**Confounders**

To mitigate the misrepresentation of the association between coffee consumption and breast cancer, each study controlled for confounding factors. In the Baker, 2006 the following variables; age, residence, age at birth of first child were considered confounding factors and were adjusted accordingly. There was no significant effects of the confounders.

In the McLaughlin study, the confounding factors included age, county of residence, race, menstrual status, age at first live birth, diagnosis of benign breast disease, family history of breast cancer, and alcohol consumption and they had minimal effect (McLaughlin 1992).

Boggs et. al. considered the following confounding factors; age, energy intake, age at menarche, BMI at age 18, family history of breast cancer, education, geographic region, parity, age at first birth, oral contraceptive use, menopausal status, age at menopause, female hormone use, vigorous activity, smoking status and alcohol intake. The numerous confounders were controlled for to reduce misrepresentation.

Gierach et. al. considered the following confounders; age, race/ethnicity, education BMI, smoking status and dose, alcohol, proportion of total energy from fat, age at first live birth, menopausal hormone therapy, history of breast biopsy and family history of breast cancer. The confounding factors had no significant impact on the overall results.

In Tang et. al. study the following confounding factors were identified; age, waist/ hip ratio, age at menarche, BMI at age 18, family history of breast cancer, education, geographic region, parity, age at first birth, live births, menopausal status, age at menopause, female hormone use, vigorous activity,smoking status and alcohol intake, location of hospital, years of interview. The study concludes that in all observational diet-disease studies it is not possible to ecxlude bias and confounding (Tang 2009).

Rosenberg et. al. confounded for age and no difference in results were noted.

**QUALITY ASSESSMENT**

**Table 4 - Quality Assessment**

| | Study Baker | Study Boggs | Study Gierach | Study McLaughlin | Study Rosenberg |
|---|---|---|---|---|---|
| Was the purpose stated clearly? Yes \ No | yes | yes | yes | yes | yes |
| Does the study apply to the research question? | yes | yes | yes | yes | yes |
| Was relevant background literature reviewed?Yes/No | yes | yes | yes | no | yes |
| Type of study design cohort 1/case control 2 | case control | prospective cohort | prospective cohort | case control | case control |
| Was the sample described in detail? Yes/ No | yes | yes | yes | yes | yes |
| Results were reported in terms of statistical significance? Yes/No | yes | yes | yes | yes | yes |
| Conclusions were appropriate given study methods and results | yes | yes | yes | yes | yes |

The 5 studies included in the review met the quality assessment questions in the table above, except the McLaughlin et. al. study could have elaborated on the background literature.

# CHAPTER V
# DISCUSSION AND CONCLUSION

## 5.1 DISCUSSION

Five out of the six articles included in the review found no association between the consumption of coffee and the risk of breast cancer; however, one article (Baker, 2006) showed a protective effect on the risk of breast cancer in premenopausal women in the US and no effect on post menopausal women. Coffee consumption rates varied between the studies from ever drank to up to 7 cups of coffee per day; however, dosage was elaborated in the studies. Majority of the articles demonstrated no association between coffee consumption and breast cancer, with the exception of one article that found a differing result based on menstrual status. All the studies included in the review had a fairly large number of participants; however, participants in each study were not truly representative of the general public, for example, in Boggs, 2010, the population was primarily African American female, Gierach, 2012, the population was 96% postmenopausal, Tang 2013, Baker 2006 were hospital based population and McLaughlin, 1992 and Rosenberg, 1985 were residents of the eastern US. Confounders were adjusted in all studies; however, as was pointed out in many studies, in observational diet-disease studies it is difficult to eliminate bias and confounding.

This review did highlight a need for further research in the effect of coffee in women who are carriers of the susceptible BRAC1 and BRAC2 genetic mutation. Three studies revealed a positive effect of coffee consumption and the risk of breast cancer in women with the BRAC genetic mutation.

## 5.2 CONCLUSION

This systematic review provided showed that there is no relationship between coffee consumption and breast cancer i.e. coffee neither reduces nor increases the risk of cancer in women in the United States.

## 5.3 Author's Conclusion

Although coffee consumption affects diseases in other parts of the body, it does not affect breast cancer. However, there is evidence that more research must be conducted to determine whether coffee consumption together with genetic mutations alter the risk of breast cancer in women. The results of this research would influence the incidence and mortality rates in women with breast cancer.

### Recommendations for Research

More funding should be dedicated to studies that determine the effects of coffee consumption in women with the genetic mutations. The incidence and mortality rates suggests a need for more funding to identify ways of eliminating the risks of breast cancer.

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