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# The Impact of Yoga on Cancer Patients

## A Literature Review

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Bachelor's Thesis
February 2019
Social Services, Health and Sport
Degree Programme in Nursing

Jyväskylän ammattikorkeakoulu
JAMK University of Applied Sciences

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**Description**

| Author(s) | Type of publication | Date |
|---|---|---|
| Kumal, Asmita<br>Sheikh, Sumera | Bachelor's thesis | February 2019 |
| | | Language of publication: English |
| | Number of pages<br>34 | Permission for web publication: x |

Title of publication

**The Impact of Yoga on Cancer Patients**

A Literature Review

Degree programme

Degree Programme in Nursing

Supervisor(s)

Garbrah, William & Sinivuo, Riikka

Assigned by

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Abstract

The aim of this study was to explore the impact of yoga on cancer patients through existing literature. The purpose was to provide information that can be used by nurses and to patient support well-being during cancer treatment.

The study was conducted as a literature review and the data was collected using two databases: CINAHL and PubMed. Results from eight articles were analysed using inductive content analysis method. The results revealed two main categories: Psychosocial and Physiological & Biological Impacts and eight sub categories namely; Quality of life, fatigue, stress & anxiety, depression, sleep quality, arm lymphoedema, treatment related symptoms and overall toxicities and biological markers.

In conclusion, yoga positively influenced cancer patients' quality of life, fatigue, stress & anxiety, sleep quality, treatment related symptoms & overall toxicities and biological markers. However, yoga may have wider scope of impact that needs to be explored. Further research is recommended to study impact of yoga on other cancer types and all eight limbs of yoga to verify it as an evidence-based option in supportive treatment. Yoga could further be explored to find its influence on biological markers of cancer. Lastly, yoga training could be provided as a nursing tool to oncology nurses, thus they can encourage over all well-being of cancer patients along with medical treatment.



Keywords/tags (subjects)

Yoga, Cancer


Miscellaneous

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# 1 Introduction

Globally, about one in six deaths is due to cancer, it was the second leading cause of death in 2018 representing an approximate 9.6 million deaths. About one out of three deaths from cancer are due to the five leading behavioral and dietary risks: high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use and alcohol use. Late-stage presentation and inaccessible diagnosis and treatment are common. (WHO 2018)

According to the World Cancer Research Fund (2018), the prevalence of cancer is higher in Europe, Asia, North America and Oceania. The Finnish Cancer Registry as of 2016, states that there have been many new cases of breast cancer, prostate cancer, lung cancer and colorectal cancer. (Cancer Statistics 2016.)

Few of the common types of cancers are carcinoma, sarcoma, leukaemia, lymphoma, multiple myeloma, melanoma, brain and spinal cord tumours. They are then named after the organ they originate from. Similarly, types of cancer treatments depend on the type and stage of the cancer. Few of the main treatment options are surgery, radiation therapy, chemotherapy, immunotherapy, targeted therapy, hormone therapy, stem cell transplant and precision medicine. (Types of Cancers n.d.).

Yoga on the other hand, is a rising research subject which is said to have numerous benefits on mental stress, obesity and hypertension. It has been used as a non-pharmaceutical measure as a complement to drug treatment (Taneja 2014). According to Sisk (2015) nowadays, cancer patients are considering using yoga to manage their critical illnesses to regain control over their bodies and self-healing. Not only does yoga help with physical and psychological problems but also has spiritual healing values. (26.)

The nurses could be trained to incorporate yoga into their main nursing interventions, which could be used to reduce fatigue, anxiety, nausea and encourage emotional well-being during chemotherapy and other painful procedures. It has also been tested as a nursing intervention for the patients and care givers by the Oncology Nursing Society's Putting Evidence into Practice series, therefore, it may be used to cope with treatment related toxicities. (ibid., 26.) Hence the aim of this review is to examine the effects of yoga on cancer patients through existing literature.

# 2 Yoga

## 2.1 Definition, Limbs and Styles of Yoga

Yoga is a discipline used to enhance or build up one's natural power in a balanced way to accomplish total self-acknowledgment (Yoga, 2016). It was discovered by ancient Indian sages through meditation (Kumar 2007, 1). Patanjali describes yoga as a method of 'spiritual union' and established eight limbs of yoga stated in Table 1 and explained further (Sisk and Fonteyn 2016, 183). Moreover, different styles of yoga have also been mentioned.

TABLE 1. Limbs of Yoga (Sisk and Fonteyn 2016, 183)

| Term | Focus | Characteristics |
|---|---|---|
| Yama | Ethical Behaviour | Non-harming, truthfulness, non-stealing, responsible sexuality, non-acquisitiveness |
| Niyama | Personal Behaviour | Purity, commitment, contentment, self-study, surrender to the whole |
| Asana | Posture | Physical poses that stretch, condition, and massage the body |
| Pranayama | Breathing Regulation | Regulation and refinement of breathing to expand prana (life force) and remove toxins |
| Pratyahara | Sensory Inhibition | Temporary withdrawal of the senses from the external environment to the inner self |
| Dharana | Concentration | Locking attention on an object or field, such as breath, mantra, or image |
| Dhyana | Meditation | Increasingly sustained attention, leading to a profound state of peace and awareness |
| Samadhi | Deep absorption | A transcendent state of oneness, wisdom, and ecstasy |

*Yama, Niyama, Asana and Pranayama*

***Yama*** is the first limb of yoga. It is a way of moral conduct and has five more principles namely, ahimsa; non-violence, satya; truthfulness, asatya; non-stealing, big heartedness, bramhacharya; non-excess, awareness of energy and aparigraha; non-possessiveness. ***Niyama*** is the second limb of yoga, which means self-observation, self-discipline and integration of body, mind and spirit. It also follows five principles namely, saucha; purity, santosha; contentment, tapas; discipline, svadhaya; sacred self-examination, isvara pranidhana; surrender to the divine. (8 Limbs of Yoga 2019). ***Asana*** is postures of yoga. The main goal of these yoga postures is to ideally combine immobility and relaxation (Kumar 2007, 1-5). ***Pranayama***, where prana means life force is considered a vital scientific and therapeutic component of yoga. It is the process of breathing or controlling the motion of inhalation, retention and exhalation of air. Through breathing in pranayama, self-control can be attained. By controlling prana, the forces of universe such as gravity, magnetism, electricity and nerve currents can be controlled (ibid., 1-5).

*Pratyahara, Dharana, Dhyana and Samadhi*

***Pratyahara*** is the state that occurs when a yoga practitioner is completely indulged in asana, pranayama and meditation and becomes unaware of any external distractions. ***Dharana*** is a way of training the mind to focus on a point. This practice further includes mudra, mantra, chanting, and concentrated gazing. (8 Limbs of Yoga 2019.) ***Dhyana,*** meaning meditation is a popular tool for self-control and happiness. Studies have revealed that the body reaches a profound rest during meditation and mind becomes more alert (Kumar 2007, 1-5). ***Samadhi*** is an experience where the practitioner's consciousness bonds with the 'divine consciousness' (8 Limbs of Yoga 2019).

*Styles of Yoga*

There are various styles of yoga namely, Hatha yoga, Jyana yoga, Mantra yoga, Bhalti yoga, Kundalini yoga, Karma yoga, Kriya yoga, Swarga yoga and Raja yoga. (8 Limbs of

Yoga 2019) 'Hatha yoga' is the commonly practiced style in the United States and Europe. It comprises of body postures, breathing exercises and meditation. Some styles involved in Hatha yoga are Ananda, Anusara, Ashtanga, Bikram, Iyengar, Kripalu, Kundalini and Viniyoga. (National Centre for Complementary and Alternative Medicine 2013). The meaning of Hatha is ''to strike'' which implies striking the body with the challenge of posture and ''to yoke'' which means the yoga itself (8 Limbs of Yoga 2019).

## 2.2 General Benefits of Yoga on Health

Yoga interventions are non-invasive and cost effective, therefore, can be well executed for people having functional or other impairments (Heeter & Lehto 2018). The goal of yoga is not only limited to mental well-being but also physical fitness, mental clarity, developing self-control and general wellbeing (Kumar 2007, 1).

Practicing yoga could have physical benefits with patients having one or more chronic illnesses (Ross, Friedmann, Bevans and Thomas 2013, 7). A study performed under physically inactive older adults, who practiced yoga for 3 months had a better self-reported health, improved lower body flexibility and overall improved physical functioning (Tew, Howsam, Hardy and Bissell 2017, 6). Practice of yoga, particularly 'Hatha' yoga has shown significant benefits in lower body range motion and balance. However, further investigations and evidence is still required on this subject (Hewett, Cheema, Pumpa & Smith 2015, 3-6). If practiced properly, yoga meditation can lead to a healthy state of relaxation by generalizing a reduction in multiple physiological and biochemical markers, such as heart rate, respiratory rate, plasma cortisol; a major stress hormone, pulse rate and electroencephalogram (Kumar 2007, 1-5).

The integral practice of yoga has shown improvement in different health variables such as general health, personalities, emotional intelligence and sustained attention (Khemka, Hankey & Ramarao 2011). According to research review done by Wood-

yard (2011), constant practice of yoga increases serotonin levels and improves depression. It inhibits the areas which are responsible for sensations such as fear, aggressiveness and rage in our brain and stimulates the rewarding or pleasuring centers thereby creating the sensation of blissful mindfulness. (ibid.) According to Kumar (2007), asanas help to squeeze and stretch glands and thus boost their secretions and balance them. Endocrine defects are therefore cured, and emotional and mental problems caused by these defects gradually disappear and mind slowly becomes much calm and concentrated (ibid., 1-5). It has also been mentioned that the calming effect of the pranayama helps to overcome drug dependency, but not many scientific studies are available to prove the authenticity (Kuppusamy, Kamaldeen, Pitani, Amaldas & Shanmugam 2018, 11-16).

## 2.3 Benefits of Yoga on Anxiety, Stress and Fatigue

Stress and anxiety may cause several adverse effects on health and lead to chronic health conditions such as coronary heart disease, lower quality of life and even suicidal behaviour. Research on yoga has demonstrated improvement in stress, mood and anxiety, therefore, the implementation of yoga in therapeutic purposes is up-and-coming. (Büssing, Khalsa, Michalsen, Sherman & Telles 2012.) A study has suggested that yoga practice has decreased the anxiety rate in breast cancer patients (Li & Goldsmith 2012, 22-24). According to a report presented by Büssing and colleagues, (2012) several randomised controlled trials revealed the efficacy of yoga as a nursing intervention for treatment of anxiety disorder. However, effective clinical justifications are still needed. (ibid., 2.)

Regular practice of pranayama can have a positive impact on autonomic nervous system, cardiovascular and respiratory functions, thereby reducing stress on various systems (Kuppusamy et al. 2018). Despite the lack of adequate and consistent instruments, some studies have described that yoga may reduce perceived stress as efficiently as other active control interventions such as relaxation, cognitive behavioral therapy or dance (Büssing et al. 2012, 3).

Yoga as a therapeutic method has been used to improve the level of fatigue in psychiatric, asthmatic and some chronic pancreatic patients (Boehm, Ostermann, Milazzo & Büssing 2012, 2). Studies on effects of yoga on fatigue, both on cancer patients and healthy individuals discovered a small amount of positive effect (Büssing et al. 2012, 2).

### 2.4 Benefits of Yoga on Cancer

For cancer patients, the physical benefits of yoga may help to alleviate some of the side effects such as nausea and dizziness from radiation and chemotherapy throughout treatment. Yoga may help lessen those side effects with additional benefits such as sleep improvement. (Jayalakshmi 2014, 48.) According to Sisk & Fonteyn (2016), pranayama may help reduce emotional stress, anxiety and fear or loss of control caused by cancer and its treatment. Nurses as of now utilize many evidence-based interventions to enable their patients to manage the side-effects of cancer treatment. With thorough training, the practice of yoga may also be integrated as part of the care plan in treatment of cancer. (183-184.)

## 3 Cancer

### 3.1 Definition, Types and Prevalence

Cancer can be defined as a disease in which a group of abnormal cells grow uncontrollably by disregarding the normal rules of cell division. Normal cells are constantly subject to signals that dictate whether the cell should divide, differentiate into another cell or die. Cancer cells develop a degree of autonomy from these signals, resulting in uncontrolled growth and proliferation. If this proliferation continues and spreads, it can be fatal. (Hejmadi 2010, 7.)

Most studies classify different types of cancers based on their origin in the body. Cancers are named after the body part they originate from. (Cancer: Symptoms,

Causes, Diagnosis, Classification & Management 2016 and U.S Department for Health & Human Services, n.d ) The different types of cancers are explained in table 2.

TABLE 2. Types of Cancer (Cancer: Symptoms, Causes, Diagnosis, Classification & Management 2016)

| Types of Cancers | Origin in the body |
|---|---|
| Carcinoma | tumors growing in the epithelial tissue, such as skin and the lining that covers organs like, lungs and uterus |
| Sarcoma | tumors growing in connective tissues, such as the muscle and bones. |
| Lymphoma | tumors growing in the lymph system |
| Leukemia | tumors originating in the bone marrow |
| Myeloma | tumors that originate in the plasma cells of the bone marrow. |
| Gliomas | Tumors growing in the brain |
| Blastomas | Tumors originating from immature “precursor” or embryonic cells |

In addition, according to the U.S department for health and human services, there are also mixed types of cancers, in which the components of the tumor cells could be from different categories. One such example would be carcinosarcoma (Coleman 2006; Cancer: Symptoms, Causes, Diagnosis, Classification & Management 2016 and U.S Department for Health & Human Services, n.d.)

There were 9.6 million deaths estimated in 2018, due to cancer. It is the second leading cause of death and responsible for 1 out of 6 deaths globally. It is stated that most deaths are due to; Lung cancer (1.76 million), Colorectal cancer (862,000), stomach cancer (783,000), liver cancer (782,000) and breast cancer (627,000) (Cancer 2018).

As per the World Cancer Research Fund, the prevalence of cancer is higher in Europe, Asia, North America and Oceania. Finland ranks 30$^{th}$ among the age-standardized cancer index for both sexes. Cancer rates for men in Finland is 281.7 per 100,000 and 258.5 per 100,000 for women. Finland ranks 42$^{nd}$ on the men’s cancer index and 24$^{th}$ on the women’s cancer index, respectively (Global Cancer Data by Country 2018).

The Finnish Cancer Registry as of 2016, states that there have been 5162 new cases of prostate cancer, 1742 for lung cancer and 1625 new cases for colorectal cancer, amongst men. Whereas for women, there have been 4961 new cases of breast cancer, 1625 for colorectal cancer and 992 new cases of lung cancer (Cancer in Finland 2016).

## 3.2 Risk factors, Symptoms and Diagnosis

Development of cancer cells depends on a person's lifestyle, habits and environment. However, for some cancers, genetics also play an important role. Risk factors can be biological, such as, gender, metabolism of foreign substances in the body, genetics and skin type. Moreover, environmental exposure to radon and ultraviolet rays and fine particles, as well as lifestyle, diet and physical activity play an important part. (Pukkala & Rauhalahti 2013, 8.)

Cancer symptoms can manifest themselves in various ways. Such as; a new mole or changes in an existing one, sore that does not heal, changes in breast shape, size, texture of skin or nipple, a lump forming under or on the skin, cough that does not go away or hoarseness in voice, changes in bowel movement habits or blood in stool, painful urination or blood in the urine, difficulty in swallowing food, change in appetite, loss or gain of weight without an explanation, abdominal pain or feeling weak or tired. Similar symptoms may also be caused by benign tumors or other conditions. (Signs and Symptoms 2018)

Diagnosis for cancer can be done through several procedures. The doctor may first conduct a thorough medical history interview and suggest a few tests depending on the kind and stage of the cancer suspected. Lab tests, CT scan, nuclear scan, ultrasound, MRI, PET scan, X-rays and biopsy through a needle, endoscope or surgery are few ways to detect cancer cells in the body (Cancer Diagnosis 2018).

## 3.3 Aim of Cancer Treatment, Conventional and Alternative Treatment

The aim of cancer treatment is to improve length and quality of life. Improvements in length of life are generally modest. Effects on quality of life can be harmful by adding symptoms of treatment related-toxicity, but it can also be beneficial, by reducing or delaying cancer-related symptoms. (Blinman, King, Norman, Viney & Stockler 2012, 1004.)

Cancer treatments can vary based on the choice of treatment option, location of the tumor, distribution, cell type and the patient's overall condition as well as other possible illnesses (Treatment and Rehabilitation n.d.). Conventional treatments include surgery; to surgically remove cancer from the body, radiation therapy; using high levels of radiation to kill cancer cells and decrease tumours, chemotherapy; using drugs to kill the cancer, immunotherapy; using substances made from living organisms to help immune system to fight cancer, targeted therapy; targeting the changes in cancer cells to prevent them from dividing and spreading, hormone therapy; slows the growth of cancer, stem cell transplant; restoring blood forming stem cells for patients who have lost theirs' due to radiation and chemotherapy, and precision medicine; using genetics understanding to conduct selective treatments. (Types of Cancer Treatment 2017)

While chemotherapies remain the backbone of current treatment path, they have a limited therapeutic range, significant toxicities, and frequently acquired resistance (Vanneman & Dranoff 2012, 237-251). Pain, nausea, vomiting, constipation, hair loss, skin irritation, dyspnea, and swelling are among several of the toxicities. These reactions have been reported by early stage invasive breast cancer patients who went through surgical cancer treatment, radiation treatment or adjuvant chemotherapy treatments. The severity of reported toxicities of chemotherapy were greater in number when compared to non-chemotherapy patients. (Friese, Harrison, Janz, Jagsi, Morrow, Li, Hamilton, Ward, Kurian, Katz & Hofer 2017, 1925.)

According to Mayo Clinic (2018), acupuncture, aromatherapy, exercise, hypnosis, massage, meditation, music therapy, relaxation therapy, tai chi and yoga are some of the recommended alternative cancer treatments. These alternatives can relieve treatment related symptoms and toxicities, although they cannot replace cancer medications prescribed for the patients (Alternative Cancer Treatments 2018).

## 3.4 Impact of Diagnosis, Treatment Toxicities and Long-term Consequences

Cancer patients may experience denial, anger, fear, hope anxiety, stress, depression, guilt and loneliness after diagnosis (Cancer Diagnosis 2018). Cancer diagnosis can be a stressful event not only for the patient but their families as well. Patients, their partners and family members can suffer from clinical levels of depression and anxiety. (Edwards & Clarke 2004, 562.)

With current cancer treatment options, it is not possible to avoid damaging healthy cells of the body to a certain degree. Patients may experience chronic fatigue, sexual difficulties, moderate to severe pain after curative treatment, persistent hair loss, nausea, vomiting, incontinence, gastrointestinal problems, lymphoedema, mental health problems, depression, PTSD and body image issues. (Devane 2013, 4-7.)

The impact of cancer is not limited only until treatment, the consequences are experienced long after the treatment has ended. The above-mentioned treatment toxicities may continue as a long-term consequence of the disease. Fatigue, pain, social and financial difficulties being the most common. Furthermore, 27% cancer survivors find vigorous activities more difficult or impossible, 33% have average or poor health and 9% visit a healthcare professional 10 times or more in a year (ibid., 4-7).

## 3.5 Role of An Oncology Nurse in Cancer Care

According to Tariman & Szubski (2015), oncology nurse's responsibilities array from simple information sharing to complex decision making during the treatments. The nurse's role includes sharing vital information about the patients to the multidisciplinary care team in a way that patient's perspectives and preferences are represented for further treatment and decision making. Providing information to patients and their families is also one of the main roles of an oncology nurse. The patients identify nurses as a trusted source to understand the course of their disease and treatment related information. In addition, nurses advocate for patient autonomy in case of a discourse with oncologists or other health professionals. (549-550.)

Nurses also provide psychological and emotional support to the patients throughout their cancer care to help them feel satisfied with their decisions, prevent emotional suffering and being present by listening to them during periods of uncertainties. Furthermore, symptom assessment, monitoring, management and outcome evaluation are one of the recently evolved roles of an oncology nurse. These roles are carried out with the help of standardized checklists, assessment tools, multi-professional care team meetings and evidenced based knowledge (ibid., 549-550).


FIGURE 1. Oncology Nurse's Role Model (Tariman and Subszki 2015, 550)

# 4 Aim, Purpose and Research Question

The aim of this review was to examine the impact of yoga on cancer patients through existing literature. The purpose of this review was to provide information that can be used by nurses and patients to support well-being of patients during cancer treatment.

Research Question: How does yoga influence cancer patients?

# 5 Methodology

## 5.1 Literature Review

Literature review is a document which utilizes precise catchphrases and different inquiry engines to find recently published articles. Depending upon the theme, articles from one, two or every one of the sources might be incorporated. Despite the source, investigating and assessing the subject is required. (Ward-Smith 2016, 253.)

This method was chosen because literature review provides a broad source of information on a given topic, thus the reader does not have to find and read all the studies and literature separately. Since a review is conducted on a group of studies on a certain topic, it provides a realistic and extensive view of the current research. (Aveyard 2014, 4.) Initially, a topic of interest was selected (Ramdhani, Ramdhani & Amin 2014, 50). After selecting the topic, relevant articles were searched widely to gain a good understanding of the available literature. Based on the research question the literature was organized and thoroughly scanned to find the most relevant data (Maggio, Sewell & Artino 2016, 298-299).

## 5.2 Literature Search and Article Selection

Data search was conducted by two researchers using two databases, PubMed and CINAHL (Ebsco). The literature search was conducted based on the research question, key words; (yoga and cancer) and inclusion and exclusion criteria displayed in table 3. The inclusion and exclusion criteria were used to avoid any bias and to find the most relevant articles that answered the research question. The search in CINAHL and PubMed was conducted with the filters; full text availability and year 2008-2018. However, in CINAHL the filter 'English language' was used, which was not available in PubMed. Similarly, the filter 'clinical trials' was used in PubMed which was not available in CINAHL.

TABLE 3. Inclusion and Exclusion Criteria

| Inclusion Criteria | Exclusion Criteria |
|---|---|
| Full text availability | Not relevant to the research topic |
| Published between 2008-2018 | Not answering the research question |
| Study in English language | Cancer survivors |
| Evidence based studies | Studies more than 10 years old |

In the initial stage, the articles were chosen progressively based on the titles and abstracts. In the secondary stage, full content of the articles was read to assure that the chosen articles answered the research question and met the inclusion criteria. Duplicates were removed throughout the article selection process. Finally, a total of 8 articles were chosen to conduct the literature review. Table 4 demonstrates the data search and results.

Following the literature organization, articles were analysed by reading the summary or abstract in the beginning of the studies to determine whether the articles qualify for the chosen research question (Ramdhani et al. 2014, 51-53).

TABLE 4. Literature Search

| Database | Search terms | Results | Chosen based on titles | Chosen after reading abstracts | Chosen after reading full text |
|---|---|---|---|---|---|
| CINAHL | yoga AND cancer | 95 | 18 | 6 | 5 |
| PubMed | yoga AND cancer | 43 | 20 | 5 | 3 |

## 5.3 Data Analysis

Inductive content analysis was used to analyse the selected articles. It is the process to organize existing qualitative data, using codes, generating categories and abstracting data (Elo & Kyngäs 2008, 109). This method was used for the current review because it allowed the researchers to explore the research question in a broad manner through existing literature, then generate themes and concepts respectively (Hesse-Biber & Leavy 2011, 310). Results and discussion segments from each article were read thoroughly to deduct excerpts that answered the research question. Similar excerpts were grouped together to extract codes, after which the codes were categorized by observing the similarities and differences. Similar codes were put together which led to creating categories and sub-categories. (Hennink, Hutter & Bailey 2011, 235-236.) Figure 2 demonstrates an example of the data analysis process.

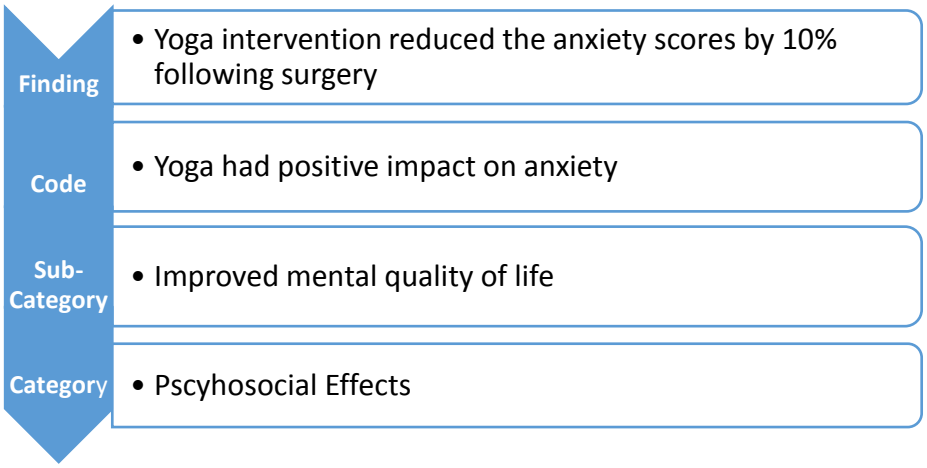


FIGURE 2. An example of data analysis

# 6 Research Results

A total of eight randomized controlled trial studies were organized and analyzed using the inductive content analysis procedure. While analyzing the results, the impacts of yoga were categorized under two main categories and eight sub-categories, shown in Figure 3.

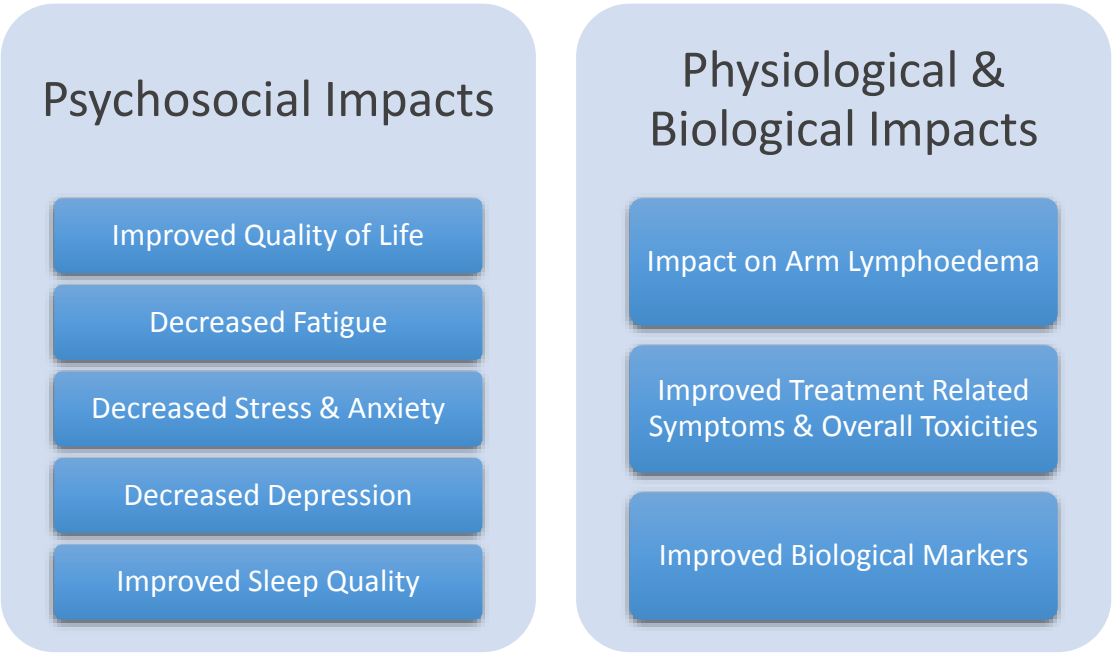


FIGURE 3. Categories and Sub-Categories of Impact of Yoga on Cancer Patients

## 6.1 Psychosocial Impacts

There was a ***significant improvement in quality of life*** after surgery for yoga group as compared to the control group. Evident improvements were observed in quality of life during radiation and chemotherapy as well as after the intervention period had ended. (Rao, Raghuram, Nagendra, Kodaganur, Bilimagga, Shashidhara, Diwakar, Patil & Rao 2017b, 241.) The outcomes exhibited that yoga group had gradual improvement in mental quality of life, physical functioning and overall general health. Increase in yoga practice at home or in class was also associated with enhanced quality of life (Loudon, Barnett, Piller, Immink & Williams 2014, 6; Chandwani, Perkins,

Nagendra, Raghuram, Spelman, Nagarathna, Johnson, Fortier, Arun, Wei, Kirschbaum, Haddad, Morris, Scheetz, Chaoul & Cohen 2014, 1061 and Dhruva, Miaskowski, Abrams, Acree, Cooper, Goodman & Hecht 2012, 476).

***Decrease in fatigue*** was observed in yoga participants by the end of interventions (Chandwani et al. 2014, 1061). The analysis of the outcomes disclosed, yoga attendants had decreased fatigue severity, fatigue interference, fatigue diurnal and fatigue frequency. Furthermore, group comparison showed improvement in overall fatigue in yoga group only. (Vadiraja, Rao, Nagarathna, Nagendra, Patil, Diawkar, Shashidhara, Gopinath & Ajaikumar 2017, 249.) However, three other studies suggested contradicting results where there was no significant improvement in degree of fatigue in one study, increased fatigue after yoga interventions in the first cycle of chemotherapy and no difference in fatigue in the third study (Loudon et al. 2014, 5; Chaoul, Bilbury, Spelman, Basen-Engquist, Hall, Wei, Shih, Arun, Valero, Babiera, Wangyal, Engle, Harrison, Li & Cohen 2018, 7 and Dhruva et al. 2012, 476).

There was a noticeable ***decrease in stress and anxiety***, in yoga group compared to the control group. As well as within group evaluation revealed positive improvements in yoga group only. (Vadiraja et al. 2017, 249 and Dhruva, et al. 2014, 476.) The result from a pranayama intervention suggested that the treatment group showed gradual improvement in anxiety and mental quality of life (Dhruva, et al. 2012, 476). The outcomes demonstrated improvement in anxiety following the surgery, before and during radiotherapy in yoga group as compared to the control group. Furthermore, there was a considerable decrease in anxiety after radiation therapy and these effects lasted during chemotherapy as well as after it, in the yoga group (Rao, et al. 2017b, 240).

Yoga group was informed to have noteworthy ***decrease in depression*** following surgery, before and after radiotherapy as opposed to control group. Additionally, only the yoga group had decreased depression during radiotherapy when within group changes were measured. This decrease in the depression level was gradually evident

throughout the intervention period. Continuation of yoga practice displayed steady decrease in depression (Rao et al. 2017b, 241, 243 and Rao, Raghuram, Nagendra, Usharani, Gopinath, Diwakar, Patil, Bilimagga and Rao 2015a, 178). On the other hand, there was a rise in depression during the first cycle of chemotherapy among the yoga participants which declined during the second cycle (Dhruva, et al. 2014, 476). Additionally, another study revealed a significant correlation between symptoms severity and distress to depression scores after surgery and during radiation and chemotherapy (Rao et al. 2015a, 178).

According to Rao, Vadiraja, Nagaratna, Gopinath, Patil, Diwakar, Shashidhara, Ajaikumar and Nagendra (2017c) the yoga group exhibited ***better sleep quality results*** in overall insomnia rating scale scores. Secondly, in their study only the yoga group had positive outcomes in symptom distress, sleep distress, sleep quality of life and sleep total distress when within group changes were compared. (ibid., 257-258). Increase in yoga practice also showed noteworthy improvement in sleep quality (Dhruva, et al. 2012, 476). Similarly, Tibetan yoga group had low daily sleep disturbance scores compared to the stretching program group and the Usual care group, post 1 week of interventions (Chaoul et al. 2018, 7). When effects were studied three- and six-months post treatment, it was found that participants who practiced yoga at least twice a week at home had better sleep quality scores and higher sleep efficiency (Chaoul et al. 2018, 2).

## 6.2 Physiological & Biological Impacts

There were a few physiological and biological impacts covered in the studies selected for this review. These included volume of arm lymphoedema. Yoga practice in breast cancer patients disclosed, there was ***no reduction in swelling caused by lymphoedema*** after eight weeks of intervention. There were no changes in extra cellular fluid, however, the tissue induration on the affected arm decreased but these results did not persist one-month post intervention and the volume of arm lymphoedema increased (Loudon et al. 2014, 5-6).

Yoga group had comparatively ***reduced symptom severities and overall toxicities*** after surgery. Symptom numbers, severity and distress during radiotherapy also reduced in yoga group. Prominent reduction in number and severity of symptoms and distress experienced by the yoga participants were observed during chemotherapy. (Rao et al. 2017b, 241-242.)

In one of the studies where the cortisol levels in breast cancer patients were studied, it presented, yoga had a ***positive impact on biological markers***. Yoga practice helped in reducing cortisol levels as well as reduced fatigue was related to lower cortisol levels within the yoga group. (Rao et al. 2017c, 258 and Vadiraja et al. 2017, 249.) The level of salivary cortisol had significantly steeper slope in yoga group at one month follow up (Chandwani et al. 2014, 1061). There was an improvement in yoga group's natural killer cell percentage when analysis was conducted between groups. Whereas, within group comparison revealed an improvement in yoga group only (Rao et al. 2017c, 258). However, there was no noticeable difference in absolute lymphocytes count in yoga group (Rao et al. 2017c, 258).

# 7 Discussion

## 7.1 Discussion of Key Results

The current review remains consistent with previous studies, where yoga had positive effects on various health variables such as anxiety, distress, depression and quality of life within patients undergoing chemotherapy. With an exception for depression, fatigue and arm lymphoedema, where the results were not consistent. (Danhauer, Addington, Sohl, Chaoul & Cohen 2017, 1357 and Prathikanti, Rivera, Cochran, Tungol, Fayazmanesh & Weinmann 2017, 2). It could be interpreted that yoga can be recommended for cancer patients to relieve these markers. Therefore, healthcare personnel may be provided information and training in yoga practice, so they can advise their patients. It could be recommended at an earlier stage also as a preventive method and not only when undergoing chemotherapy.

Sleep quality, treatment related symptoms and overall toxicities and biological markers like salivary cortisol and natural killer cell percentage also improved in yoga participants (Rao et al. 2017c, 257-258; Rao et al. 2017b, 241-242; Dhruva et al. 2012, 476; Vadiraja et al. 2017, 249; Chandwani et al. 2014, 1061 and Chaoul et al. 2018, 7). These results suggest that cancer patients can have better coping mechanism if they are able to sleep better, feel less stressed and have improved depressive symptoms while undergoing intense treatment which takes a toll on over all well-being. Yoga could be used as a tool by oncology nurses to help patients feel active and empowered during treatment since patients have been reported to experience a loss of control after being diagnosed and while undergoing treatment (Edwards & Clarke 2004, 562; Devane 2013, 4-7 and Sisk & Fonteyn 2016, 183-184). Nevertheless, further studies need to be conducted to confirm the impact of yoga on biological markers which may help researchers to approach yoga in a more scientific manner.

Considering the discomfort and pain cancer patients go through from being diagnosed to being cured (Devane 2013, 4-7 and Heeter & Lehto 2018), yoga is one such practice that is non-invasive, easy to follow and can be practiced at home or anywhere. Similar observation was made by Komatsu, Yagasaki, Yamauchi, Yamauchi T and Takebayashi (2016, 261). Additionally, varying frequencies of yoga sessions lasting between 50-90-minutes were used in each study analyzed in this review. (Rao et al. 2017c, 257-258; Rao et al. 2017b, 241-242; Dhruva et al. 2012, 476; Vadiraja et al. 2017, 249; Chandwani et al. 2014, 1061 and Chaoul et al. 2018, 7). Yoga was found to have positive results regardless of the length of sessions. It was also seen as a non-intrusive method with lack of side effects, which further reinforces that nurses can incorporate short yoga sessions within their care-plans to help patients through cancer treatment.

On the contrary to all the positive impacts of yoga, fatigue symptoms in cancer patients worsened during first cycle of chemotherapy (Chaoul et al 2018, 7), and at one-week follow-up in another study (Dhruva et al. 2014, 476). However, during the

second cycle, fatigue symptoms improved but in the second study, fatigue scores didn't show improvement. These results contradict with rest of the review articles where yoga was found beneficial for fatigue along with other symptoms. (Chandwani et al. 2014, 1061 and Vadiraja et al. 2017, 249). Likewise, depression symptoms worsened during first cycle of chemotherapy but improved during the second cycle (Dhruva et al. 2014, 476). The differences in impact within these two cycles could be due to extreme complications present in the first cycle (Crawford, Wolff, Culakova, Poniewierski, Selby, Dale & Lyman 2003, 53). Moreover, perception of fatigue and depression could be subjective to each patient and therefore could lead to varied results even after using internationally standardized measurement scales. This indicates need for further research where biological markers of depression and fatigue could be studied to avoid perception bias.

## 7.2 Ethical Consideration and Credibility

The ethical consideration of methodology and credibility of the research articles was determined based on the guidelines provided by the Medical Research Act 2010, established by the Finnish Ministry of Social Affairs and Health. Articles included in this thesis were deemed ethical because informed consent was obtained from all participants. (Medical Research Act 2010, 2). Safety and well-being of the participants were prioritized in all the selected studies and a justified screening process (inclusion and exclusion criteria) was used to avoid any potential harm or risks. Suitable internationally standardized tools were used to record and measure the data, interventions were carried out under supervision of certified yoga professionals and responsible medical teams. No adverse effects due to the interventions were recorded, any participant who could not continue owing to severity or any change in their condition, dropped out of the study (ibid., 3-5).

Studies analyzed in this review were carried out in Australia (one study), India /(four studies) and U.S.A. (three studies). Despite different geographical locations, the results were consistent with previous studies, hence, the results of this review can be

applied to a universal population. Similar internationally standardized measurement scales were used in all the studies, which increases the credibility because it improved the consistency. Therefore, they are applicable to universal population. The documentation of methodologies and outcomes were described in detail and inclusion and exclusion criteria was followed to select the most suitable participants. The risk of bias was avoided by randomizing the allocation of participants to each group by either using adapted randomization tool or by using computer generated randomization. (Valkeapää 2016, 64.) Furthermore, studies were conducted in designated research centers and within controlled environments to avoid any systematic or random errors (Drost 2011, 106).

## 7.3 Limitations and Strengths

Due to limited research available on impact of yoga on cancer patients, the reviewers found multiple studies conducted by similar group of researchers, using one randomized controlled trial group, for studying multiple variables of cancer influenced by yoga. Consequentially, four studies from the same group of researchers were analyzed in this literature review which could have translated into biased findings. Any systematic or random errors that may have occurred during the study process, apply to all four of the articles (Drost 2011, 106). Moreover, most of the studies found, were conducted exclusively on breast cancer patients which could make it difficult to translate the benefits of yoga on other cancer types (Côté & Daneault 2012, 477).

This review was conducted by two researchers, who analyzed the data individually and then cross checked each other's work to avoid plagiarism and perception bias. Additionally, quantitative studies were analyzed qualitatively which makes it easier for future researchers to understand the data and continue further investigation to explore the scope of yoga in cancer. The reviewers followed the research integrity guidelines provided by the Finnish Advisory Board and maintained integrity of this review (TENK, 2012, 28-40).

## 7.4 Conclusion and Recommendations for Further Research

In conclusion, it can be said that yoga influences cancer patients in a positive way. At best on quality of life, fatigue, stress, anxiety, depression, sleep quality, treatment related symptoms and overall toxicities and biological markers. However, yoga may have wider scope of impact that needs to be explored through further research. This review has revealed gaps in research for the influence of yoga on different types of cancer other than breast cancer, as concurred by Danhauer and colleagues as well (2017, 1340). Therefore, advanced research is recommended to study the impact of yoga on other cancer types and comparisons amongst the studies is also advised.

In addition, this study has elaborated the benefits of yoga in cancer care, which is why further studies into all eight limbs of yoga are needed to verify yoga practice as an evidence-based option in supportive treatment. As well as, yoga could be further explored to study it's influence on biological markers of cancers. Lastly, training in yoga could be provided as a tool to oncology nurses, thus they can encourage over all well-being of cancer patients along with conventional medical treatment.

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# 9 Appendices

| Authors | Publishing year and Country | Purpose | Research Method | Main Findings |
|---|---|---|---|---|
| Chaoul, A., Milbury, K., Spelman, A., Basen-Engquist, K., Hall, M., Wei, Q., Shih, YC., Banu, A., Valero, V., Perkins, G., Babiera, G., Wangyal, T., Engle, R., Harrison, C., Li, Y., and Cohen, L | 2018 USA | Examining the effects of a Tibetan Yoga Program versus a stretching program and usual care on sleep and fatigue in women with breast cancer undergoing chemotherapy | Randomized Controlled Trial | Participating in TYP during chemotherapy resulted in modest short-term benefits in sleep quality, with long-term benefits emerging over time for those who practiced TYP at least two times a week. |
| Chandwani, K., Perkins, G., Nagendra, H., Raghuram, N., Spelman, A., Nagarathna, R., Johnson, K., Fortier, A., Arun, B., Wei, Q., Kirschbaum, C., Haddad, R., Morris, G., Scheetz, J., Chaoul, A., and Cohen, L. | 2014 USA | Examining the incorporation of yoga into radiotherapy for women with breast cancer | Randomized control trial | Yoga group improved Quality of life and physiological changes associated with radiation therapy beyond the benefit of simple stretching exercises and these benefits appeared to have long-term durability. |
| Dhruva, A., Miaskowski, C., Abrams, D., Acree, M., Cooper, B., | 2012 USA | Examining the effects of pranayama on cancer associated symptoms and quality of | Randomized Control Trial | Yoga breathing was a feasible intervention among patients with cancer receiving chemotherapy. Pranayama may im- |

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| Goodman, S., and Hecht, F. | | life and evaluating its feasibility | | prove sleep disturbance, anxiety and mental quality of life. Dose-response relationship was found between pranayama use and improvements in chemotherapy associated symptoms and quality of life. |
| Loudon, A., Barnett, T., Piller, N., Immink, M., and Williams, A. | 2014 Australia | Determining the effect of yoga on women with stage one breast cancer-related lymphoedema | Randomized Controlled Trial | An 8-week yoga intervention reduced tissue induration of the affected upper arm and decreased the QOL sub-scale of symptoms. Arm volume of lymphoedema and extra-cellular fluid did not increase. These benefits did not last on cessation of the intervention when arm volume of lymphoedema increased. |
| Rao, R., Raghuram, N., Nagendra, H., Kodaganur, G., Bilimagga, R., Shashidhara, HP., Diwakar, R., Patil, S., and Rao, N. | 2017 India | Examining the effects of yoga program in comparison with supportive therapy counselling on mood states, treatment-related symptoms, toxicity and quality of life in Stage II and III breast cancer patients o conventional treatment | Randomized Controlled Trail | The results suggest a possible use for yoga as a psychotherapeutic intervention in breast cancer patients undergoing conventional treatment. |

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| Rao, R., Vadiraja, HS., Nagaratna, R., Gopinath, K., Patil, S., Diwakar, R., Shahsidhara, HP., Ajaikumar, BS., and Nagendra, HR | 2017 India | Evaluating the effects of yoga on perceived stress, sleep, diurnal cortisol and natural killer cell counts in patients with metastatic cancer | Randomized Controlled Trial | The results suggest modulation of neuroendocrine responses and improvement in sleep in patients with advanced breast cancer following yoga intervention |
| Rao, R., Nagarathna, R., Nagendra, HR., Usharani, MR., Gopinath, KS., Diwakar R, Patil, S., Bilimagga, R., and Rao, N | 2017 India | Assessing the effects of yoga program in comparison with supportive therapy on self-reported symptoms of depression in breast cancer patients undergoing conventional treatment | Randomized Controlled Trial | The results suggest possible antidepressant effects with yoga intervention in breast cancer patients Undergoing conventional treatment. |
| Vadiraja, H., Rao, R., Nagarathna, R., Nagendra, H., Patil, S., Diwakar, R., Shashidhara, HP., Gopinath, K., and Ajaikumar, B. | 2017 India | Evaluating the effects of yogic intervention in managing fatigue in metastatic breast cancer patients | Randomized Controlled Trial | Yoga reduces fatigue in advanced breast cancer patients. |