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Alternative and Complementary Support for People with Hypothyroidism

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Abstract

Comprehensive care for those suffering from hypothyroidism is not a common practice. General practitioners and nurses tend to focus simply on restoring hormone levels of patients to their proper ranges, but neglect treating the numerous other symptoms and comorbidities that can come along with hypothyroidism. Alternative and complementary therapies are seldom suggested to those with the condition. This leaves many hypothyroid patients feeling that their treatment is suboptimal even when their hormone levels fall within the proper reference range.

The aim of the study is to gain a clearer picture of what alternative and complementary therapies are available to those with hypothyroidism and review their efficacy with the hope that there may be more options that nurses can encourage their patients to explore in the future.

In this systematic scoping literature review, an inductive approach was used to analyze 12 articles. This study is intended to take a comprehensive look at alternative or complementary therapies that could be offered to a hypothyroid patient instead of or in addition to traditional thyroxine-replacement therapy and the research into their current efficacy.

The study questions were categorized are divided into two categories: alternative therapies and complementary therapies. The therapies identified include combination therapy, desiccated thyroid extract, age-, gender-, and ethnicity-specific TSH reference range limits, physical exercise, diet, fatigue-coping strategies, and the time of day medication is taken.

The results reveal that there is a lack of research into this topic. Only a handful of scientific studies have been performed to identify additional therapies for hypothyroid patients and the efficacy of these therapies are still very unclear. This greatly highlights a need for continued studies into this topic with the hope that nursing care can improve for these patients.

Language: English Key words: Hypothyroidism, alternative therapy, complementary therapy, thyroxine, combination therapy, desiccated thyroid extract, iodine intake, physical exercise, fatigue-coping.

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1 Introduction

Comprehensive care with options for those suffering from hypothyroidism is not a common practice. General practitioners and nurses tend to focus simply on restoring hormone levels in a patient to their proper ranges, but neglect treating the numerous other symptoms and comorbidities that can come along with hypothyroidism. Additionally, alternative and complementary therapies are seldom suggested to those with the condition (American Thyroid Association, 2013).

My personal interest in this subject comes from the fact that I was diagnosed with hypothyroidism when I was 15 years old. After many years of receiving thyroid hormone replacement therapy, yet still feeling many intense symptoms that come along with hypothyroidism, I began exploring other treatment options and complementary therapies. However, the doctors and nurses that I encountered rarely had any interest in exploring any other treatment option aside from monitoring thyroid-stimulating hormone (TSH) levels and prescribing a dose of synthetic thyroxine to supplement the current values of T4. These experiences have sparked an interest to investigate what other therapies may be available for hypothyroidism and the effectiveness of these therapies.

In my home country, the United States of America, it is estimated that about 10 million Americans have hypothyroidism, of which most are women. It's possible that as much as 10% of women in the U.S. have some degree of thyroid hormone deficiency and that millions are currently living with hypothyroidism and don't know it (Norman, 2018). Nearly 4.6% of the U.S. population over 12 years of age have hypothyroidism (Griffin, 2012, 23).

Hypothyroidism is considered to be an uncomplicated condition to care for and the use of synthetic thyroxine has been shown to be well-tolerated in the majority of patients. However, the use of synthetic thyroxine is not always satisfactory and the prevalence of patients with TSH levels higher or lower than the reference range is quite common. These discrepancies can be attributed to medication compliance, interference from other medications, or comorbidities that are associated with hypothyroidism. Even so, little research has been done to find a solution to the issue of suboptimal treatment of hypothyroidism and general practitioners and nurses seem to have little knowledge on other interactions that may be limiting synthetic thyroid hormone therapies (Dew, King, Okosieme, Pierce, Donovan, Taylor, Hickey, Dayan, Leese, Razvi, & Wilkes, 2018, 2).

It is important that health care providers understand additional ailments and interactions caused by having hypothyroidism and that they have the ability to coach their patients on how to ensure they are receiving optimal treatment. Simple suggestions include nutrition and supplements that benefit or inhibit thyroid function, beneficial herbs and physical therapies, as well lifestyle changes which may help a person with hypothyroidism to feel better amidst their ongoing symptoms (Grunebaum, 2014).

2 Background of the study

There are many concepts to explore in the topic of alternative and complementary therapies for those with hypothyroidism. These concepts can be broken down into four key categories: hypothyroidism condition, alternative therapies, complementary therapies, and current nursing interventions. Additionally, it is vital to explore previous research in this area to determine what, if any, progress is being made.

2.1 Hypothyroidism

Hypothyroidism is indicated by a deficiency in thyroid hormone production in the thyroid gland. The level of deficiency can be severe or moderate. A severe deficit of thyroid hormones is called overt hypothyroidism. The more moderate form of hypothyroidism is called subclinical hypothyroidism and can often go unnoticed, as it seldom has signs and symptoms (Brenta, Vaisman, Sgarbi, Bergoglio, Carvalho de Andrada, Pineda Bravo, Orlandi, & Graf, 2018, 268). There are primary and secondary causes of hypothyroidism. The known primary causes are spontaneous atrophic (autoimmune destruction of the gland), goitrous thyroiditis (including Hashimoto's disease, drug-induced, iodine deficiency, and dyshormonogenesis or genetic enzyme defects), post-ablative (following radioactive iodine), post-thyroid surgery, transient, subclinical, or congenital. The known secondary causes are pituitary failure, hypothalamic failure, or post-pituitary surgery (Carson, 2009, 50). Figure 1 demonstrates the most common causes of both primary and secondary hypothyroidism (Kostoglou-Athanassiou and Ntalles, 2010, 83).

Primary	Secondary (central)
	a. Pituitary
1. Chronic autoimmune thyroiditis	1. Pituitary adenomas
2. Iodine deficiency or excess	2. History of pituitary surgery or radiotherapy
3. Thyroidectomy	3. History of head trauma
4. Therapy with radioactive iodine	4. History of pituitary apoplexy
5. External radiotherapy	**b. Hypothalamus**
6. Drugs	1. Hypothalamic or suprasellar tumors
7. Thyroid agenesis or dysgenesis	2. History of hypothalamic surgery or radiotherapy

Figure 1: Causes of Primary and Secondary Hypothyroidism.

Women, particularly those over the age of 60, are more likely to have hypothyroidism. While hypothyroidism often does not show symptoms in the early stages, if left untreated it can cause a number of other health problems, such as obesity, joint problems, infertility, and cardiac disease and the signs and symptoms of hypothyroidism can become more severe. The constant stimulation to release more hormones can cause an enlarged thyroid (goiter). If the hypothyroidism becomes more advanced, it is known as myxedema. Although myxedema is rare, it is a very serious condition and can be life-threatening. Signs and symptoms can include low blood pressure, lowered breathing, low body temperature, unresponsiveness, and coma. In some cases, myxedema can cause death (Mayo Clinic, 2018).

Hypothyroidism affects all types of people, regardless of age, sex, race, economic standing, or level of education. It is one of the most common diseases associated with the thyroid (American Thyroid Association, 2013, 4).

2.1.1 Autoimmune Disease

Autoimmune disease is classified as a condition in which the immune system attacks the body by mistake. Typically, the immune system should guard against bacteria and viruses by sending out cells to attack them. In this defense, the immune system can tell the difference between foreign cells and the body's own cells. However, in autoimmune disease, a part of the body is seen as foreign and autoantibodies are released to attack it. In the case of hypothyroidism, only the thyroid is targeted. In some other disorders, the immune system can affect the whole body (Watson, 2017).

The immune system's attack on the cells in the thyroid result in inflammation and damage, which inhibits the ability to produce thyroid hormone. Once ample thyroid cells have been attacked, there are not enough left over to meet the body's constant need for thyroid hormone. The autoimmune effect on the thyroid can begin suddenly, but it is typically developed slowly over many years (American Thyroid Association, 2013, 7).

2.1.2 Thyroid Gland

The thyroid gland is an organ located in the base of the neck and is shaped like a butterfly. It releases hormones that controls metabolism and regulate other vital body functions. Such functions include breathing, heart rate, central and peripheral nervous systems, body weight, muscle strength, menstrual cycles, body temperature, and cholesterol levels. It works by

producing, storing, and releasing hormones into the bloodstream to be sent to the body's cells. It uses iodine from foods ingested to make triiodothyronine (T3) and thyroxine (T4) (Brady, 2018).

The thyroid gland is extremely vascular, which requires a high blood supply from the superior and inferior thyroid arteries. It is one of the largest endocrine glands and weighs roughly 30 grams. It is the only endocrine gland that keeps large stores of hormones, with the average stores being enough for a 100-day supply of thyroid hormones (Carson, 2009, 49).

T4 and T3 are produced and secreted by the thyroid. The production of T4 and T3 relies heavily on the amount of iodine in the diet, from sources such as table salt, milk, seafood, and produce grown in iodine-rich soil. Dietary iodine is absorbed from the small intestine and turned into iodide. It is then sent through the blood to the thyroid gland, where the thyroid cells accept it. Using this process, called iodide trapping, the thyroid can produce more T4 and T3 (Carson, 2009, 49).

If the levels of T4 and T3 fall, the hypothalamus will release thyroid-releasing hormone (TRH). The release of TRH can be encouraged by factors such as exercise, malnutrition, stress, and sleep. Once the levels of TRH rise, the anterior pituitary gland begins secreting thyroid-stimulating hormone (TSH). This TSH then promotes the thyroid gland to produce and release more T4 and T3 in an ever-flowing cycle (Carson, 2009, 49-50).

2.1.3 Thyroid Stimulating Hormone (TSH)

Thyroid stimulating hormone (TSH) is produced in the pituitary gland. Its purpose is to regulate the amount of hormones released by the thyroid. If more TSH is produced, the thyroid will produce more T3 and T4 to be released into the bloodstream. The two glands work together to ensure the correct amount of thyroid hormones are produced. However, this cooperation is disrupted in a person with hypothyroidism (Reed-Guy, 2016).

2.1.4 Reference/Normal Range

Doctors use a set of reference values to interpret a patient's test results. The reference range, or normal range, are the values that are seen in 95% of the healthy population. However, a patient with values outside of the reference range may still be healthy and some with test results within the reference range may have a health problem ("Normal Range", n.d.). The

normal range of thyroid-stimulating hormone levels is 0.4 to 4.0 milli-international units per liter. However, if a patient is already being treated for hypothyroidism, the normal range can be between 0.5 to 3.0 milli-international units per liter (Reed-Guy, 2016).

The normal and abnormal TSH levels, measured in mU/L, can be put simply as follows:

0.0 – 0.4	0.4 – 4.0	4.0 – 10.0	Over 10.0
Hyperthyroidism or suppressed TSH	Normal range of TSH	Subclinical (mild) hypothyroidism	Hypothyroidism

Figure 2: Normal and Abnormal TSH Levels.

(American Thyroid Association, 2013, 10).

2.1.5 Signs and Symptoms

The symptoms of hypothyroidism are vast. Unfortunately, a great deal of hypothyroidism symptoms can be confused with other health conditions. In general, hypothyroidism causes many body processes to slow. This slowing can cause a person to feel cold and tired, have dry skin, and show increases in forgetfulness, depression, and constipation. These symptoms typically appear very slowly, sometimes over the course of many years. However, in some cases, the onset can be more swift. The lower the thyroid levels drop, the more severe these symptoms may be (American Thyroid Association, 2013, 5).

According to the American Thyroid Association, some of the most common symptoms are:

- Decreased energy
- Increased fatigue, need for rest, and falling asleep during the day
- Decreased sweating
- Feeling cold even when others around feel warm
- Dry, itchy skin
- Increased hair loss
- Dry, coarse, and brittle hair
- Appetite loss
- Mild weight gain and trouble losing weight
- Snoring that was not present previously
- Memory problems
- Muscle cramps and aches in the bones and joints
- Paresthesia
- Increased constipation

- Puffy appearance in the face, hands, ankles, and feet
- Heavier and/or increased frequency with menstrual periods, more severe cramping, more severe premenstrual symptoms, and discharge from the breasts
- Irritability
- Increase in depression
- Goiter
- Increase in hearing loss
- Slow heart rate
- Higher cholesterol
- Higher blood pressure
- Delays in growth for children

(American Thyroid Association, 2013, 6).

2.1.6 Risk Factors

There are many factors which may contribute to the development of hypothyroidism. For example, family history of the disease may play a role in a person being diagnosed with it. Family history includes all of the unseen traits that a family shares. These traits can be indicators of risk for numerous genetic conditions and diseases. Such conditions include cancer, diabetes, asthma, heart disease, Alzheimer's disease, depression, and, of course, hypothyroidism (Holland, 2016). Having a close relative, such as a parent or grandparent, who has an autoimmune disease (not necessarily hypothyroidism) is a factor that contributes to the risk of a person developing hypothyroidism (American Thyroid Association, 2013, 5).

Other common risk factors of hypothyroidism include increased age, being white or Asian, having thyroid surgery, having Down syndrome or Turner syndrome, having bi-polar disease (manic depression), and having been treated with radioactive iodine to the neck or upper chest. In addition, women are at a much higher risk of developing hypothyroidism. This risk increases during pregnancy, post-delivery, and during menopause (American Thyroid Association, 2013, 5).

2.1.7 Causes

As with the vast number of symptoms related to hypothyroidism, the causes can also vary greatly. The most common cause of hypothyroidism is autoimmune disease, which has already been discussed in greater detail in section 2.1.1. The second most common cause of

hypothyroidism is the surgical removal of part or the entire thyroid. This removal is usually due to nodules, cancer, or Graves' disease. If the thyroid is completely removed or if the leftover thyroid tissue does not function properly, hypothyroidism is a result (American Thyroid Association, 2013, 7).

The third most common cause of hypothyroidism is radiation treatment. Much like the reasoning for surgery, radiation that destroys thyroid cells is typically due to Graves' disease, nodular goiter, or thyroid cancer. Radioactive iodine is used in the treatment and destroys the thyroid, which results in hypothyroidism. Non-related diseases, such as Hodgkin's disease, lymphoma, or cancers in the head or neck are also treated with radiation which may destroy the thyroid and result in decreased function (American Thyroid Association, 2013, 7).

The fourth leading cause of hypothyroidism is as a congenital (from birth) condition. According to the American Thyroid Association, roughly 1 in 4000 babies are born every year without a thyroid or with a partially-formed thyroid. Some babies can have part or all of their thyroid in the wrong location (ectopic thyroid). For some babies, the thyroid cells do no work correctly or they may make enough hormone for a short time, but slows functioning later in life (American Thyroid Association, 2013, 7).

Thyroiditis is the fifth most common cause of hypothyroidism. This is defined by the inflammation of the thyroid. Typically, it is due to an autoimmune attack or from a viral infection. This condition can cause the thyroid to release all of its hormone stores at once. This causes the thyroid to become overactive for a short time and then underactive once all of the hormones have been released. If the cause is viral, most people recover completely and their thyroid function stabilizes, but 25% with autoimmune thyroiditis have permanent lowered thyroid function (American Thyroid Association, 2013, 8).

Medications can interfere with thyroid function, which can lead to a lowered function. Most commonly, lithium can cause hypothyroidism. Other common medicines which can inhibit thyroid function are amiodarone, interleukin-2, and interferon alpha. These drugs are highly likely to trigger hypothyroidism in those who already have a genetic predisposition to autoimmune thyroid disease (American Thyroid Association, 2013, 8).

Unacceptable amounts of iodine is the seventh most common cause of hypothyroidism. Because the thyroid must have iodine to make thyroid hormone, the proper levels must be consumed. Those who live in poorer part of the world may not get enough iodine in their

diet, which could lead to decreased function of the thyroid and ultimately hypothyroidism. If hypothyroidism is looked at on a global perspective, iodine deficiency is the most common cause of hypothyroidism, but it is rare in developed countries. Conversely, too much iodine in the diet can also cause hypothyroidism (American Thyroid Association, 2013, 8).

Lastly, hypothyroidism can be caused by damage to the pituitary gland. Since the pituitary gland communicates with the thyroid about how much hormone to make, damage will cause it to send incorrect directions. Pituitary gland damage can occur through injury, tumor, radiation, or surgery (American Thyroid Association, 2013, 8).

2.1.8 Diagnosis

Diagnosis is defined as the act of identifying a disease, illness, or problem by using its signs and symptoms. Diagnosis can also include the investigation of the cause or nature of the condition ("Diagnosis", n.d.).

Diagnosing hypothyroidism is not possible using just symptoms alone because many of the symptoms can also occur in those with a normally functioning thyroid. The symptoms, instead, act as clues to conditions and additional testing must be done. One common indicator that a person may have hypothyroidism is if their symptoms show a change in how they used to feel. In addition, a medical and family history is typically taken along with a physical exam. These examinations can give indicators as to whether hypothyroidism is a likely diagnosis (American Thyroid Association, 2013, 9).

Diagnosing hypothyroidism is typically done using a whole picture of many health aspects, including blood tests and symptoms. Since hypothyroidism is more common in older women, many doctors recommend that they be screened for the disorder as a part of routine examinations. Blood tests measure the levels of TSH and, on occasion, the level of thyroxine. Low levels of thyroxine and high levels of TSH indicate that the thyroid is functioning under normal values. The pituitary gland is producing more TSH to try to activate the thyroid into producing more thyroxine (Mayo Clinic, 2018).

2.2 Alternative Therapies

Alternative therapy can be defined as a medical system or practice that is not usually recommended in standard care (American Thyroid Association, 2013).

2.2.1 Alternative Medications and Extracts

These medications are defined as medications and animal extracts that contain thyroid hormones. Extracts typically come from the thyroid glands of pigs and contain both T4 and T3. These animal extracts can often be unreliable in many cases, so they are not typically recommended (Holland, 2017).

2.3 Complementary Therapies

Complementary therapy is a therapy designed to go along with the conventional treatment with levothyroxine. If successful, it can help to alleviate some of the symptoms a hypothyroid patient experiences even when their blood tests show they are within reference range. Complementary therapies should not be used in place of conventional treatment (Grunebaum, 2014).

2.3.1 Dietary Recommendations

Dietary recommendations can be defined as dietary strategies that help promote thyroid function. These strategies include eating a balanced diet that includes adequate amounts of iodine, limiting soy intake, avoiding too much fiber, and not taking thyroid medicine with other supplements (Holland, 2017).

2.3.2 Fatigue Coping Strategies

Fatigue coping strategies can be defined as routines and techniques that help to combat low energy levels. These strategies include getting quality sleep, eating a diet rich in fruits and vegetables, meditation, and yoga (Holland, 2017).

2.3.3 Exercise

Exercise is a group of physical activities used to promote health and strengthen the body. Since hypothyroidism can trigger muscle and joint pain, a regular exercise routine can help to alleviate these symptoms. Examples include low-impact workouts, strength training, and cardiovascular training (Madhusoodanan, 2015).

2.4 Current Interventions

Hypothyroidism is a lifelong condition that requires consistent monitoring and symptom alleviation techniques. The current common interventions for hypothyroidism include regular blood tests and maintaining a dose of synthetic thyroxine (Holland, 2017).

2.4.1 Monitoring Hypothyroidism

Doctors and nurses may ask if the patient is experiencing any symptoms of hypothyroidism, even with treatment. Blood tests will be used to measure how much TSH the pituitary gland is making. In addition, a thyroxine (T4) test may also be used to help in the evaluation of thyroid function and how the medication is performing. Typically, if there is a low level of T4 and a high level of TSH, the medication dosage is too small (Holland, 2017).

2.4.2 Medications

Synthetic thyroid hormone, called thyroxine or levothyroxine, is used as the standard treatment for hypothyroidism. This synthetic hormone mimics the natural hormone and is very similar to the T4 that is produced and released by the thyroid gland. These synthetic thyroid hormones deliver a steady, prolonged dose of the T4 that is lacking in a hypothyroid patient. Dosage and adjustments are determined by checking that the thyroid stimulating hormones are within the reference range (Berber, 2018).

The purpose of levothyroxine is to return an appropriate level of thyroid hormone to the blood and make symptoms of the disease more manageable. Typically, this medication will be taken by a hypothyroidism patient for the rest of their lives, with dosages regularly being varied by blood test results (Holland, 2017).

Hypothyroidism cases which are uncomplicated are treated solely with this synthetic T4, which comes in 25, 50, and 100 microgram tablets. The treatment is started with a low dose between 25-50 micrograms and then gradually increased every three to four weeks until the TSH level normalizes. Typical doses are between 100-200 micrograms per day. These tablets are usually taken in the morning on an empty stomach and only once per day. With this treatment, symptoms should begin to subside in roughly two to four weeks (Carson, 2009, 53).

3 Theoretical Framework

As a framework for this thesis, the Uncertainty in Illness Theory by Merle H. Mishel was used. This theory outlines how a patient's uncertainty about their chronic or acute illness can influence their outlook. This theory is used to describe the changed experienced by these individuals and their families. The theory was created through Mishel's own experiences with her father's battle with cancer as well as her dissertation research working with hospitalized patients. During her research, she found that those who were chronically or acutely ill tended to focus on events that others deemed unimportant. She recognized that those events made the individuals feel like they had a sense of control over what was happening to them and helped to prevent them from becoming overwhelmed by their situation. Mishel recognized that it could be important for medical professionals to recognize this behavior to influence how they cared for their patients (Alligood, 2018, 447-456).

Merle H. Mishel developed and tested the Perceived Ambiguity in Illness Scale, which was later named the Mishel Uncertainty in Illness Scale (MUIS-A), during her doctoral dissertation research in 1980. The original scale has been used as a foundation for three additional scales called MUIS-C, PPUS, and PPUS-FM. MUIS-C is a community version of the scale for chronically ill individuals who are not hospitalized or receiving medical care. PPUS is used to measure parents' perceptions of uncertainty in relation to their child's illness. Lastly, PPUS-FM is used to measure uncertainty in spouses or other family members when a family member is acutely ill (Alligood, 2018, 447-456).

The Uncertainty in Illness theory was created during Mishel's dissertation research with hospital patients. She used both qualitative and quantitative outcomes to create the first theory of uncertainty in regards to illness. During her research, the concept of uncertainty had not yet been used in a health and illness context. She used multiple other models to form a basis for her own theory, such as Hamilton and Warburton's information-processing model and Budner's personality model (Alligood, 2018, 447-456). Hamilton and Warburton's model was created to measure stress and cognition (Hamilton & Warburton, 1979). Budner's model was created to measure how intelligence relates to tolerance of ambiguity and English proficiency (Budner, 1984, 29-50).

The theory was restructured in the 1990s to include the Western approach to science, which uses a more mechanistic view and stresses control and predictability. With this reconceptualization, Mishel recognized bias built into the original theory and decided to use

principles from chaos theory and other open systems to get a more accurate reading on how chronic illness affects people and how they must continually find new meaning in their illness (Alligood, 2018, 447-456).

Mishel's original Uncertainty in Illness Theory, which was published in 1988, included many major assumptions (Figure 3). The main concepts are:

1. Uncertainty is an intellectual state which represents shortcomings in an existing cognitive schema to support illness-related events.
2. Uncertainty is a fundamentally impartial experience which isn't desirable or unfavorable until it is deemed as such.
3. Adaptation represents continuity in the individual's usual behavior. The preferred outcome of managing is to reduce uncertainty that could be seen as danger or maintain uncertainty that could be seen as opportunity.
4. The relationship among illness events, uncertainty, assessment, managing, and adjustment are linear and unidirectional, moving from situations that make the person feel uncertain towards adaptation.

(Alligood, 2018, 447-456)

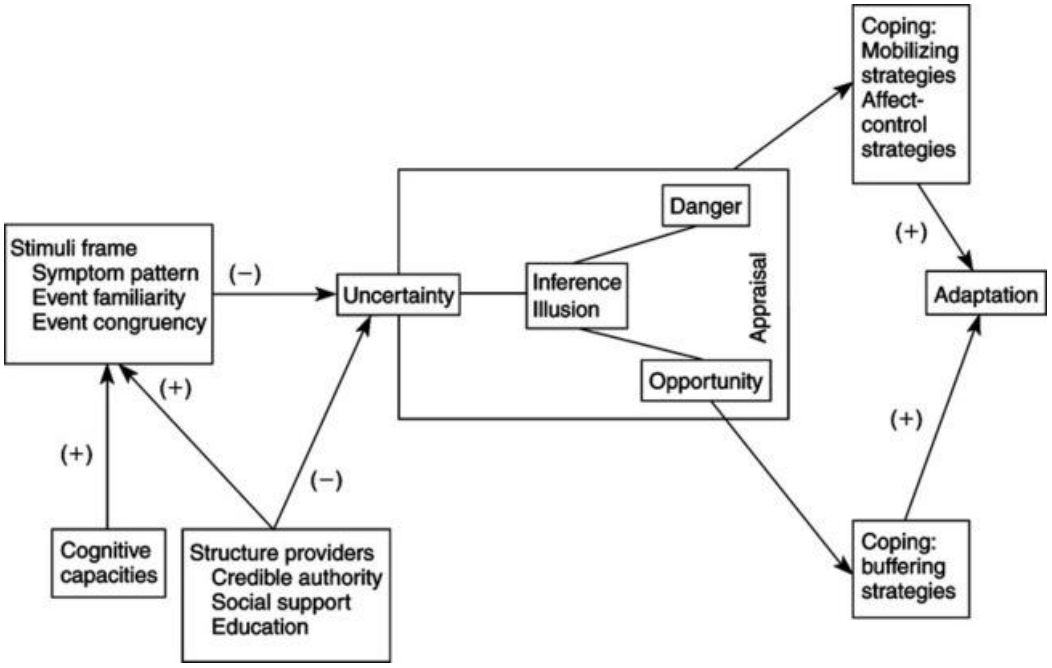

Figure 3: Model of Perceived Uncertainty in Illness.

(Mishel, 1990, 258)

When the theory was adjusted in the 1990s, the 3rd and 4th theories were altered due to her findings in both Western medicine and in contradictory findings when the theory was applied. Mishel and others found that people viewed uncertainty as an opportunity even when their condition did not have a certain downward trajectory. In these situations, especially in those who had long-term chronic illnesses, people tended to develop a new view of life instead (Alligood, 2018, 447-456). According to Mishel, the original assumption is indicative of cultural values that uncertainty is a negative experience and is not favorable when compared to certainty (Mishel, 1990, 258).

Chaos theories were then introduced to explain how long-term uncertainty could become a stimulus to change a person's outlook on life and illness. From this, three additional assumptions were added to replace the linear stress assumptions in the theory:

1. People usually function in far-from-equilibrium states.
2. Major fluctuations enhance the system's receptivity to change.
3. Fluctuations result in adjustments.

(Alligood, 2018, 447-456)

These new assumptions caused Mishel to think that chronic uncertainty causes people to move away from uncertainty as negative to a new way of life that accepts uncertainty. Therefore, uncertainty can then result in a new level of organization and a new outlook on life which incorporates growth and change (Figure 4). For the purpose of this study, the updated assumptions will be utilized to describe how those undergoing hypothyroid treatment can still experience fluctuations and non-equilibrium. However, these fluctuations should be seen as motivating factors to explore various treatments and potentially accept that these fluctuations cannot be changed.

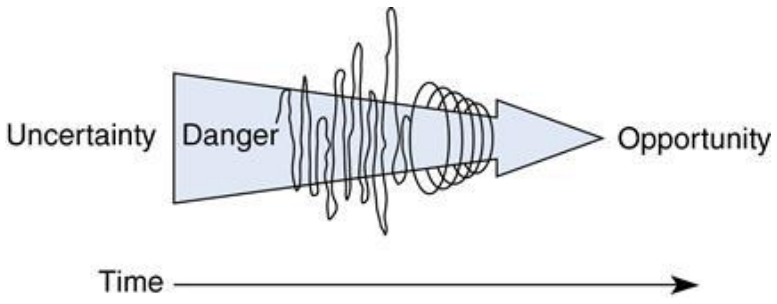

Figure 4: Reconceptualization Model of Uncertainty in Chronic Illness.

(Alligood, 2018, 447-456)

The Uncertainty in Illness Theory is invaluable to future nurses. It provides a guideline for how an ill patient may be experiencing their illness and how their outlook may be affected by additional information and support. Nursing interventions can be used to ensure the patient experiences optimal adjustments to their illness and continues to alter their outlook as the disease potentially changes. The theory helps to define many components regarding the diagnosis and treatment of chronic or acute disease and help guide medical professionals in providing information and support to their patients for a more positive outcome (Alligood, 2018, 447-456).

The Uncertainty in Illness Theory is a very valuable tool in working with patients. Although an individual may be faced with a lifelong, acute, or fatal disease, it could be possible to alter their outlook by providing education and support. The more a patient knows, the more certainty they have going forward by knowing what they might expect from their illness.

Mishel's Uncertainty in Illness Theory is of great interest because it provides a way to measure how knowledgeable a patient is about their illness and how that can in turn influence the way they feel about their condition and their future outlook. This theory can be applied to chronic, long-lasting and acute illnesses. In this way, it is a great tool for those suffering from thyroid disorders, such as hypothyroidism. Because hypothyroidism has no absolute cure and requires a lifetime of monitoring and medication, it is important that thyroid patients have a clear understanding of how their disease manifests and when to seek additional medical intervention.

For thyroid patients, it is important that a healthcare provider recognizes the ever-changing symptoms and struggles of the patient and can provide both care and coaching to help them deal with their condition. Although thyroid diseases are not considered to be acute (in most cases), they require day-to-day care in eating habits, exercise, vitamin levels, sleep, medication regimens, and care for other secondary ailments caused by the disease. In this sense, the Uncertainty in Illness Theory is a great tool to use for those with hypothyroidism because the more knowledgeable a patient is about the hypothyroid disease, the more secondary effects they may be able to prevent. Not only does the increased knowledge create a better attitude for the patient, but it could be used in the prevention of future complications of the disease. However, in many instance, a hypothyroid patient must also accept that their treatment and symptoms can be in far-from-equilibrium states. This theory can also be utilized in this way in order to enable hypothyroid patients to see this non-linear trajectory as a sort of opportunity to explore other methods to alleviate their symptoms.

4 Aim and Problem Definition

Currently, many healthcare practitioners and nurses tend to focus simply on restoring hormone levels in a hypothyroid patient to their proper ranges simply by using the synthetic hormone replacement Thyroxine. However, many patients still feel suboptimal with this treatment. Therefore, the overall aim of the study is to gain a clearer picture of what therapies are available to those with hypothyroidism and review their efficacy with the hope that there may be more options that nurses can encourage their patients to explore in the future. To do this, it is necessary to investigate the current interventions and what studies are being conducted regarding alternative and complementary therapies for those with hypothyroid disease. This study is intended to take a comprehensive look at alternative or complementary therapies that could be offered to a hypothyroid patient instead of or in addition to traditional thyroxine-replacement therapy and the research into their current efficacy.

The following questions will be explored:

- What alternative therapies are there for those with hypothyroidism?
- What complementary therapies are there for those with hypothyroidism?

5 Method

The intent is to find out about alternative or complementary therapies for hypothyroid patients. This will be achieved through a scoping literature review, which may include a mix of qualitative and quantitative studies, of previous studies and research on the topic. The goal is to gain a comprehensive overview of what therapies are available to those with hypothyroidism and review their efficacy with the hope that there may be more options for hypothyroid treatment that can be offered in the future. Since the target group, hypothyroid patients, is difficult to make contact with or observe in person, a scoping literature review is the most thorough and reliable approach to this topic.

5.1 Ethical Considerations

There are some ethical considerations to keep in mind when conducting a literature review. Typically, it is important that the interaction between the researchers and the participants be ethically sound, but since this is a literature review, there is no need to focus on the issues of anonymity, confidentiality, informed consent, and impacts from either the participants or

researchers on the study (Sanjari, Bahramnezhad, Fomani, Shoghi, & Cheraghi, 2014, 1). However, even though a literature review does not usually provide absolute insight as to whether these protocols were employed, it is still important to be extremely critical of the studies used.

In performing a literature review, it is important to focus on the hypothyroid issues previously presented and review other studies that can be built upon. These previous studies can be used to create a more comprehensive insight into the alternative and complementary treatments available to hypothyroid patients, but if it happens that the information has already been specifically researched and provided in a previous study, it could be unethical to research the same issue. In order to use the previous studies in an ethical way, they should be viewed as raw data that is analyzed and interpreted anew. However, it is also important that the work of the previous research studies be presented with accuracy and fairness (The Research Ethics Guidebook, n.d.).

One of the most important ethical considerations is to avoid plagiarism. Plagiarism refers to the use of another's words, images, ideas, data, or original works without citing the original creator, thereby claiming them as your own works. Other people's work may only be described in one's own words and with proper citations (Wager, E. & Wiffe, P.J., 2011, 132).

5.2 Systematic Scoping Literature Review

Data collection will be achieved through exhaustive research into studies on alternative and complementary therapies for hypothyroid patients. Additionally, it is important to also research current methods being employed in the treatment of these patients. In the process of achieving a comprehensive overview, there may also be studies on coinciding conditions, such as celiac disease, that are prominent in hypothyroid patients and how treatment could be altered based on these or similar comorbidities, but they will be excluded for the purpose of this study.

In the scoping literature review, previous qualitative and quantitative research will be used. Because the topic of alternative and complementary therapies for hypothyroid patients has such a limited amount of current studies, a scoping review is most beneficial because it can identify potential underserviced areas of information. A scoping study can also bring attention to and validate further research into a topic (Coughlan, Cronin, & Ryan, 2013, 19-23).

5.3 Data Collection

According to Coughlan, Cronin & Ryan (2013, 38-40), the first step in finding studies for inclusion in a literature review should be detailing the criteria which will be included or excluded. These criteria can help to create a search strategy that focuses on literature only pertinent to the parameters of the objective in question. These criteria can include defining search terminology, defining how literature is found, timelines for which the studies should fall within, or the language of the articles. These criteria are often defined in order to reduce the potential for bias. These criteria must include justification as they can influence the validity of the overall findings of the study.

For the purposes of this study, modern research will be the most valuable. Therefore, only articles published between the years 2004 and 2019 will be included. Additionally, only articles that are in English will be included. There is the potential that these criteria could lead to missing important information, but it will help to ensure the most up-to-date and accessible information is included. Additionally, only peer-reviewed articles with the full text available will be considered. The articles must focus on alternative or complementary therapies for hypothyroid patients, but without other focus on comorbidities.

Research is conducted through exhaustive database searches. These databases include NCBI (National Center for Biotechnology Information), Research Gate, and EBSCO. Study searches are documented thoroughly (Appendix 1) and the pertinent articles will be systematically reviewed (Appendix 2) to define an unbiased strategy for including complementary and alternative hypothyroidism therapies in nursing interventions.

The main search terms will always include ‘hypothyroid’ to ensure only studies about hypothyroidism are included. In addition, ‘alternative’, ‘management’, ‘combination therapy’, ‘treatment’, and ‘nutrition’ may be added to yield additional results.

5.4 Data Analysis

Data analysis involves organizing and analyzing the studies collected in an effort to draw conclusions on the research questions of the study. Because analyzing qualitative data can be confusing because it lacks structure, the researcher must use proper methodology to classify the information they are studying. The main purposes of data analysis are to organize the data, interpret the data, identify patterns, relate the data to the research aim, and develop informed and provable conclusions (Achievability, 2018).

Analyzing qualitative data does not follow an inflexible process, but there are two main approaches that can be followed: a deductive approach and an inductive approach. For the purpose of this study, the inductive approach will be utilized. This approach is not based on preexisting knowledge of the study phenomenon. Using this approach, the following steps will be used:

- 1. Document the data collection process: Search histories will be recorded and applicable articles prepared for categorizing.
- 2. Organize the data: Using the research questions, the studies will be separated into two categories – complementary therapies and alternative therapies.
- 3. Code the data: Once the studies have been categorized, they will be individually coded to look for related concepts and properties. The coding process will also include efficacy rates and how much research has been completed on the therapy, if known.
- 4. Validate the data: It is vital to ensure that the methods employed in this study are accurate and that they could be reliably replicated. Transparency in the methods employed is vital in this step.
- 5. Report findings and form a conclusion: State the findings of the study in relation to the research aim and questions. There must be a link between the data that has been analyzed and the research questions. In this step, pros and cons of the study and limitations will be stated.

(Schutt, 2012, 362).

6 Presentation of Result

This chapter will focus on answering the research questions indicated in chapter 4 with information gathered from the studies that related to this scoping literature review. A search history was recorded (Appendix 1) with applicable articles (Appendix 2) being separated into two main categories. From these two main categories, seven subcategories were identified regarding alternative and complementary therapies for hypothyroid patients.

6.1 Use of Alternative Therapies

Through coding and analyzing the articles which focused on alternative therapies, three main themes were identified: combination therapy, treatment using desiccated thyroid extract, and alternative hypothyroid treatment based on age-, gender-, and ethnicity-specific TSH reference range limits.

6.1.1 Combination Therapy

Studies on combination therapy for hypothyroid patients appear to be the most common alternative treatment method as the topic yielded the most results and legitimized studies. Combination therapy involves using doses of both thyroxine (also known as levothyroxine, l-thyroxine, or LT-4) and triiodothyronine (also known as liothyronine, levotriiodothyronine, or LT-3) instead of the traditional therapy using only thyroxine (also known as thyroxine monotherapy). Combination therapy has been studied due to the many complaints hypothyroid patients have in their overall condition despite using thyroxine monotherapy and maintaining acceptable serum TSH values. Previous studies performed on rats showed that thyroxine monotherapy was insufficient to ensure euthyroidism (normal thyroid gland function) in all tissues. Euthyroidism was only reached using a combination of thyroxine and triiodothyronine. Using these findings, it was hypothesized that thyroxine monotherapy could be insufficient in humans to maintain euthyroidism in all tissues as well (Appelhof, Fliers, Wekking, Schene, Huyser, Tijssen, Endert, van Weert, & Wiersinga, 2005, 2666).

The analyzed studies of combination therapy focused on many aspects of patient health compared to their thyroxine monotherapy counterparts. According to one study, the most common complaints of those using thyroxine monotherapy include fatigue (91% of study participants), constipation (42% of study participants), and pain (49% of study participants). Comparatively, these symptoms have been measured in lower frequencies in hypothyroid patients who were completely untreated (Michaelsson, Medici, la Cour, Selmer, Røder, Perrild, Knudsen, Faber, Nygaard, 2015, 179). This finding greatly highlighted the need to explore combination therapy or other treatment options for hypothyroid patients.

Although combination therapy appears to be the most explored alternative treatment for hypothyroid patients, the effects and benefits are still very unclear. In Denmark, the use of combination treatment greatly increased after a hypothyroid patient named Helle Sydendal published a book detailing her recovery on combination therapy and urged others to explore

the same treatment. Thereafter, clinicians in Denmark noted an increased demand for combination therapy and many began prescribing the treatment to patients despite an insufficient level of previous research which displayed the efficacy of the treatment (Michaelsson, et al., 2015, 175).

While some studies noted a preference for combination therapy, the cause of this was also analyzed as potentially not being from the therapy itself. One study found that patients noted overall improvements on nearly all scales despite whether they were on combination therapy or monotherapy. The study theorized that this improvement was related to the Hawthorne effect, which occurs when routine self-care is improved during a trial because the patient is being studied. In other words, the patients adhered more strictly to their treatment plan than they would have outside of the study. The same study showed that the general outcome was in support of combination therapy, but that it was still not recommended based on the fact that results could have been skewed due to a number of subjective factors rather than objective factors. For example, patients on combination therapy lost more weight on average, but this was most likely due to an overdose of triiodothyronine rather than better treatment (Appelhof, et al., 2005, 2672). Therefore, although combination therapy may prove to be beneficial to some patients, there are also risks associated with it that are not present with thyroxine monotherapy. Triiodothyronine comes with an easier potential to overdose, leading to the suppression of TSH. This suppression comes with an increased risk for complications such as heart disease and osteoporosis (Michaelsson, et al., 2015, 175).

Another study on combination therapy focused on three single nucleotide polymorphisms (SNPs) on the type II iodothyronine deiodinase (DIO2) gene as well as one SNP on the cellular membrane transport-facilitating monocarboxylate transporter (MCT10) gene. Patients were separated into two groups and given three consecutive months of monotherapy followed by three consecutive months of combination therapy or vice versa. An evaluation was done to identify in which of the two treatment periods the patients showed improvement. Using genotyping, improvements were compared to the specific polymorphisms the patients exhibited to see if there was a genetic preference to monotherapy or combination therapy. The study found that patients who exhibited two specific polymorphisms in MCT10 and DIO2 were more likely to show improvement on combination therapy. This study suggests the future possibility to individually customize specific hypothyroid treatments based on the genetic structure of the patient (Carlé, Faber, Steffensen, Laurberg, & Nygaard, 2017, 143).

6.1.2 Desiccated Thyroid Extract

The use of desiccated thyroid extract has been ongoing since the 19th century. However, it is still considered to be an alternative treatment for hypothyroidism due to the lack of traditional studies into its use as a treatment for the condition. In one study, patients who were on a consistent dose of thyroxine for at least six months were randomized to either continue taking thyroxine or to switch to desiccated thyroid extract in capsules that looked identical. The primary outcome showed no difference in symptoms, general health, or neuropsychology. However, patients using desiccated thyroid extract showed an overall decrease in weight and the treatment was preferred by the highest percentage of study participants. Patients using desiccated thyroid extract also showed improvements in mental health and did not show any significant adverse effects of the treatment. However, the study was completed on only 70 patients, highlighting the fact that larger studies with longer intervals is required to justify these results (Hoang, Olsen, Mai, Clyde, & Shakir, 2013, 1983-1989).

6.1.3 Age-, Gender-, and Ethnicity-Specific TSH Reference Range Limits

The use of age-, gender-, and ethnicity-specific TSH reference range limits may not necessarily be considered an alternative treatment, it could be used to prescribe traditional medications in an alternative fashion based on these patient-specific ranges. Currently, TSH reference ranges are based on an averaged curve of measurements among all people. However, studies have shown that TSH reference limits can vary based on age and/or racial/ethnic groups. For example, multiple studies have shown that an acceptable serum TSH level in black individuals is actually lower than in white individuals, which means that the possibility of a white individual incorrectly being diagnosed or treated for hypothyroidism could be higher. One study used a large population that is representative of the United States' composition to show how TSH reference range limits differ based on environmental influences, genetic and/or ethnic background, and age. These specific TSH reference ranges could be used to both properly diagnose and prescribe appropriate dosages of medications to different groups of people (Boucai, Hollowell, & Surks, 2011, 5).

6.2 Use of Complementary Therapies

Through coding and analyzing the articles which focused on complementary therapies, four main themes were identified: physical exercise, diet, fatigue-coping strategies, and whether there was a difference between morning or evening intake of hypothyroid medication.

6.2.1 Physical Exercise

The effect of physical exercise on thyroid hormones appeared to be the most popular method studied among any other complementary therapy for hypothyroidism. Three separate studies were analyzed on how different techniques can affect thyroid function: exercise intensity, regular physical exercise, and yoga.

A study which focused on how exercise intensity affected thyroid hormones was not directed at hypothyroid patients, but the practice could be used to help hypothyroid patients in their treatment. The study measured three levels of exercise intensity: low intensity (45% of maximum heart rate), moderate intensity (70% of maximum heart rate), and high intensity (90% of maximum heart rate). Levels of lactate, T3, free T3, T4, free T4, and TSH were measured at each intensity. The study found that the maximum rate of hormone increase occurred in the moderate intensity range, with the exception of TSH. Therefore, the levels of circulating lactate, T3, free T3, T4, and free T4 all increase in this range, indicating improved thyroid function. (Ciloglu, Peker, Pehlivan, Karacabey, Ilhan, Saygin, & Ozmerdivenli, 2005, 831-833). However, because this study was not directed at hypothyroid patients in particular, additional research would need to be performed to see how the same factors affect a patient with an underactive thyroid.

A study on the effects of regular physical exercise on the thyroid function of treated hypothyroid patients showed the TSH level in patients who regularly exercise to be significantly lower compared to those who do not participate in regular exercise. Regular exercise sessions of one hour per day were performed using either sports or jogging for a period of 3 months, while a control group did no exercise. After the research period was complete, the TSH levels were measured in both groups and found that the exercising group showed a significant decrease in TSH levels. Additionally, the average weight of the exercising group also decreased. The study suggests that regular exercise can improve thyroid function as well as mental and physical health in those with hypothyroidism. Therefore, thyroxine replacement therapy has the potential to be decreased in these patients (Bansal, Kaushik, Singh, Sharma, & Singh, 2015, 245-246).

The effects of yoga on blood levels of thyroid hormones has also been researched. However, much like the study on exercise intensity, the yoga study was not targeted at hypothyroid patients, but could still be useful based on the results. According to the study, participants used combined yogic activities in the morning for 6 days/week for 12 weeks and a control group continued with their normal routines. The results indicated an increase in serum TSH

levels in males and a decrease in T3 and T4 in both males and females in the yoga-practicing group (Chatterjee & Mondal, 2017, 9). Using these results, it could be argued that yoga actually inhibits thyroid function rather than improves it and should therefore be avoided.

6.2.2 Diet

Although the internet yields a plethora of websites and articles regarding diet for hypothyroid patients, finding research based on actual studies is quite sparse. However, an interesting study focused on the effect of dietary iodine intake on hypothyroidism. It highlights the fact that thyroxine and triiodothyronine are synthesized from the amino acid tyrosine and iodine which are ingested in the diet. Using this information, it could be possible to improve treatment using iodinated foods. The study results showed that ingesting foods to maintain a level of 150 μg per day showed notable improvements in TSH levels. The study demonstrated that ingesting an appropriate level of iodine in the diet could contribute to regulating thyroid hormones naturally, along with the proper medication dose (Lopez, Franco, Cepeda, & Vázquez, 2018, 190-192). However, the study was completed on one person, a 52-year-old woman, so the need for additional research is necessary to solidify this claim.

6.2.3 Fatigue-Coping Strategies

A major complaint of hypothyroid patients is overwhelming fatigue. Because of this, other lifestyle factors can suffer as well such as motivation to exercise and/or plan and execute a healthy diet. The effects of aromatherapy through the inhalation of essential oils on fatigue has been studied in hypothyroid patients. Hypothyroid patients were studied in two groups, one which was treated with the inhalation of essential oils and a control group that was treated with the inhalation of a vegetable oil blend. By the end of the study, participants who had been treated with aromatherapy showed improved fatigue scores across all scales when compared to the group that was treated with vegetable oil. However, improvements were not all of statistical significance, meaning they could be anomalous. Additionally, this is the first and only study that has investigated the effects of aromatherapy on fatigue in hypothyroid patients (Hawkins, Hires, Dunne, & Keenan, 2019). Therefore, additional research would be required to justify any claims of the effectiveness of this alternative treatment.

6.2.4 Morning or Evening Intake of Medication

Because thyroid hormone levels vary throughout the day, studies have been conducted to see whether treatment for hypothyroid patients are more or less effective depending on the time of day traditional thyroxine treatment is taken. Typically, thyroxine is recommended to be taken in the morning on an empty stomach at least half an hour before breakfast. However, lifestyle factors and convenience may make it difficult for patients to take their medication in the morning (Hossain, Banerjee, Mondal, & Maiti, 2018, 89-90).

According to a study completed by Bolk, Visser, & Nijman (2010, 1999-2002), TSH levels were decreased in patients who took their medication in the evening. Patients who took their medication in the evening also showed increased levels of free T3 and free T4. Although the study did not show any quality-of-life improvements among study participants, this result indicates that taking thyroxine in the evening could prove to be more beneficial than the traditional morning intake.

In a similar study, patients achieved normal thyroid function quicker when they took an evening dose of thyroxine compared to a morning dose. However, no significant changes were measured in levels of serum TSH and free T4. The study suggests that normal thyroid function may have been achieved quicker using the evening dose due to adherence – patients may be less compliant in taking morning doses due to busy schedules or the intake of other morning medications which may interfere with thyroxine absorption. While the evidence of this study does not allow for the conclusion that thyroxine should be taken in the evening, the study recommends that evening intake be considered due to the study results still showing a positive effect in the treatment of hypothyroidism (Hossain, et al., 2018, 91-93).

7 Discussion and Critical Results

The use of the study method as well as the interpretation of the results will be examined in this chapter.

7.1 Use of the Method

According to Liberati, Altman, Tetzlaff, Mulrow, Gøtzsche, Ioannidis, Clarke, Devereaux, Kleijnen, & Moher, (2009, 20-21), critiquing one's own work at the end of a literature review is important to determine whether specific protocols were followed and that the study can be trusted and replicated. In order to do this, limitations of the study must be evaluated.

Such limitations include validity (risk of bias) and reporting (usefulness) of the studies included in the literature review, limitations of the review process, and the applicability of the review. Additionally, it is vital to evaluate whether there was a serious risk of biases when selecting and evaluation studies, whether the studies selected are not precise enough, or if there was a great deal of missing data or important research.

Because this literature review was carefully structured before studies were sought and selected, it helped to define a narrow scope for only reviewing alternative and complementary therapies for hypothyroidism. However, at the start of this process, it was believed that there would be far more studies to evaluate than are actually available. This limitation led to two of the studies included in this literature review being related to the effect that certain activities have in altering thyroid hormones, but did not directly apply to hypothyroid patients. The inclusion of this material could be viewed as inapplicable if it was deemed to not be useful to hypothyroid patients specifically.

A rather significant limitation of this study was the inability to locate multiple studies in the same subcategory. For example, the subcategories of desiccated thyroid extract, age-, gender-, and ethnicity specific TSH reference range limits, diet, and fatigue-coping strategies yielded only on applicable article each. While they hold a significant weight when exploring alternative and complementary therapies, it is hard to determine the efficacy of these therapies without a broader range of studies.

Initially, research was planned to be articles written in English and limited between the years of 2009-2019 in order to include the most recent studies and data. However, as the search for studies was carried out, it was clear that more information could be obtained if the timeline was broadened to the years of 2004-2019. Because the study criteria only encompassed 15 years and studies which were written in English, it could be speculated that additional important information could have been left out of this this literature review.

Other important criteria for critiquing a literature review include credibility (equality between the research results and the objective actuality), dependability (the consistency of findings over time), and confirmability (lack of bias in the presentation of the data) (Bitsch, 2005, 82-87). Regarding credibility, the results of this study reflect the amount of research available as closely as possible given the resources and timeframes available. However, if additional databases were used, there were more researchers involved, and a longer timeframe was possible, it could be in the realm of possibility to find additional data regarding alternative and complementary therapies.

Dependability is assured at the time this literature review was written. Searches were carefully documented and the most relevant research was selected based on the research questions. However, it is possible additional research on these topics will occur as time passes. Therefore, it could be possible that the results of this literature review become outdated or even obsolete with the continuation of treatment studies and/or improvements. Confirmability was ensured through exploration of all possible studies on alternative and complementary therapies that could be located. To the best possible extent, the studies were presented in an unbiased manner using only information and statistics presented by the studies themselves. Studies were not presented in a hierarchal manner and were given equal weight dependent on the number of studies that were located within each subgroup.

7.2 Discussion and Summary of Results

Alternative therapies for hypothyroidism include combination therapy using both thyroxine and triiodothyronine, the use of desiccated thyroid extract, and the use age-, gender-, and ethnicity-specific TSH limits. Combination therapy is growing in popularity due to its exposure in the media combined with hypothyroid patients seeking out alternative methods to treat their condition. However, although it is highly sought and seems to be the most researched alternative treatment, the effects are still not clear due to a lack of evidence of its efficacy (Michaelsson, et al., 2015, 175). Combination therapy also comes with risks that include overdosing on triiodothyronine, which can lead to other health complications (Appelhof, et al., 2005, 2672).

Much like combination therapy, the use of desiccated thyroid extract is greatly understudied. Patients using this therapy showed a decrease in weight and an increase in mental health. However, information on how desiccated thyroid extract affects a large section of hypothyroid patients is unavailable. Therefore, additional research is needed to study the actual efficacy of this treatment (Hoang, et al., 2013, 1983-1989).

The use of age-, gender-, and ethnicity-specific TSH reference range limits could be considered an alternative treatment as it could be used to prescribe traditional medications in alternative dosages than current guidelines suggest. Studies reflect that TSH reference limits can vary based on age and/or racial/ethnic groups, so it is important to consider these factors when diagnosing and prescribing a treatment for hypothyroidism (Boucai, et al., 2011, 5).

Complementary therapies for hypothyroidism include physical exercise, diet, fatigue-coping strategies, and evening versus morning intake of thyroxine. The effects of exercise intensity, regular physical exercise, and yoga on thyroid hormones have all been studied. Exercise intensity at levels that meet 70% of the maximum heart rate have shown to improve thyroid function overall (Ciloglu, et al., 2005, 831-833).

Regular physical exercise also proved to be beneficial in improving thyroid function as well as decreasing the weight of the individual. Mental and physical health were both shown to be improved by people with hypothyroidism who participated in regular physical exercise. This thyroid function improvement and symptom alleviation could lead to a decrease in thyroxine therapy (Bansal, et al., 2015, 245-246). The effects of yoga on blood levels of thyroid hormones showed an increase in serum TSH levels in males and a decrease in T3 and T4 in both males and females (Chatterjee & Mondal, 2017, 9). These results could indicate that yoga actually inhibits thyroid function rather than improves it.

The dietary intake of iodine may also have an effect on hypothyroidism. Because thyroxine and triiodothyronine are synthesized from the amino acid tyrosine and iodine, which are ingested in the diet, there is a possibility that eating iodinated foods could improve treatment (Lopez, et al., 2018, 190-192). However, research on this claim is insufficient to substantiate this claim.

Aromatherapy through the inhalation of essential oils has been studied to demonstrate its effect on fatigue in hypothyroid patients. Participants treated with aromatherapy showed a decrease in fatigue, but the evidence was not strong in favor of this treatment causing the improvement. This method of symptom-alleviation has limited research so its effectiveness is still unclear (Hawkins, et al., 2019).

Evening versus morning intake of medication could also affect the treatment of hypothyroid patients. Although morning intake of thyroxine is typically recommended, studies show that TSH levels were decreased in patients who took their medication in the evening (Bolk, et al., 2010, 1999-2002). Additionally, patients achieved normal thyroid function quicker when they took an evening dose of thyroxine compared to a morning dose, but this could have been due to increased adherence in taking medication (Hossain, et al., 2018, 91-93).

Considering the Uncertainty in Illness theory, these findings can present opportunities to hypothyroid patients to consider if they are unhappy with their current treatment. With an increased knowledge of additional therapies, it could be possible to alleviate or prevent some

of the secondary effects caused by hypothyroidism. However, because the efficacy of additional therapies outside of traditional T4 treatment is mostly unknown, it is necessary to embrace the uncertainty and non-linear trajectory of this condition. This uncertainty should be seen as an opportunity to continue research into additional therapies.

These result should lead those who have hypothyroidism to not see uncertainty as a negative, but rather to accept the uncertainty that still surrounds this condition. The acceptance of uncertainty can lead to new outlooks which can lead to growth and change. The uncertainty should be a motivator to seek out various treatment options and push for additional research into hypothyroidism therapies. Because those with hypothyroidism experience major fluctuations within their condition, their receptivity to change can be enhanced. From these fluctuations, a push for change can occur in regards to research and treatment options (Alligood, 2018, 447-456).

8 Conclusion

This study has been very eye-opening. At the start, there was a lot of optimism and hope that research on alternative and complementary therapies for hypothyroid patients was increasing and there would be a surplus of information. However, finding only a handful of articles proved to be extremely difficult and it quickly became clear that the research potential of previous studies was very limited in this field. Although the lack of studies was disappointing for the purpose of this literature review, it greatly highlights the fact that alternative and complementary therapies for hypothyroid patients need to be studied more.

Suboptimal treatment in hypothyroid patients is an ongoing epidemic. Although patients adhere to their medication, they often continue to feel the adverse symptoms of hypothyroidism. For nurses, having an increased knowledge of this all-too-common condition and possible ways to enhance the overall condition of these patients is invaluable. While research into additional therapies is ongoing and slow, other symptom-alleviating techniques could be suggested to patients with the hope they find some success in them.

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Appendix 1: Table of Search History

Number (#)	Database	Search terms	Hits	Actual Usable
1	NCBI (PubMed)	Hypothyroid	15151	
2	NCBI (PubMed)	Hypothyroid and Treatment*	5554	
3	NCBI (PubMed)	Hypothyroid and Alternative*	242	• Desiccated Thyroid Extract Compared with Levothyroxine in the Treatment of Hypothyroidism: A Randomized, Double-Blind, Crossover Study
4	NCBI (PubMed)	Hypothyroid and Complementary*	41	• An Approach for Development of Age-, Gender-, and Ethnicity-Specific Thyrotropin Reference Limits • Effects of Evening Vs Morning Levothyroxine Intake: A Randomized, Double-Blind, Crossover Trial
5	NCBI (PubMed)	Hypothyroidism and Nutrition*	677	• Constant Iodine Intake Through the Diet Could Improve Hypothyroidism Treatment
6	NCBI (PubMed)	Hypothyroid and Combination Therapy	599	• Treating Hypothyroidism with Thyroxine/Triiodothyronine Combination Therapy in Denmark: Following Guidelines or Following Trends? • Hypothyroid Patients Encoding Combined MCT10 and DIO2 Gene Polymorphisms May Prefer L-T3 + L-T4 Combination Treatment – Data Using a Blind, Randomized, Clinical Study • Combined Therapy with Levothyroxine and Liothyronine in Two Ratios, Compared with Levothyroxine Monotherapy in Primary Hypothyroidism: A Double-Blind, Randomized, Controlled Clinical Trial
7	Research Gate	Hypothyroid		• A Comparative Study on Effect of Evening Versus Morning Intake of Levothyroxine in Patients of Hypothyroidism

				• Exercise Intensity and its Effects on Thyroid Hormones • Effect of Combined Yoga Programme on Blood Levels of Thyroid Hormones: A Quasi-Experimental Study • The Effect of Regular Physical Exercise on the Thyroid Function of Treated Hypothyroid Patients: An Interventional Study at a Tertiary Care Center in Bastar Region of India • Aromatherapy Reduces Fatigue Among Women with Hypothyroidism: A Randomized Placebo-Controlled Clinical Trial
8	EBSCO (all)	Hypothyroid	384	
9	EBSCO (all)	Hypothyroid and Treatment*	126	
10	EBSCO (all)	Hypothyroid and Alternative*	5	
11	EBSCO (all)	Hypothyroid and Complementary*	2	
12	EBSCO (all)	Hypothyroid and Nutrition*	8	
13	EBSCO (all)	Hypothyroid and Combination Therapy	1	

Appendix 2: Analyzed Articles

Bibliographic data	Aim	Research method	Data collection methods	Result
Appelhof, B.C., Fliers, E., Wekking, E.M., Schene, A.H., Huyser, J., Tijssen, J.G.P., Endert, E., van Weert, H.C.P.M., & Wiersinga, W.M. (2005). Combined therapy with levothyroxine and liothyronine in two ratios, compared with levothyroxine monotherapy in primary hypothyroidism: a double-blind, randomized, controlled clinical trial. *The Journal of Clinical Endocrinology & Metabolism, 90 (5),* 2666-2674.	Study the value of combined treatment with levothyroxine and liothyronine when compared with treatment using levothyroxine alone in primary hypothyroidism.	A double-blind, randomized, controlled trial was performed on 141 patients between 18-70 years old with primary autoimmune hypothyroidism. Patients were randomly assigned to one of three treatment branches.	Serum TSH was measured and doses were adjusted as needed throughout the clinical study. Study participants regularly filled out a set of questionnaires and the main outcome, side complaints, and resting heart rate were assessed. The investigators and the study participants were not aware of the treatment assignments given throughout the trial.	Study participants preferred combined levothyroxine and liothyronine treatment to the typical levothyroxine monotherapy. However, changes in mood, well-being, fatigue, and neurocognitive functions could not sufficiently explain why the outcome favored combination therapy.
Bansal, A., Kaushik, A., Singh, C.M., Sharma, V., & Singh, H. (2015). The effect of regular physical exercise on the thyroid function of treated hypothyroid patients: an interventional study at a tertiary care center in Bastar region of India. *Archives of Medicine and Health Sciences, 3 (2),* 244-246.	Investigate the effect of regular physical medium-intensity exercise on thyroid function in patients who are already undergoing treatment for hypothyroidism.	A study was performed on 20 ambulatory hypothyroid patients who were on treatment.	Serum samples were taken and analyzed for triiodothyronine (T3), thyroxine (T4), and thyroid stimulating hormone (TSH) before and after 3 months of participants doing daily exercise for 1 hour per day and those not doing exercise. The test results were used to find notable differences between the two test groups.	Serum TSH was notably decreased in patients who did regular physical exercise. Serum T3 and T4 were also notably increased in the group that participated in regular physical exercise. The average weight was also found to be decreased in the group that exercised regularly. It is recommended that hypothyroid patients should do

				regular physical exercise along with their thyroxine treatment to optimize their thyroid function.
Bolk, N., Visser, T.J., & Nijman, J. (2010). Effects of evening vs morning levothyroxine intake: a randomized double-blind crossover trial. *Archives of Internal Medicine, 170 (22),* 1996-2003.	Investigate whether levothyroxine intake at bedtime instead of intake in the morning improves thyroid hormone levels.	A randomized double-blind crossover trial was performed between April 1, 2007 and November 30, 2008 on 105 participants with primary hypothyroidism at Maasstad Hospital Rotterdam in the Netherlands.	Participants were instructed to take 1 capsule in the morning and 1 capsule at bedtime (one which contained levothyroxine and the other a placebo) over a 6-month period, with a switch after 3 months. Thyroid hormone levels were used as primary outcome measures, while creatinine and lipid levels, body mass index, heart rate, and quality of life were used as secondary outcome measures.	Levothyroxine taken at bedtime greatly improved thyroid hormone levels. Plasma lipid levels and effects on quality-of-life showed no significant changes between morning and bedtime intake. The study recommends that physicians consider prescribing bedtime levothyroxine doses instead of morning doses.
Boucai, L., Hollowell, J.G., Surks, M.I. (2011). An approach for development of age-, gender-, and ethnicity-specific thyrotropin reference limits. *Thyroid, 20 (1),* 5-11.	Develop age- and ethnicity-specific thyrotropin (TSH) reference limits to decrease the misclassification of patients with thyroid dysfunction.	Using the National Health and Nutrition Examination Survey III, a TSH median was determined in specific racial/ethnic groups designated as Mexican Americans, non-Hispanic Whites, and non-Hispanic Blacks.	TSH limits of a thyroid disease-free population was compared to a reference population using the exclusion of anti-thyroid antibody positive subjects and TSH values >10 mIU/L or <0.1 mIU/L. Using quantile regression, the effects of age, racial/ethnic groups, body weight, gender, and urinary iodine concentration on TSH reference limits in the anti-thyroid antibody negative population was examined.	Anti-thyroid antibody status did not affect the 2.5 centile and median TSH in any racial/ethnic groups or the 97.5th centile in Blacks. On average, the 97.5th centile of disease-free Whites and Mexican Americans was higher than the standard population group. TSH in the 2.5th, 50th, and 97.5th centile groups increased with age, but were lower in Blacks than in Whites or Mexican Americans. Women showed

				lower 2.5th and 50th centiles than their male counterparts. An equation was developed to predict subpopulation-specific TSH reference limits.
Carlé, A., Faber, J., Steffensen, R., Laurberg, P. & Nygaard, B. (2017). Hypothyroid patients encoding combined MCT10 and DIO2 gene polymorphisms may prefer L-T3 + L+T4 combination treatment – data using a blind, randomized, clinical study. *European Thyroid Journal, 6 (1),* 143-151.	Investigate the reasons that about half of all hypothyroid patients prefer levothyroxine (L-T4) + levotriiodothyronine (L-T3) combination therapy, 25% prefer T4 therapy, and 25% have no preference.	A prospective, double-blind, cross-over study was performed on 45 overtly autoimmune, hypothyroid patients who were in euthyroid status on ≥ 6 months of L-T4 therapy. Patients were randomized into 2 groups of either 3 continuous months of L-T4 therapy following by 33 months of combination therapy or the opposite.	Three single nucleotide polymorphisms (SNPs) were investigated on the type II iodothyronine deiodinase gene and 1 SNP on the cellular membrane transport-facilitating monocarboxylate transporter gene. Participants were asked in which two treatment periods they felt better, thereby indicating which treatment was preferred.	60% of the patients preferred the combination therapy. The study showed that the combination of polymorphisms in DIO2 and MCT10 enhanced the participants' preference for combination therapy. Combination therapy, therefore, should be restricted or recommended depending on the individual's polymorphisms.
Chatterjee, S. & Mondal, S. (2017). Effect of combined yoga programme on blood levels of thyroid hormones: a quasi-experimental study. *Indian Journal of Traditional Knowledge, 16 (1),* S9-S16.	Investigate the effect of a combined graded yoga program on the basal level of thyroid hormones in middle-aged adults.	A study was conducted on 45 healthy men and women, who were divided into two groups: yoga-practicing and a control group. The yoga-practicing participants used combined yoga practices daily in their morning routine for 6 days/week for 12 weeks. The control group continued with	Basal levels of serum thyrotropin (TSH), triiodothyronine (T3), and thyroxine (T4) were measured before the study began and after 6 and 12 weeks. This data was analyzed using ANOVA.	Twelve weeks of yoga training produced a notable increase in serum TSH for males and decreased T3 and T4 for both males and females when compared to the control group. No changes were observed in the control group during the 12 weeks of the study.

		their routine activities.		
Ciloglu, F., Peker, I., Pehlivan, A., Karacabey, K., Ilhan, N., Saygin, O., & Ozmerdivenli, R. (2005). Exercise intensity and its effects on thyroid hormones. *Neuroendocrinology Letters, 26 (6)*, 830-834.	Study the effects that acute aerobic exercise has on thyroid hormone values.	A study was performed on 60 well-trained male athletes. Three intensities of exercise were used using a bicycle ergometer at 45% (low intensity), 70% (moderate intensity), and 90% (high intensity). The intensities were selected in accordance with the athlete's maximum heart rate.	During each exercise intensity level, blood lactic acid, heart rate, total triiodothyronine (T3), free triiodothyronine (fT3), serum total thyroxine (T4), free thyroxine (fT4), and thyroid stimulating hormone (TSH) values were measured.	Exercise which was done at the anaerobic threshold (70% of the maximum heartrate) caused the most notable changes in hormone levels. The rates of T4, fT4, and TSH continued rising at 90% of the maximum heart rate, but the rate of T3 and fT3 began to fall.
Hawkins, J., Hires, C.Y., Dunne, E.W., Keenan, L.A. (2019). Aromatherapy reduces fatigue among women with hypothyroidism: a randomized placebo-controlled clinical trial. *Journal of Complementary and Integrative Medicine*. Advance Online Publication. doi: 10.1515/jcim-2018-0229.	Identify the effect of daily aromatherapy inhalation of an aromatherapy blend of essential oils on fatigue.	A study was performed on women between the ages of 18-55 with a diagnosis of hypothyroidism. These participants were randomized into two groups: the aromatherapy group which were treated with the inhalation of essential oil blend, and control group which were treated with an odorless vegetable oil blend.	Baseline scores were measured on the Multidimensional Fatigue Symptom Inventory (MFSI) and scores were reevaluated throughout the study.	Both groups felt a reduction in fatigue symptoms during the first week, but by the end of the study the aromatherapy group had improved fatigue scores across all subscales of the inventory. There is possible evidence that regular inhalation of an aromatherapy blend may help to reduce fatigue among women with hypothyroidism.
Hoang, T.D., Olsen, C.H., Mai, V.Q., Clyde, P.W., & Shakir, M.K.M.	Investigate the effectiveness of desiccated thyroid extract when	A randomized, double-blind, crossover study was performed	Patients were randomized to take either desiccated thyroid extract or	There were no significant changes in symptoms and neurocognitive

(2013). Desiccated thyroid extract compared with levothyroxine in the treatment of hypothyroidism: a randomized, double-blind, crossover study. *The Journal of Clinical Endocrinology & Metabolism, 98 (5)*, 1982-1990.	compared with levothyroxine in hypothyroid patients.	on 70 patients between the ages of 18-65 who were diagnosed with primary hypothyroidism and were on a stable dose of levothyroxine.	levothyroxine for 16 weeks and then switched for the same duration. Biochemical and neurocognitive tests were given as a baseline and at the end of each treatment period. These sets of values were analyzed and evaluated.	measurements between the two therapy options. Patients lost an average of 3 pounds on desiccated thyroid extract. At the end of the study, 48.6% of patients preferred desiccated thyroid extract, 18.6% preferred levothyroxine, and 32.9% had no preference.
Hossain, S., Banerjee, M., Mondal, S., & Maiti, A. (2018). A comparative study on effect of evening versus morning intake of levothyroxine in patients of hypothyroidism. *Thyroid Research and Practice, 15 (2)*, 89-93.	Compare the serum thyroid stimulating hormone and T4 level between patients who take levothyroxine in the evening with patients who take it in the morning.	A study was performed on 147 patients divided into two groups.	147 patients were recruited and placed into two study groups, A and B. While 73 patients were in group A and 72 were in group B, only 58 patients from group A and 57 patients from group B were considered for evaluation. There were no numerical differences in achievement of euthyroidism between the two groups. Other levels, such as cholesterol, LDL, and triglycerides, were not significantly different between the groups.	Levothyroxine taken at bedtime improved the thyroid hormone level. Medical practitioners should consider advising patients to take their medication at bedtime as an alternate to the typical morning dose.
Lopez, Y., Franco, C., Cepeda, A., & Vázquez, B. (2018). Constant iodine intake through the diet could improve hypothyroidism treatment: a case report. *Journal of*	Explore the effect of constant iodine intake within the diet in a postmenopausal woman with hypothyroidism	A study was performed on one woman on a 1-month diet in which the foods provided were naturally containing iodine.	Baseline anthropometric nutritional, pharmacological, and habit data were recorded. The woman was put on a 1-month long diet in which the foods provided were	Blood levels of thyroid-stimulating hormone were improved (1.78 μIU/mL) and cholesterol was reduced (198 mg/dL). This study concluded that constant iodine

Physiology and Biochemistry, 74 (1), 189-193.			naturally containing iodine to ensure that the recommended requirement of 150 μg/day were met. Information about the foods were supplied and explained to the patient. The diet was also meant to help the patient lose weight and was balanced and closer to the nutritional recommendations.	intake through the diet for this patient with hypothyroidism was very effective and should be also considered in hypothyroidism treatment.
Michaelsson, L.F., Medici, B.B., la Cour, J.L., Selmer, C., Røder, M., Perrild, H., Knudsen, N., Faber, J., Nygaard, B. (2015). Treating hypothyroidism with thyroxine/triiodothyronine combination therapy in Denmark: following guidelines or following trends? *European Thyroid Journal, 4 (3),* 174-180.	Investigate the current Danish trends in the use of combination therapy using T4 and T3.	Investigation using an internet-based questionnaire and information from major Danish medical entities. 384 patients responded to the questionnaire and 293 of those were included in the study	The internet-based questionnaire was distributed by two Danish patient forums. Additionally, information was taken from the Division of Pharmacies and Reimbursement at the Danish Health and Medicines Authority as well as from the only Danish pharmacy that produces desiccated thyroid and L-T3 tablets.	69% of the participants had six or more symptoms and 84% had a treatment effect. 44% of the participants received prescriptions from general practitioners of which 50% received desiccated thyroid hormones and 28% adjusted their dose themselves. European guidelines of combination therapy are not always followed in Denmark and causes many patients to adjust their dose themselves which could put them at a risk for overtreatment.