NUTRITION AND PSORIASIS: A REVIEW OF THE LITERATURE

By
Jordan Stotko

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Food Science and Nutrition Department
California Polytechnic State University
San Luis Obispo, CA

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Abstract

Psoriasis is a chronic, inflammatory skin condition that causes a diminished quality of life and continuous pain for individuals of various ages and stages of existence. A cure for this condition is non-existent, although research continues to determine how nutrition can provide relief. Consumption of specific nutrients, particularly omega 3 fatty acids, may be beneficial in mitigating the various symptoms of psoriasis. Vitamin A, vitamin D, and selenium are additional nutrients that have been studied more recently, however their benefit is still unknown. Whether a correlation exists between these nutrients and psoriasis is unclear. Therefore, a review of current research was completed to define, examine, and identify psoriasis with regard to availability of treatment options and the role of nutrients. Findings from short-term, double-blind trials indicate mixed findings regarding the use of oral and topical fish oils. However, findings in double-blind, placebo-controlled studies with intravenous fish oil indicate moderate improvement for psoriasis. Thus far, the experimental evidence suggests improvement in symptoms when omega-3 fatty acids are incorporated into the diet. Although, more research is needed, treatments including prescription medications, over the counter products, and combined and alternative therapies continue to provide relief until further studies are conducted.

Introduction

Psoriasis is a common, chronic, and persistent inflammatory skin disease characterized by defined, erythematous, dry, scaling plaques of diverse sizes (James, Berger, and Elston, 2011, p. 190). The disease presents itself with various risk factors and triggers throughout ones' lifetime starting in a wide range of ages. Fortunately, for those affected by psoriasis, there is a foundation that can provide helpful information such as a source for diagnosis and mitigation of symptoms. In addition to the foundation, other resources were obtained through medical research.

The National Psoriasis Foundation [NPF] is a non-profit, voluntary health agency dedicated to finding a cure for psoriasis and eliminating their devastating effects through research, education, advocacy, connection and leadership. The mission of this organization is to cure those with psoriasis and improve the quality of life for those affected. The foundation was created in 1968 and has grown to become the primary patient advocacy group for about 7.5 million Americans living with a form of psoriasis (NPF, 2014).

There are six types of psoriasis: plaque, guttate, inverse, pustular, erythrodermic and "napkin." Pustular psoriasis is a type that also contains a few forms of its own including von Zumbusch, palmoplantar pustulosis, acropustulosis, and impetigo herpetiformis. Each of these types of psoriasis and the various forms within certain types can come in three levels of severity, mild, moderate, and severe. Gender and ethnicity are two factors that are also involved in this disease.

The disease occurs with equal frequency in both genders (James, Berger, and Elston, 2011, p. 193). Between one and two percent of the US population has psoriasis, while two to three percent of the world's population is involved (Christophers, 2001; James, Berger, &

Elston, 2011, p. 193; Solis et al., 2011). Psoriasis is less frequent in tropical climates; it is also less common in ethnicities of North American and West African black people (James, Berger, & Elston, 2011, p. 193).

Unfortunately, those who suffer from this disorder have been shown to have a diminished quality of life. This can be explained by individuals dealing with periods of flare-ups and oftentimes, remission (Renton, 2014). In addition to flaring, numerous symptoms may also appear in combination and vary between individuals, type of psoriasis, and the severity.

Generally, the progression of psoriasis is variable among each individual and onset can be abrupt and widespread (James, Berger, & Elston, 2011, p. 191). Treatment of psoriasis includes oral and topical medications, light therapy, systemic, biologic and combination therapy, as well as alternative therapy. Although, some experts believe that psoriasis can be treated by nutrition there are no specific diets or guidelines to follow (Solis et al., 2011).

The role of dietary habits and psoriasis is a topic that has been studied for several years (Ricketts, Rothe, & Grant-Kels, 2010). Psoriasis patients who use nutritional treatment methods seem to prevent similar non-transmissable chronic diseases (NTCD), emit a higher quality of life, and also have more clinical stabilization (Solis et al., 2011). However, consuming a diet based on a poor life style may play a role in developing this skin condition. Therefore, psoriasis can be influenced by nutrition as a cause to the disorder or as prevention and treatment (Solis et al., 2011). Various topics will be briefly discussed within this literature review including an overview on psoriasis, in addition to nutrients and the mechanisms of action behind them. This paper will include a review of the effects of nutrients and psoriasis progression, followed by a summary of current research and future research still to be discovered. The purpose of this

literature review is to examine current treatment options available for this common skin condition and the role of nutrition.

Psoriasis

Definition, Risk Factors, Diagnosis, Age of Onset, Transmissibility

Psoriasis can be defined as an overgrowth of skin cells causing superficial red, flaky patches covered by silvery plaques (National Institutes of Health [NIH], 2014). Symptoms of this condition may include: itching, scaling, and burning (Helmick, Lee-Han, Hirsch, Baird, & Bartlett, 2014). This skin condition is also considered an autoimmune disease, which is driven by T lymphocytes known as defense cells (Solis et al., 2011). There is no complete understanding with regard to the etiology of this disease (Johnson, Ma, Kanada, & Armstrong, 2013). In many patients, environmental factors like diet, stress, and infection, along with genetics can play a significant role and may trigger the development of skin lesions (Johnson et al., 2013; Naziroglu, Yildiz, Tamturk, Erturan, & Flores-Arce, 2012). According to Farber and Nall (1974), findings indicate that 36% of 5600 respondents with psoriasis had one or more members of their families who were suffering from the condition. Few risk factors have been supported in the current research, however recent studies have been looking at factors including: BMI, waist-hip ratio, alcohol consumption, waist circumference, cigarette smoking, and stress (Solis et al., 2011; Naziroglu et al., 2012; Plunkett & Marks, 1998). Some of the studies had the patients self-report their psoriasis, meaning a diagnosis was confirmed by a healthcare provider (Helmick et al., 2014; Wilson, 2013). Psoriasis is a disease that is hard to diagnose since it resembles other skin conditions, however 95% of the time a healthcare provider can make the determination by performing a simple visual inspection, in which case well differentiated, inflamed, and thickness can rule out other conditions (NIH, 2014; NPF, 2014). Lu, Yu, & Deng

(2012) discuss two phenomenon's referring to typical lesions present in psoriasis that are used in diagnosis of the disease. Skin lesions usually appear as red macules and papules, along with the silver scaling. Once the silver scaling is lightly scraped, beneath its surface is a layer of pink shiny thin film appears known as the thin film phenomenon. Next is the dot hemorrhage phenomenon also known as Auspitz syndrome, which results when several bleeding points appear as a cause from scraping the thin film. Around one third of those affected develop psoriasis before age 16, although the disease may present itself at any age (Renton, 2014). Most often, the condition appears in adults before age 35. Psoriasis cannot be spread through physical contact, therefore it is not contagious (NHS, 2014). There are five types of psoriasis, each containing a different appearance and various triggers.

Types of Psoriasis

Plaque Psoriasis (Psoriasis Vulgaris) Plaque psoriasis is also known as psoriasis vulgaris is the most common form of the disease (NPF, 2014). This form occurs in 90% of cases and typically appears as red, dry, raised patches with a layer of silvery scaling skin (NHS, 2014). Generally, plaque psoriasis appears on face, scalp, elbows, palms of hands, lower back, knees, and soles of feet which is often painful and may crack and bleed (NPF, 2014).

Guttate Psoriasis Guttate psoriasis is the next most common form that usually starts during early childhood or young adulthood. This form causes numerous lesions, which appear as small, red, annular, widespread spots around the trunk and extremities and sometimes on the scalp, face, and ears (NPF, 2014; Renton, 2014). This form of psoriasis is generally found in about 10% of individuals with the disease and does not appear as thick in comparison to plaque psoriasis. Since this form appears suddenly, various triggers may provoke its appearance such as: tonsillitis, stress, skin injury or trauma (also known as Koebner or isomorphic reaction),

upper respiratory infections, (acute) streptococcal infections (i.e. strep throat), and drugs including antimalarials and beta blockers (NPF, 2014; Plunkett & Marks, 1998).

Inverse Psoriasis (Flexural or Intertriginous Psoriasis) The third type of psoriasis is inverse psoriasis also referred to as flexural or intertriginous psoriasis. This form is distinct, as it appears as red lesions commonly found in occluded areas such as: under arms, groin, below breasts, and other skin folds. It can also appear redder, more scaly and less dry than guttate psoriasis, or smooth and shiny (NPF, 2014; Renton, 2014). This form is commonly irritated from rubbing and sweating due to the tenderness and location on the body. Many individuals are often combating another form of psoriasis in conjunction with the inverse psoriasis (NPF, 2014).

Pustular Psoriasis Pustular psoriasis is a form that is evident by white sterile blisters, which contain non-infectious pus from white blood cells, surrounded by red skin. The pustules tend to cycle along with skin redness and scaling. Usually this form is limited to the hands and feet and is generally seen in adults, however generalized pustular psoriasis may cover the entire body. Some triggers of pustular psoriasis include: irritating topical agents, internal medicines, overexposure to UV light, pregnancy, systemic steroids, infections, emotional stress, and sudden withdrawal of potent topical steroids or systemic medications (NPF, 2014). There are three forms of pustular psoriasis.

The first type is one that can appear suddenly and is known as von Zumbusch. It can be distinguished because it generally covers widespread areas of the skin, which become red, painful and tender. After a few hours the pustules appear and within in one to two days the pustules will dry out, causing the skin to be left smooth and shiny in appearance. It is rare for a child to develop this type of pustular psoriasis, but if it did occur this would be the first flare and it would likely be a better outcome than if it occurred in an adult. This form is life threatening

and requires immediate medical attention. Oftentimes those who acquire this form of psoriasis must be hospitalized for rehydration and suffer from symptoms such as: fever, chills, severe itching, increased pulse, exhaustion, anemia, weight loss, and muscle fatigue (NPF, 2014).

The second type of pustular psoriasis is called palmoplantar pustulosis (PPP). Commonly affects the palms of the hands and soles of the feet, especially the base of the thumb and sides of the heels. Initial appearance is pustules that form in a studded pattern on top of the red skin plaques. After this it appears as a brown color, which becomes crusted and peels off. This type of pustular psoriasis is typically recurring with new pustules followed by low activity periods (NPF, 2014).

The third type of pustular psoriasis is referred to as acropustulosis. This form is rare, but appears as lesions on the ends of fingers and is sometimes found on the toes. This form is generally brought on by an event such as a skin injury or infection. These lesions can be painful and disabling due to the deformity it causes within the nail and, in severe cases, bone changes occur (NPF, 2014).

The final type of pustular psoriasis is called impetigo herpetiformis. This is a form associated with pregnancy. Initially, redness occurs in body folds with studded pustules, followed by a general pustular flare and increasing toxicity. Delivery is how many patients respond and an early delivery is highly considered as long as it is safe for the baby (James, Berger, & Elston, 2011, p. ; NPF, 2014).

Erythrodermic Psoriasis Erythrodermic psoriasis is a form that usually affects the entire body surface, however this is a rare form of psoriasis, which only affects 3% of those affected and occurs once or more in a lifetime. This form may occur in association with von Zumbusch and usually appears on individuals dealing with unstable plaque psoriasis. Since it is

widespread, bright red, and appears to be exfoliating the skin, it is also classified as life threatening and is often accompanied by severe itching and pain (NPF, 2014).

"Napkin" psoriasis This form of psoriasis refers to the location of the disease, in this case the diaper area. Normally this type is seen in infants between two and eight months old. These lesions appear in patches of the skin as bright red and delineated, covering a majority of the diaper area (James, Berger, & Elston, 2011, p. 191).

Severity

Psoriasis has three severities, mild, moderate, and severe. According to the NPF (2014), a mild case is when less than 3% of the body is affected. A moderate case would be three to 10% and a severe case is greater than 10%. For visualization purposes, 1% of skin is equal to the surface area of a hand. Mild psoriasis affects approximately four out of five individuals, where as moderate to severe psoriasis affects one out of five. Renton (2014) describes three severities as they related to scalp psoriasis. Mild contains dry, flaking skin that is mixed with normal skin, in addition to the hairline being unaffected and having no reported hair loss. Moderate scalp psoriasis also contains dry, flaking skin that is also scaling on a majority of the scalp with little normal skin, as well as the hairline becoming affected causing minimal hair loss. Severe would be indicated when the entire scalp is affected with minimal normal skin containing thick lumpy scales. The hairline is also affected and has redness and scaling extending beyond the scalp, which may cause temporary hair loss to occur. A person's quality of life is directed affected by the severity of psoriasis, especially depending on the location of the lesions. For example, daily activities can become impaired if the psoriasis appears on the palms of the hands or soles of the feet (NPF, 2014). Another important factor is the prevalence of the disease and the trends in occurrence.

As evidenced by current research, psoriasis is a disease that contains a wide assortment of forms and severity levels. Each form contains its own distinguishable features and symptoms and is prompted to occur throughout life by triggers and risk factors.

Psoriasis Prevalence in the US Population

Patients with psoriasis have been found to have a higher prevalence of metabolic disorders including diabetes, obesity, hypertension, hyperlipidemia, cardiovascular disease (CVD), also high tobacco consumption frequency, and increased morbidity and mortality (Balbas, Regana, and Millet, 2011; Chuan-jian, Jing-jie, and Jing-wen, 2012). Ricketts, Rothe, and Grant-Kels (2010) also found similar evidence of an increased occurrence with each component of metabolic syndrome, in addition to an increased prevalence of atherosclerosis and psoriasis patients. Wolters (2005) found that frequency and severity of the disease have been reported to decrease in periods of insecure food supply and also found that in Europe incidence rates are estimated to be about one to 5%, whereas in the U.S. it is quoted to be about four to 6%. Countries like Finland, Norway, Germany, and Iceland have shown a higher incidence of psoriasis, while it is less prevalent in people residing in East Africa and those who are Eskimos and Indians (Solis et al., 2011). In East Africans, American blacks, and Indians zero to 7% occurrence rates have been reported and zero to 4% was found among Chinese populations (Wolters, 2005). In the U.S. population, psoriasis prevalence has been estimated to be between 0.5% and 3.15% while discrepancies have been found in gender, race/ethnicity, and age (Helmick et al., 2014).

Symptoms, Onset, and Progression

Helmick (2014) found that symptoms of psoriasis may include scaling, itching, burning, and redness, but can be characterized by a vast range. As mentioned earlier, psoriasis can occur

at any age, however studies indicate a higher prevalence between the ages of 20 and 30 years, and also between 50 and 60 years (Solis et al., 2011). According to Farber and Nall (1974), females have been shown to experience earlier disease onset than males.

Treatment Options

Psoriasis is a disease that affects individuals differently, causing treatments to vary from person to person (Renton, 2014). Recognizing treatments or treatment combinations is a process usually completed through trial and error in order to become effective (Renton, 2014). Because of this chronic condition, effective communication with physicians is necessary to keep patients better informed on treatment options specific to each type of the disease (Renton, 2014). Mild, localized psoriasis typically includes topical corticosteroids, vitamin A and D analogues as treatment, since they have been well tolerated and effective (Dabade, Feldman, Ghasri, & Yentzer, 2011). However, more aggressive forms of the disease warrant treatments using traditional systemic therapies, biologics and/or phototherapy (Menter, Korman, Elmets et al., 2009). Currently, treatment options for psoriasis are separated by first and second line therapies. First line therapy includes prescription medications, over the counter products, combined and alternative therapies, and few dietary factors.

First line therapies Topical treatments help to slow or stabilize excessive cell reproduction and reduce inflammation (NPF, 2014). The most frequent prescription topical treatment methods like corticosteroids, continue to be recommended as the first line of therapy for short-term use (Handa, 2010; Mason et al, 2013). Commonly these medicines are referred to as anti-inflammatory agents due to their role in reducing lesion swelling, redness, and itching. Many topical treatments can be prepared as ointments, gels, foams, lotions, creams, sprays or shampoos. The strengths range from very strong (class one) to very weak (class seven).

Response time for topical treatments is generally immediate, however the side effects that may result limits the exposure time. Common side effects caused by topical corticosteroids include: atrophy, thinning of skin, striae, telangiectasis, redness, easy bruising, dilated surface blood vessels, and decreased drug response (Handa, 2010; NPF, 2014). Topical treatments are usually recommended for use once to twice a day for up to four weeks due to safety concerns (Renton, 2014). To avoid possible side effects, the lowest strength medication should be used for the least amount of time. More commonly, physicians prescribe long-term use of mid-potency medications or sporadic use of steroids. Two of the most potent common topical corticosteroids used are Clobetasol Proprionate 0.05% and Betamethasone Dipropionate 0.05% (Handa, 2010). There are various non-steroidal medications that can be used as first line therapies, in addition to over the counter products and complementary alternative medicines (CAM).

Non-steroidal topical medications, Calcipotriene/Calcipotriol (Calcitriol) or Dovonex/Vectical are vitamin D3 derivatives. Calcitriol is an active natural form of vitamin D3. These medications are used twice a day for chronic, moderately severe psoriasis generally found on the scalp, but may also be used on the nails. Besides avoiding the face, including the lips and eyes, this topical can be applied practically anywhere on the body. Common side effects include hypercalcemia, itchy skin and general discomfort, as well as burning, stinging, and irritation, while less common side effects include dryness, peeling, rash, dermatitis and overall worsening of psoriasis (Handa, 2010; NPF, 2014). Along with hypercalcemia, hypercalciuria and kidney stones are other side effects associated with oral vitamin D3 (Ricketts, Rothe, & Grant-Kels, 2010). Because this medication also contains increased susceptibility to light, there is an increased risk of skin tumors that may form. Another uncommon side effect is the changes in

the limits of calcium metabolism, which would warrant discontinuing the medication until calcium levels return to normal (NPF, 2014).

Another group of topical medications that do not contain steroids and are used for psoriasis are a third generation retinoid and include Tazorac and Tazarotene, however these medications do not work as efficiently as steroids. They can also cause dryness and skin irritation at the site of application and patients have a high susceptibility to sunburns (NPF, 2014; Handa, 2010). Other side effects caused by topical vitamin A analogues include hair loss, hypertriglyceridemia, hyperostosis, tissue calcification, and teratogenicity (Ricketts, Rothe, & Grant-Kels, 2010). These medicines can be used as a cream, gel or foam. Foam medications are a newer alternative to topical treatments because they are easy to apply, contain minimal residue, absorb rapidly, and have higher bioavailability (Handa, 2010). Applications can be done once a day to receive the same effectiveness as twice a day applications.

Another topical medication used on the scalp is Anthralin or Dithranol which comes in a cream or ointment and contains strengths ranging from 0.1 to 3%. A thin layer applied once daily and a gradual increase in the concentration may be done according to bodily response and patient tolerance. This topical is left on skin for five to ten minutes followed by a thorough shampoo wash and rinse. Redness and irritation is common after treatment. Temporarily, this medication may cause staining of fingernails, gray/white hair, untreated skin and fabrics (Handa, 2010; NPF, 2014). The U.S. Food and Drug Administration (FDA) has approved a few over-the-counter medications for use on psoriasis (NPF, 2014).

Salicylic acid ointment is sometimes recommended which helps to smooth the skin by promoting peeling of the outer layer by softening, smoothing and lifting psoriasis scales (NPF,

2014). The side effects from long-term use includes, irritation and weakened hair shafts which may cause breakage and temporary hair loss.

Coal tar is an additional topical ointment, cream or shampoo treatment, generally used for the scalp. The tar is obtained from coal and wood from juniper and pine trees. Tar helps to slow the rapid growth of cells, restore its natural appearance, and reduce inflammation, itching and scaling. In general, the higher the concentration of tar the more potent the agent. Tar may cause irritation, redness and dryness and may stain clothing, linens, and light colored hair. A strong odor is commonly found with use, along with sensitivity to the sun and folliculitis (NPF, 2014). Coal tar shampoo is available and along with the ointment is used twice a week (Handa, 2010). In addition to coal tar, foam is another agent used commonly for scalp psoriasis.

Moisturizers help to keep skin lubricated which helps with psoriasis by reducing itching, redness, and promoting healing. Cooking oils and shortening are common household ingredients that can also be used as substitutes for moisturizers (NPF, 2014). Increased effectiveness of topical medications has been seen with use of moisturizers (Renton, 2014; Green, 2011). Bath solutions are another treatment method that can benefit psoriasis patients. Oil, oilated oatmeals, Epsom salts or Dead Sea salts can help removed psoriasis scaling and provide relief from itching.

Keratolytics help with scale lifting and allow prescription medications to reach the lesions. Products vary in design by body, scalp or both and when used on the scalp are generally stronger and may be too harsh for other areas of the body. Products that include salicylic acid, lactic acid, urea, and phenol can be used as scale lifters (NPF, 2014).

Some topical medications or moisturizers may benefit when occluded with plastic wrap, dressing, or other bandage, increasing the effectiveness and the amount absorbed into the skin.

British Association of Dermatologists [BAD], 2004 recommends occluding the area after using olive, coconut, or arachis oils at night. Over the counter anti-itch ingredients approved by the FDA include: calamine, hydrocortisone, diphenhydramine hydrochloride, camphor, benzocaine, and menthol. However, these ingredients should be used sparingly as they may cause irritation and dryness.

Other treatments such as combination therapy or complementary alternative medicines (CAM) are other options. Combination therapy used at lower dosages seems to be an effective approach, as this method offers potential for increased efficacy and decreased toxicity (Dabade et al., 2011). Taclonex is a medicine that combines Calcipotriene with Betamethasone Dipropionate and is commonly used on the scalp once daily for moderate to severe cases (Handa, 2010). This medication should not be applied to the face, underarms, groin or other skinfolds due to the skin's sensitivity in these areas. Side effects may include itching, skin thinning, burning, and/or skin rash, while other less common effects are redness, skin irritation, folliculitis, worsening of psoriasis, changes in skin color, and thin swollen blood vessels at the application site (NPF, 2014). When combining vitamin D analogues with corticosteroids, irritation is minimized and a decreased amount of the steroid is needed to be effective (Handa, 2010).

Complementary alternative medicines are an additional treatment option, which has gained rising interest (NPF, 2014). Complementary alternative medicines focus more on preventative care and pain management (NPF, 2014). Greater than one third of Americans (36 percent) use complementary and alternative therapies as indicated by surveys for the National Center for Complementary and Alternative Medicine (NCCAM) and National Center for Health Statistics (part of the Center for Disease Control and Prevention) (NPF, 2014). Therapies that

follow this pathway includes herbs and supplements, diet, mind/body therapies like aromatherapy, meditation, and yoga, physical therapy, exercise, acupuncture, and tai chi (NPF, 2014). Most CAM are safe, but some may interfere with other treatments prescribed (NPF, 2014). With regard to diet and nutrition, although evidence is limited, some dietary changes have impacted the chronic conditions that patients face (NPF, 2014). Few diets have been reported as effective CAM approaches including: weight loss, heart healthy, anti-inflammatory, and gluten-free (NPF, 2014).

In about 13 to 34% of cases plaque psoriasis has been associated with obesity (Neimann et al., 2006; Sterry, Strober, & Menter, 2007). A diet looking to provide weight loss would include: whole fruits and vegetables, whole grains, lean meats, fish, eggs, nuts and low-fat or non-fat dairy options. In order to successfully lose weight, one must burn off more calories than consumed (NPF, 2014). Slower weight loss, about one to two pounds per week, seems to have the most success (NPF, 2014). A heart healthy diet is another option that has had success.

With psoriasis patients and their increased risk of CVD, consuming a heart healthy diet may be beneficial as it lowers inflammation and improves heart health (NPF, 2014). Heart healthy diets contain limited alcohol, fish, lean meats, and skinless poultry. This diet is also cautious about portion control and limiting the amounts of processed and fast foods consumed (NPF, 2014). Another option is an anti-inflammatory diet.

Due the inflammation that psoriasis causes the body, patients have followed an anti-inflammatory diet and had success (NPF, 2014). Foods that increase inflammation include: fatty red meats, dairy, processed foods, refined sugars and nightshade vegetables such as tomatoes, potatoes, and peppers and therefore, should be avoided. Foods that help reduce inflammation include: cold water fish containing omega-3 fatty acids, olive oil, nuts and seeds, walnuts,

flaxseed, pumpkin seeds (also containing omega-3 fatty acids) and bright colored fruits and vegetables like carrots, spinach, and blueberries among others (NPF, 2014). The last diet option is gluten-free.

Recent research has found that approximately 25% of psoriasis patients may be sensitive to gluten (NPF, 2014). Gluten is found in products like bread, pastas, and crackers and is sometimes used when processing foods such as licorice, soy sauce, monosodium glutamate (MSG), lunch meats, and salad dressings (NPF, 2014). If a gluten free diet is attempted, it is recommended to avoid gluten products for at least three months to see results. All gluten must be avoided, meaning to perform this task accurately nutritional labels must be reviewed. The next option for treatment is used for unmanageable or severe psoriasis and includes systemic medications, biologics, and phototherapy (Handa, 2010).

Second line therapies These forms of therapy are used only when all topical treatments have been used consistently and have still failed (Handa, 2010). Second line therapies include systemic drugs, biologics and phototherapy. Prescription medications that work throughout the body are known as systemic drugs (NPF, 2014). As a second line therapy method, these drugs are usually used on moderate to severe psoriasis. Another reason for using these drugs is for patients who are unresponsive to topical medications or unable to use UV light therapy. These forms of medication have been used for over ten years and are commonly taken orally, in a pill or liquid form, or given by injection (NPF, 2014), Acitretin also known as Soriatane, Cyclosporine, and Methotrexate are the three systemic drugs that will be briefly discussed.

Acitretin is a second-generation retinoid, a synthetic version of vitamin A that is taken by mouth, once a day with food. This is the only oral retinoid that has gained FDA approval for treating psoriasis. The drug generally takes anywhere from eight to sixteen weeks to see

improvement and may take as long as six months to reach its maximum effectiveness (NPF, 2014). Like all drugs, side effects are something a patient should consider before taking a medication. Hair loss, chapped lips and dry mouth, dry skin and eyes, bleeding gums and nose bleeds, increased sunlight sensitivity, peeling fingertips and nail changes, changes in blood fat levels, depression, aggressive thoughts or thoughts of self-harm, joint pain, headaches, decreased night vision, and elevated liver enzymes are side effects that have been seem when taking this medication (Ricketts, Rothe, & Grant-Kels, 2010). Serious birth defects and tissue calcification can also be caused. Alcohol should be avoided during treatment, especially for woman of childbearing potential due to the drugs slow removal from the body (NPF, 2014). Accutane (Isotretinoin) is a first generation oral retinoid that is commonly used in the treatment of cystic acne. This drug is sometimes used instead of Acitretin to treat psoriasis.

Another systemic drug used for psoriasis is Cyclosporine. Cyclosporine was first used in 1997 as an immunosuppressant for use with organ transplants. Its function is to suppress the immune system by slowing the rate of immune cell generation. This medication is also taken orally in either, capsule or liquid form. If the liquid form is consumed it must be diluted with room temperature orange or apple juice, preferably. This drug must be taken consistently to be effective. With the stronger doses, results can be seen in as little as two weeks, however maximum effectiveness will not be reached for at least three to four months. The FDA recommends not taking Cyclosporine for over one year, but there is no length of time that a patient should discontinue treatment prior to resuming again. Side effects for this medication include: decreased kidney function, headache, increased potassium levels, hypertension, high cholesterol, excessive hair growth, tingling or burning sensation in extremities, skin sensitivity, increased growth of gum tissue, flu-like symptoms, upset stomach, drowsiness, and muscle,

bone or joint pain. If patients have been treated with methotrexate or other immunosuppressant drugs, coal tar or radiation therapy there is an increased risk of developing skin cancer while taking the drug. Kidney damage is another risk dependent on the length of use and strength of drug (NPF, 2014). Cyclosporine is safe to use in combination with topicals like Dovonex and Vectical and may be given in lower dosages to lessen potential side effects.

Methotrexate also a systemic drug, was initially used to treat cancer, but in 1970s the drug gained FDA approval and now it is prescribed for treatment of severe psoriasis (NPF, 2014). Methotrexate functions by binding to an enzyme, preventing it from being involved in the rate of skin cell reproduction and ultimately slowing the growth rate. For long-term use of the drug less common side effects such as liver damage and reversible liver scarring can occur. In unusual instances, years after using this drug, cancers such as bone marrow toxicity and lymphoma have presented. Increased infection risk may also be caused as the drug lowers white blood cell counts.

Another option for therapy is biologic drugs or biologics. Biologics are also used in the treatment of moderate to severe psoriasis and can be administered by injection or intravenous (IV) infusion. Some biologics may be done by the patient themselves, while others must be provided by a doctor (NPF, 2014). These protein-based drugs have been used for over 100 years and are cultivated in a laboratory originating from living cells. Biologics differ from systemic drugs in that they target a specific area of the immune system rather than the affecting the whole system (NPF, 2014). Well known biologics are Enbrel (Etanercept), Humira (adalimumab), Stelara, and Remicade (Inflixumab).

Biologics function by blocking TNF-alpha, a protein or cytokine that signals to create inflammation (NPF, 2014). A physician must administer Stelara, as this drug is injected

subcutaneously. Remicade is another biologic that must be dispensed by a physician or infusion center since it enters the body through IV. Unlike these two biologics, Enbrel and Humira are injected in the abdomen or extremities, usually by the patient or a family member. Some common side effects caused by these drugs include: respiratory infections, flu-like symptoms, and reactions at injection sites. The more rare side effects include: severe nervous system disorders such as multiple sclerosis, seizures, inflammation in the optical nerves, blood disorders, and certain types of cancer. There is also an increased risk of infection. Biologics may also be used in combination therapy with other medications like topicals or phototherapy, although phototherapy along with Remicade may cause increased risk of skin cancer. Enbrel, Humira, and Remicade are all effective and safe to be used in conjunction with Methotrexate (NPF, 2014).

The final option for second-line therapy is phototherapy treatments. Exposing the skin to ultraviolet light normally is known as phototherapy also called light therapy. This form of treatment is must successful when it is consistent and can be done at home with a phototherapy unit, in a doctor's office, or at a psoriasis clinic. According to the American Academy of Dermatology [AAD] and the World Health Organization [WHO], tanning inside raises melanoma risk by 59% and does not offer the type of light that is most effective in treating psoriasis (NPF, 2014). There are several different types of light therapy including: ultraviolet light A (UVA), ultraviolet light B (UVB), sunlight, laser treatments, and tanning beds (NPF, 2014).

UVA and UVB can be found in natural sunlight, but UVB works by penetrating the skin and slowing the affected skin cell growth, making this treatment method more effective (NPF, 2014). Similar to UVB treatments, the sun works identically with multiple short-term exposures.

To start, sunlight exposure should begin with five to ten minutes of daily afternoon sun; with additional thirty second increases if tolerated well. Areas of the skin unaffected by psoriasis should be covered with sunscreen and all areas should be exposed equally. This process can take up to several weeks before improvement is evident. Topicals that may increase sunburn risk include Tazarotene and coal tar, therefore these medications should be authorized before using while being exposed to sun. As an effective treatment for psoriasis, UVB must be used consistently, for a set length of time on a regular basis, and can be used either at home or in a medical facility. For home UVB treatment, initial treatments must begin at a medical facility and then the patient may use a light unit at home. All phototherapy treatments still require a prescription, including the equipment for home use, along with regular follow-ups by a physician. Two types of UVB treatment exist; broad-band and narrow-band and they differ based on the amount of ultraviolet light that is released. This form of phototherapy functions by targeting immune cells of the skin and keratinocytes, which causes remodeling of the epidermis and reduction of inflammation (Jabbar-Lopez, Wu, & Reynolds, 2014). Unfortunately, this treatment may cause the psoriasis to become worse before it gets better. This is evident with redness and itching caused by the light. Brief flares occur with low-level doses of UVB, in some circumstances, however reactions usually resolve when treatment continues. This treatment can be combined with topical medicines and/or systemic drugs for increased efficacy, although side effects like increased photosensitivity and burning, or a shorter remission may occur. UVB combined with systemic drugs may significantly increase efficacy and allow for reduced dosages of systemic medications (NPF, 2014).

Another form of light therapy is laser treatment. Recently, the FDA approved a laser called the excimer laser for treating chronic, localized plaques (NPF, 2014). This laser works by

emitting high intensity UVB light to the area and can target specific areas of the body that are affected by mild to moderate psoriasis. It has also been shown to be effective in treating scalp psoriasis. Treatment response varies between patients, however it may take about four to ten sessions to see results, depending on the severity. Patients are recommended to receive up to two treatments per week, but must wait at least 48 hours in between treatments. Laser treatments have been more effective on scalp psoriasis when combined with topical steroids for treatment on the scalp (NPF, 2014).

Tanning beds are frequently used as an alternative to natural sunlight. These machines emit mostly UVA light. Psoriasis benefits from the exposure primarily to UVB light, however some organizations such as the American Academy of Dermatology (AAD), the FDA, and the Centers for Disease Control (CDC) discourage the used of sun lamps and tanning beds. The AAD and the World Health Organization (WHO) found that the risk of melanoma skin cancer increases by 59% when using indoor tanning machines. In May, the FDA changed the risk level of tanning machines from class I (low risk) to class II (moderate risk). These machines may damage skin, initiating premature aging and an increased risk of skin cancer due to the UV radiation emitted (NPF, 2014).

Nutrients: Mechanisms of Action

Few nutrients have been studied regarding their effect and role in the treatment of psoriasis, however there are some that studies have included such as: omega fatty acids, vitamin A and vitamin D3 and their analogues, and antioxidants.

Omega Fatty Acids

Omega fatty acids are essential fatty acids in the human diet since they cannot be synthesized due to the lack of appropriate enzymes (McCusker & Grant-Kels, 2010). Two

common omega fatty acids include: linolenic also referred to as omega 3 and linoleic also known as omega 6 (McCusker & Grant-Kels, 2010). Omega 3 fatty acids (FAs) are important in their role as immune modulators and include a couple types of fatty acids like eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), while omega 6 FAs function as structural precursors for stratum corneum ceramides (McCusker & Grant-Kels, 2010). Varied results have been produced with the supplementation of fish oil in psoriasis, dependent on administration method (McCusker & Grant-Kels, 2010). The natural sources of omega 3 FAs are fish oils (Yashodhara et al., 2009). The mechanism of action in psoriasis treatment regarding fish oil is based extensively on the modification of serum, epidermal and blood cell membrane lipid composition (Ricketts, Rothe, & Grant-Kels, 2010).

Vitamin A and analogues

Topical and systemic vitamin A as retinoids may function to block the growth of hyperproliferative keratinocytes and stimulate their terminal differentiation (Reichrath, Lehmann, Carlberg, Varani, & Zouboulis, 2007). Some carotenoids present in fruits and vegetables such as alpha-carotene, beta-carotene, and beta-cryptoxanthin are internally converted to vitamin A (McAnally & Szymanski, 1966; Goodman, Huang & Shiratori, 1966; Deuel, Ganguly, Wallcave & Zechmeister, 1953).

Vitamin D3 and analogues

Keratinocytes showed a large inhibition of cell progression and hastened development when exposed to vitamin D (Wolters, 2005). Vitamin D3 (cholecalciferol) and its analogues use activities such as non-reproductive and prodifferentiative as well as immune response control (Wolters, 2005). Important vitamin D3 facilitated processes in psoriasis treatment involve the down regulation of keratinocyte production and the initiation of variation (Rickets, Rothe, &

Grant-Kels, 2010). The mechanism of action in psoriasis treatment regarding topical vitamin D is still being determined, although it has been well established in treating psoriasis (Ricketts, Rothe, & Grant-Kels, 2010).

Selenium

Antioxidants are the final nutrients that seem to have an influence on the oxidative stress caused by psoriasis. Selenium is known for its UVA and UVB defensive and anti-inflammatory nature, along with its inhibitory effect on DNA synthesis and stimulatory outcome on cellular production (Ricketts, Rothe, & Grant-Kels, 2010). In addition to being an antioxidant, selenium plays an important role in non-enzymatic cellular defense against reactive nitrogen and oxygen species (Kharaeva, Gostova, De Luca, Raskovic & Korkina, 2009). In patients with psoriasis, selenium levels may be diminished, meaning adding them back into the diet could be influential for psoriasis patients (Ricketts, Rothe, & Grant-Kels, 2010).

Effects of Nutrients and Psoriasis Progression

This section of the paper will discuss the findings in research with regards to various nutrients that have been used to treat psoriasis. These include: omega fatty acids/fish oils, vitamin A, vitamin D, and antioxidants.

Omega Fatty Acids

Omega fatty acids, omega 3 and omega 6 have been found to have beneficial effects on psoriasis. Fish oil is a supplement that was commonly used in studies. One study contained 28 patients who used oral fish oil supplements, containing 1.8g EPA, for eight weeks to treat their chronic psoriasis, which showed a significant decrease in the Psoriasis Area Severity Index [PASI] (Drevon, 1992). In a 12 week double blind, randomized, placebo controlled study that included 32 patients, each receiving ten fish oil capsules, containing 1.5g EPA, there was a

decrease in itching and erythema that was present among 24 patients (Bittiner, Tucker, Cartwright, & Bleehen, 1988). In one study performed on 83 chronic plaque psoriasis patients that was double-blind, randomized, placebo-controlled, multicentric trial, researchers used omega 3 fatty acid lipid emulsion for two weeks. This emulsion contained 4.2g EPA and DHA and found an 11% decrease in PASI scores (Mayser et al., 1998). An additional study was done on 20 guttate psoriasis patients for 10 days and used omega 3 FAs lipid infusion and an omega-6 emulsion containing 2.1g EPA and 21g DHA through IV method (Grimminger et al., 1993). There was a 45 to 76% decrease in PASI score in the omega 3 group and a 16 to 25% decrease in PASI score in the omega 6 group (Grimminger et al., 1993). One trial was completed on 25 patients with topical applications of fish oil containing 15.8% EPA, 10.1% DHA and showed a significant reduction in erythema, itching and thickness of plaques and was single blind, randomized, and controlled (Escobar, Achenbach, Iannantuono, & Torem, 1992). A study by Bittiner, Tucket, Cartwright, & Bleehen (1988) had patients receiving 3g of oral omega 3 FAs (mostly EPA) from 10g fish oil daily. Table 1 summarizes the various studies and their results on oral, intravenous, and topical fish oil treatment and psoriasis.

Table 1 Fish oil in the treatment of psoriasis

Study, year	Type of study	Pts	Type of psoriasis	Therapy	Duration	Results
Oral fish oil alone						
Soyland, 1993	DB, MC	145	Moderate-severe psoriasis	Oral fish oil (5 g EPA + DHA) vs corn oil	4 mon	No significant change in PASI
Bittiner, 1988	DB, R, PC	28	Stable, chronic psoriasis	Oral fish oil (1.8 g EPA) qd vs olive oil	8 wks	Significantly better improvement in erythema ($P < .05$) in fish oil group. Nonsignificant improvements in pruritus, scaling, & BSA involvement in fish oil group

Bjorneboe, 1988	R, DB, PC	30	Stable psoriasis	Oral fish oil (1.8 g EPA) qd vs olive oil	8 wks	No significant difference in erythema, desquamation, infiltration, BSA involvement
Danno, 1998		40		Etretinate + EPA vs etretinate 20 mg/d monotherapy		Significant improvements in erythema, thickness, and scale in EPA group
Intravenous fish oil						
Mayser, 1998	DB, R, PC, MC	83	Chronic, plaque psoriasis (PASI ≥ 15)	ω-3 EPA + DHA lipid emulsion vs ω-6 lipid emulsion	14 days	Significantly greater decrease in PASI by 11.2 ± 9.8 in ω-3 group vs by 7.5 ± 8.8 in the ω-6 group (P = .048)
Grimminger, 1993	DB, PC	20	Acute guttate psoriasis (≥10% BSA)	ω-3 vs ω-6 intravenous emulsion	10 days	Moderate clinical improvement (P < .05)
Topical fish oil						
Escobar, 1992	R, PC, SB	25	Plaque psoriasis	Topical fish oil (15.8% EPA + 10.1% DHA) vs liquid paraffin	4 wks	Significantly improved erythema and scaling w/ fish oil and liquid paraffin; significant decrease in lesion induration with fish oil only
Henneicke-von Zepelin, 1993	DB, PC, MC	52	Moderat e, plaque psoriasis	Topical ω-3 PUFAs (1% or 10%) vs placebo	8 wks	No statistically significant difference between ω-3 vs placebo group
(From Riketts, Rothe, Grant-Kels, 2010)						

Vitamin A

According to Ricketts, Rothe and Grant-Kels (2010) reports conflicted with regard to serum vitamin A levels in patients with psoriasis. However, a few studies indicated that patients with "common psoriasis", severe erythrodermic and pustular psoriasis, and even patients with both active and inactive psoriasis have decreased serum vitamin A levels based on reported results (Rocha-Pereira et al., 2001; Marrakchi et al., 1994; Majewski et al., 1989). In a recent study Johnson, Ma, Kanada, and Armstrong (2014) reported the significant association between

psoriasis and elevated levels of vitamin A and beta-carotene. Another finding indicated the significantly higher serum levels of beta-carotene as well as vitamin A in regards to psoriasis, suggesting that the vitamin A pathway may be altered in these individuals.

Vitamin D

Vitamin D as a topical has been researched for the treatment of psoriasis and has provided improvement. Seventeen patients with moderate to severe psoriasis were provided 0.25mcg of oral or topical vitamin D3 taken once or twice daily in a small prospective study. As long as urinary calcium remained within normal limits the dosage was increased during follow up visits. Results of the study found that a single dose given at bedtime instead of twice a day helped reduce hypercalciuria. Significant clearing was evident in 10 of the 14 patients, where four patients had mild improvement or no benefit (Smith, Pincus, Donovan, & Holick, 1988). Another study produced moderate improvement in the skin lesions in two of the eight patients when provided oral D3 with 0.5 to 2mcg/d dosage for six months (El-Azhary, Peters, Pittelkow, Kao, & Muller, 1993). An additional study that was randomized, placebo-controlled, and double blinded provided a daily dose of 1 mcg D3 in 41 patients for 12 weeks. These patients had moderate to severe psoriasis and showed no difference between the two groups in PASI scores as noted in the table below (Siddiqui & Al-Kwawajah, 1990). Table 2 explains the study and the results on oral vitamin D treatment and psoriasis.

Table 2 Oral vitamin D in the treatment of psoriasis

Study, year	Type of Study	Pts	Type of Psoriasis	Therapy	Duration	Results
Siddiqu, 1990	R, DB, PC	50 (41 completed the trial)	Moderate to severe psoriasis	Oral 1-α-hydroxyvitamin D_3 1 μg/d	12 wks	Nonsignificant improvement in PASI between vitamin D3 vs placebo; (45% vs 38.2% had <33% reduction in PASI).

(From Ricketts, Rothe, & Grant-Kels, 2010)

Antioxidants

Antioxidants seem to have a role in the pathogenesis of psoriasis. In one case-control study patient questionnaires were assessed and there was an increased consumption of carrots, tomatoes, and fresh fruit that correlated with a significant decrease in risk (Naldi, Parazzini, Peli, Chatenoud & Cainelli, 1996). As evidenced in a few studies in conditions of the skin, like psoriasis, findings have shown that coenzyme Q10, vitamin E, and selenium become lower than usual (Briganti & Picardo, 2003; Passi, De Pità, Grandinetti, Simotti & Littaru, 2003; Serwin, Wasowicz, Gromadzinska & Chodynicka, 2003). In an eight week trial, psoriasis patients originally had decreased levels of an antioxidant enzyme, however they were given supplements containing selenium and vitamin E which led to an increase in glutathione peroxidase enzyme (Kharaeva, Gostova, De Luca, Raskovic & Korkina, 2009). Using supplements containing antioxidants like coenzyme Q10, vitamin E, and selenium may be an additional option for patients to manage severe forms of psoriasis (Kharaeva, Gostova, De Luca, Raskovic & Korkina, 2009). Table 3 shows the studies and their results on selenium treatments and psoriasis.

Table 3 Selenium in the treatment of psoriasis

Study, year	Type of Study	Pts	Type of Psoriasis	Therapy	Duration	Results
Kharaeva, 2009	R, PC	58	Severe erythrodermic psoriasis & severe psoriatic arthritis	Selenium (aspartate salt 48 μg/d) + coenzyme Q (ubiquinone acetate, 50 mg/d) + vitamin E (α-tocopherol, 50 mg/d) vs placebo	30-35 days	Significant improvement (vs placebo) in clinical skin scores in erythrodermic & psoriatic arthritis variants
Serwin, 2003	DB, PC, parallel group	22	Active plaque psoriasis	Topical 5% salicylic acid + 0.1% to 0.3% dithranol ointment + 200 μg /d selenomethionine or placebo	4 weeks	No effect of Se supplements on improvement in clinical psoriasis
Serwin, 2006	DB, R, parallel group	37	Active psoriasis	Selenomethionine 100 μg/d or placebo + NBUVB 5× wk	4 weeks	No significant difference in reduction of PASI score between groups

Fairris, 1989	PC, DB	69	Psoriasis	600 μg Se-enriched yeast or 600 μg Se-enriched yeast + 600 IU vitamin E or placebo	12 weeks	No clinical improvement with any of the regimens
Harvima, 1993	Pilot	7	Mild to severe plaque psoriasis	Selenomethionine-yeast tablets (total 400 μg/d Se)	6 wks	No clinical improvement noted
(From Riketts, Rothe, Grant-Kels, 2010)						

Summary and Future Research

The objective of this literature review was to define, examine, and identify psoriasis with regard to current treatment options available and the role of nutrition. Overall, findings indicated the treatment options and the order in which treatment should begin. Each type of psoriasis has a treatment method suitable, however the location of the disease, patients response and tolerance to various treatments and their side effects, as well as the severity all factor into the outcome. Diet does make difference in this skin disorder, although the function that many nutrients have is still unclear. Psoriasis is a debilitating skin disorder that can affect anyone at anytime. Unfortunately, there is no cure or prevention. The only option to regain a quality of life without itching and scratching are medications and diet. Diet as a factor, needs to be researched and tested for worldwide approval. In the meantime, patients will continue to suffer the cosmetic and emotional effects of an incurable disease.

After looking at the current literature on this topic findings helped draw some conclusions. One study used oral fish oil for eight weeks and had a significant decrease in the PASI. Another trial used oral fish oil and there was a decrease in itching and erythema. An additional study used omega 3 fatty acid lipid emulsion and has an 11% decrease in PASI scores. One trial used omega 3 fatty acid lipid infusion and an omega 6 emulsion through IV which had a 45 to 76% decrease in PASI for the omega 3 group and a 16 to 25% decrease in the omega 6 group. Another study used topical applications of fish oil and had significant reduction

in erythema, itching, and plaque thickness. Findings on the benefit of vitamin D demonstrated in one study that a single oral dose in the evening, before bed, helped reduce hypercalciuria. Another study used oral vitamin D3 and have moderate skin lesion improvement after six months. An additional study used oral vitamin D3 for 12 weeks, but these patients showed no difference in PASI scores when compared to the placebo group. One finding on the benefit of antioxidants was seen after eight weeks of consuming a supplement containing vitamin E and selenium, where patients had increased glutathione peroxidase enzymes.

After reviewing current research in this topic, it is clear that specific nutrients such as omega fatty acids, vitamin A and analogues, vitamin D and analogues, and antioxidants all need to be further researched, as the mechanism for the efficacy in mitigating symptoms has not yet been fully discovered. The role of nutrition could be explained by the fact that specific foods have anti-inflammatory effects, which help control inflammation caused by psoriasis. However, this hypothesis cannot be fully supported by reviewing the literature and more studies should be conducted. Criteria for epidemiological studies in diagnosing psoriasis is another area where research is lacking as discussed by Plunkett and Marks (1998). Per Johnson, Ma, Kanda, and Armstrong (2013) more research is still needed to determine the role of nutritional factors in psoriasis pathogenesis and progression. Other research topics could be controlling diets for psoriasis treatments and monitoring long-term dietary intake in psoriasis patients. A study by Wolters (2005) explains that further well-designed clinical trials are necessary in order to verify or refuse any benefits via dietary manipulation. Lakdawala (2013) mentioned uncertainty with vitamin D deficiency and vitamin D supplementation in patients with psoriasis due to the lack of randomized, controlled trials. Rahman et al., (2013) mentioned in the near future, better management of psoriasis might include a new first line of approach such as nanomedicines for

effective omega 3 polyunsaturated FA delivery. As stated by Naziroglu et al., (2012) further information is needed on selenium, as this topic is scarce. Data that was presented in a study illustrated that patients have reduced concentrations of selenium when affected by psoriasis; however, reports are conflicting. More up-to-date, population-based, prospective studies need to be conducted on a larger scale and are necessary as a foundation for on-going research as discussed by Plunkett and Marks (1998).

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