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Improve psoriasis symptoms with strategies to manage nutrition

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Abstract
Psoriasis is an inflammatory skin disease that has been linked to both genetic and environmental factors. From 0.09 to 11.43% of the world's population has this dermatosis; in industrialized nations, the prevalence is between 1.5% and 5%. Psoriasis is believed to be caused by a combination of adaptive and innate immune responses. The PASI scale measures the clinical severity of psoriasis on a scale from 0 to 100. This analysis was conducted to determine if existing nutrition interventions are effective in alleviating psoriasis symptoms. Science Direct, Google Scholar, Scopus, PubMed, and ClinicalTrials.gov were used to compile the data for this review. We used the following search terms to narrow our results: psoriasis, nutrition, diet treatment, vitamin, RCTs, and clinical trials. Ten studies were selected from the 63 articles for this review. Research designs are evaluated using the Risk of Bias 2 (RoB2), the Risk of Bias in Non-Randomized Studies of Interventions (ROBINS-I), and the Newcastle-Ottawa Scale (NOS). Studies concluded that a Mediterranean diet, vitamin D3 supplementation, the elimination of cadmium (Cd), lead (Pb), and mercury from the diet, as well as intermittent fasting and low-energy diets for weight loss in obese patients, can alleviate the symptoms of inflammatory diseases. Psoriasis patients undergoing treatment should adhere to dietary recommendations.

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Keywords: psoriasis, PASI score, nutrition, weight loss

Introduction

An inflammatory skin disorder known as psoriasis is characterized by its widespread nature. Patients with this dermatosis make up anywhere from 0.15 percent to 5 percent of the population in developed nations. Periods of remission followed by relapses have been observed. This is a skin disease that also affects the body's internal organs. (World Health Organization psoriasis, 2016) [34]. Psoriasis is characterized by a buildup of abnormally proliferating keratinocytes (epidermal cells), or plaques (Zuccotti *et al*., 2018) [36].

The pathogenesis of psoriasis is influenced by immune disorders that cause an uptick in pro-inflammatory cytokine production. The overactivity of Th1, Th17, and Th22 lymphocytes leads to an excessive production of pro-inflammatory factors. Examples of these factors include C-reactive protein (CRP), interleukins 1, 2, 6, 8, 12, 17, 22, and 23, interferon (IFN)-γ, tumor necrosis factor (TNF)-α, ceruloplasmin, α2-macroglobulin, and α1-antitrypsin, among others. In both the active and remission stages of psoriasis, the concentration of these factors is elevated. The stimulating effect of TNF- on the proliferation of keratinocytes is a crucial factor in the pathogenesis of psoriasis (Kilmer, 2010) [19].

Regardless of the fact that psoriasis can manifest at any age, even in childhood, the condition tends to flare up between the ages of 16 and 22, and again between the ages of 57 and 60. Both sexes are equally vulnerable to this condition. Less than 3% of the skin surface is affected in the mild form of the disease, which affects about two-thirds of patients. The negative effects of

psoriasis on quality of life can be seen in the condition's association with lower work productivity, greater physical disability, and impaired social relationships (Reich, 2012) [29]. Psoriasis is a complex disorder with multiple contributing factors, including both genetic and environmental factors. Recent research has pinpointed more than 60 disease susceptibility regions linked to Th17 cell activation as a result of genome-wide association studies. Psoriasis pathogenesis is widely believed to involve both the adaptive and innate immune systems (Potter, 2008) [28]. Genetic and environmental factors, in addition to immune system dysfunction, contribute to disease progression (Rendon & Schäkel, 2019) [31]. Psoriasis susceptibility has been shown to be influenced by HLA complex genes (specifically HLA-Cw6). However, many people who inherit psoriasis-related genes never show any symptoms of the disease (Owczarek, 2022) [26].

Here are some of the environmental contributors that can bring on a psoriatic outbreak (Barrea *et al*., 2016) [4]: Medications (β-adrenolytics, angiotensin-converting enzyme inhibitors, l-natriuretic peptides); stress; skin diseases (rosacea, fungal infections, allergic contact dermatitis); chemical factors (chemical burns, topical treatments, others); infections (primarily streptococcal pharyngitis, viral infections and ultraviolet radiation (UV) are all potential causes of skin cancer.

The etiopathogenesis of psoriasis is unclear in many investigations. Psoriasis is affected by genetic, immunological, and environmental factors to varying degrees. Additionally, the association between psoriasis and other diseases must be considered (Garbicz *et al*., 2022).

Psoriasis is characterized by reddened, well-defined plaques of erythrosquamous skin covered in silvery scales (a sign of hyperparakeratosis). About a quarter of patients report painful and bleeding skin, and roughly two-thirds report itching symptoms (Gmeiner *et al*., 2020). In most cases, lesions appear on both sides of the body at roughly the same locations, including the soles, elbows, palms, knees, face, legs, lower back, scalp, and body folds. It is also common in the mouth, on the nails, and in the genitalia (Mrowietz & Reich, 2009) [29].

Psoriasis can appear in two different forms: chronic, with stable plaques, and acute, with rapid development and spread. Without treatment, this can lead to exfoliative erythroderma, which is characterized by the development of lesions at the site of injury and is sometimes called the Koebner phenomenon (Langley *et al*., 2005) [20].

Plaque psoriasis has been classified in various ways over the years, but The International Psoriasis Council (IPC) proposed a simplified clinical phenotype-based classification in 2005. Classic psoriasis, also known as plaque psoriasis or psoriasis vulgaris (commonly referred to as "psoriasis"), is the most common type, affecting 80% to 90% of patients. Psoriasis comes in several other, less common forms, including guttate, pustular, and erythrodermic. Subtypes of psoriasis include the inverse form, palmoplantar psoriasis, drug-associated psoriasis, and others based on factors such as onset, disease activity, plaque size, distribution, thickness, and anatomical localization (Lowes *et al*., 2014) [21]. Any age is possible for the onset of a disease. Type I appears before the age of 40, with a peak onset age of 15 to 20 (i.e., early onset), whereas type II appears after the age of 40, with a clear peak between the ages of 55 and 60 (i.e., late onset). Over 75% of people with psoriasis have type I, which is also the most prevalent form, is typically associated with a more advanced stage of the disease and rarely occurs in tandem with an infectious condition. Human leukocyte antigen (HLA)-Cw6 is strongly linked to type I patients and is often inherited (Rendon & Schäkel, 2019) [31].

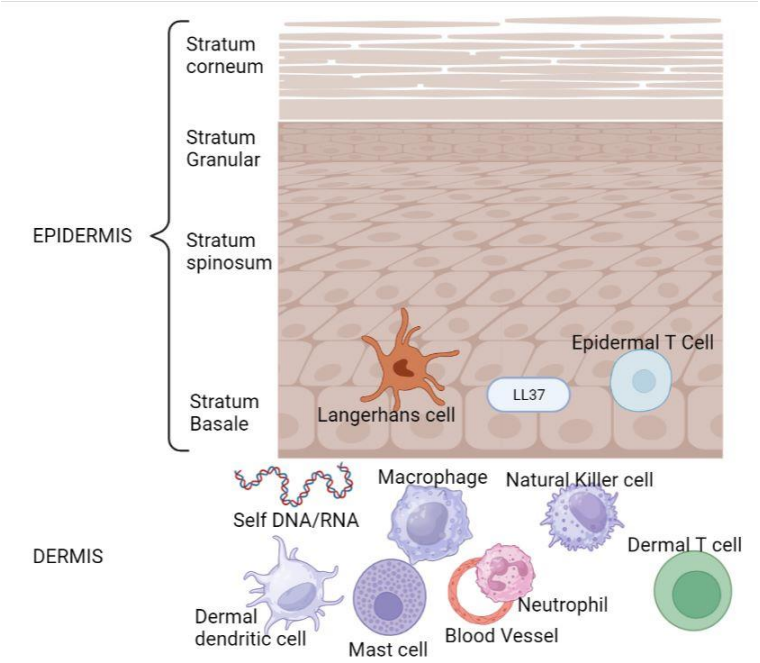


Fig 1: Healthy skin. The epidermis is the first layer of the immune system to respond to foreign invaders and environmental stresses. Proliferation of basal cells is the underlying mechanism. Langerhans cells and antimicrobial peptides in the epidermis protect the body from harmful bacteria and viruses

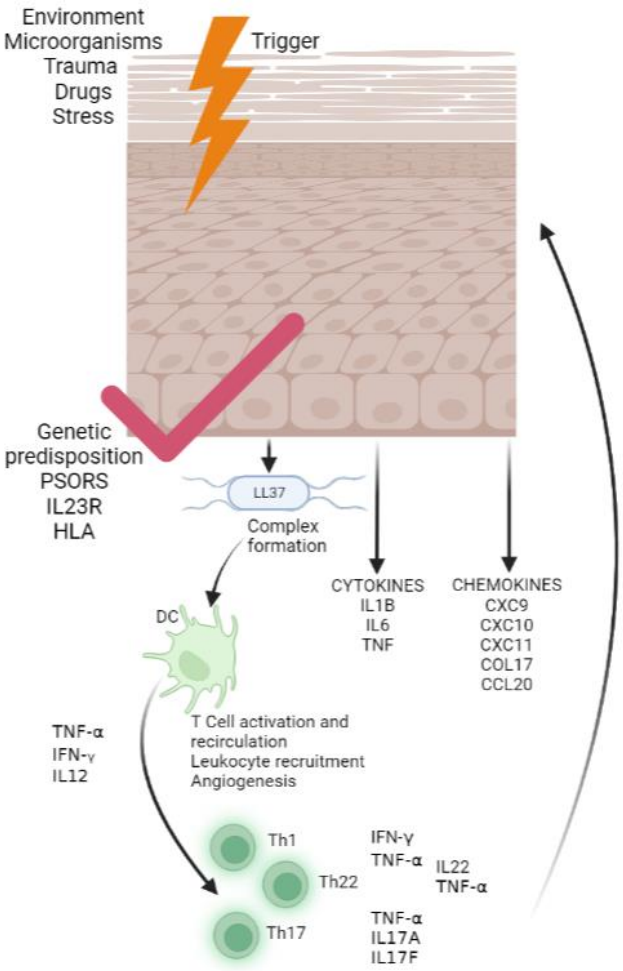


Fig 2: Dendritic cell activation requires an external trigger on the skin as well as a genetic tendency to build a self-DNA/RNA complex with LL-37. Cytokines and proinflammatory mediators are produced by effector T cells (Th17, Th1, and Th22) through the differentiation of naive T cells. It will stimulate AMP, chemokine, and cytokine production in addition to activating and multiplying keratinocytes

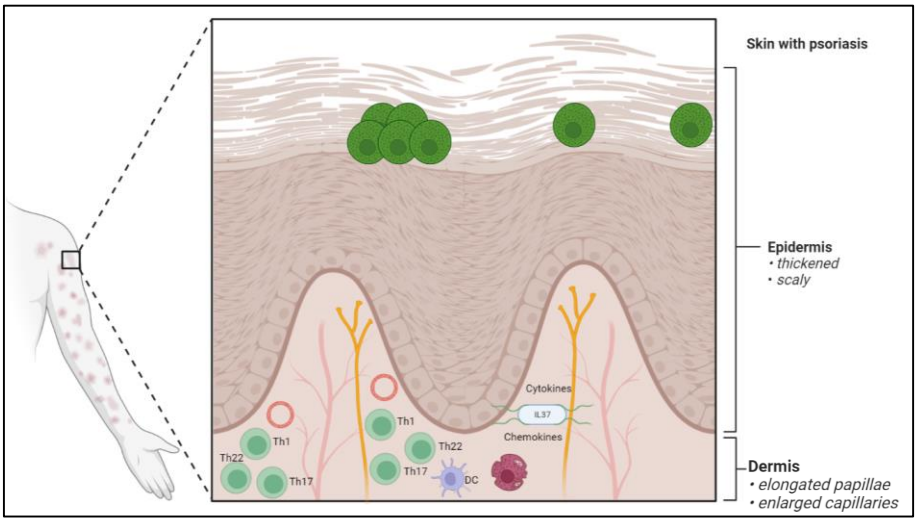


Fig 3: The psoriatic lesion, which is caused by an innate and adaptive immune response, has the following characteristics: activation of the cutaneous nerve, dilation of blood vessels, impaired differentiation of terminal keratinocytes and hyper parakeratosis, neutrophil infiltration, activation, epidermal hyperplasia and thickening, recruitment, infiltration of immune cells in the skin, and elongation of rete ridges.

Psoriasis is rated on a scale from mild to severe based on the severity of its clinical manifestations. The classification of psoriasis takes into account the severity of the cutaneous manifestations, which are typically assessed using the Psoriasis Area and Severity Index (PASI) or as a percentage of the total body surface area (BSA). The assessment considers factors such as redness, infiltration, scaling, and the extent of involvement in various body areas (trunk, head, arms, and legs) (e3). Psoriasis is classified as mild if the PASI score is below 10, while it is categorized as moderate to severe if the PASI score falls between 11 and 72. A PASI score exceeding 40 is exceptionally rare. In accordance with the S3 recommendations, psoriasis severity is defined as a PASI score of 10 or higher. Additionally, based on BSA,

psoriasis is considered moderate to severe when the affected BSA is greater than 10. (Mrowietz & Reich, 2009) [29].

When categorizing psoriasis into mild, moderate, or severe, the assessment takes into account the individual's impaired health-related quality of life.The Dermatology Quality of Life Index (DLQI) is a helpful tool for doing this. The range of possible DLQI scores is from 0 to 30. If the patient's skin condition has a score of 0 or 1 on the Dermatology Life Quality Index (DLQI), the patient's quality of life is not adversely affected by their skin condition. When the value is greater than 10, it indicates a severe decrease in quality of life (Reich & Mrowietz, 2007) [30]. All of these metrics are used to assess treatment effectiveness in clinical studies and can be adapted for use in therapy. Psoriasis is considered moderate to severe, and systemic treatment is usually necessary, if either the PASI or BSA is greater than 10, and the DLQI is also greater than 10 (Finlay, 2005) [12]. Additional elements that influence the severity of a psoriasis case include the patient's response to previous therapies, the degree to which the disease has spread to prominent areas (such as the scalp and nails) or the area of the genitals, and the presence or absence of special manifestations, such as itchiness, which may requires systemic treatment in some cases (Mrowietz & Reich, 2009) [29].

Both the severity and activity level of the disease are crucial. The appearance newly developed lesions at frequent times, the spread of already present foci, and the occurrence of multiple recurrences following therapy are all possible markers of highly active illness. These considerations are crucial for deciding on a course of treatment. The goal of this review was to evaluate the efficacy of current nutritional treatments in reducing psoriasis symptoms, as assessed by the Psoriasis Area and Severity Index (PASI), in people with mild to severe psoriasis, by examining (1) the various kinds of treatments that have been shown to be effective for the affected population, and (2) the significant results of these interventions, along with their associated sizes. In order to provide a more full picture of what works for the afflicted population, we also intended to evaluate other critical outcomes of the selected nutrition treatments.

2. Methods

a. Search strategies

The protocol for the systematic review was developed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) declaration for systematic review reporting (Moher *et al*., 2009). A systematic literature search was conducted using Science Direct, Google Scholar, Scopus, PubMed, and ClinicalTrials.gov. Several keywords were used to search for relevant studies: psoriasis, nutrition, diet treatment, vitamin, randomized controlled trials (RCTs), and clinical trials. The initial search carried out on July 11th, 2023, and no recent or related articles were discovered.

Inclusion criteria

- The patients is psoriasis disease
- The study was randomized controlled trial, non-randomized controlled trial, case control, and cohort study
- The year of study 2013–2023
- Dietary nutrition for patient psoriasis disease include carbohidrate, fat, vitamin, and mineral

Exclusion criteria

- The study not the randomized controlled trial, non-randomized controlled trial, cohort study, and case control
- The year of study under 2013
- The patient is human, not animal

b. Data extraction

The titles and abstracts were examined to ensure that they fulfilled the inclusion requirements. Full-text reports were then reviewed to determine whether or not the articles were appropriate for inclusion based on criteria such as outcomes, interventions, study designs, and patient populations. Studies were excluded and the reasons were documented.

c. Quality assessment

Two reviewers (CVA and KD) independently evaluated the methodological quality of the studies using the Risk of Bias 2 (RoB2), Risk of Bias in Non-Randomized Studies-of Interventions (ROBINS-I) tools, and Newcastle-Ottawa Scales (NOS) tools. Only randomized trials that have had their risk of bias evaluated using the Cochrane risk-of-bias tool for randomized trials, version 2, are included in Cochrane Reviews. RoB 2's specified areas of bias include a wide range of potential problems with trials and their reporting. The purpose of a set of inquiries, known as "signalling questions," is to elicit details about trial elements that are pertinent to each domain's risk of bias. Based on the responses given to the signaling questions, an algorithm suggests a bias risk assessment for each domain. Bias risk ratings can range from "Low" to "High," with the option of "Some concerns" as well. The ROBINS-I, a tool created to evaluate the risk of bias in findings, can be used in non-randomized studies that compare the health effects of various interventions. The NOS was used to assess journals with cohort and case control study designs.

3. Results

a. Description of selected studies

The systematic search generated 63 articles, with an additional two identified via bibliographic evaluations. Only English-language, peer-reviewed articles published between 2013 and 2023 were included. Nine duplicate studies were eliminated from the databases. After evaluating 54 articles according to their titles and abstracts, 32 full-text articles were reviewed. Twenty-two studies were excluded because they contained the wrong outcome (n = 3), intervention (n = 4), study design (n = 9) or patient population (n = 6). This analysis included ten studies. Please see Figure 4 for the PRISMA flow diagram.

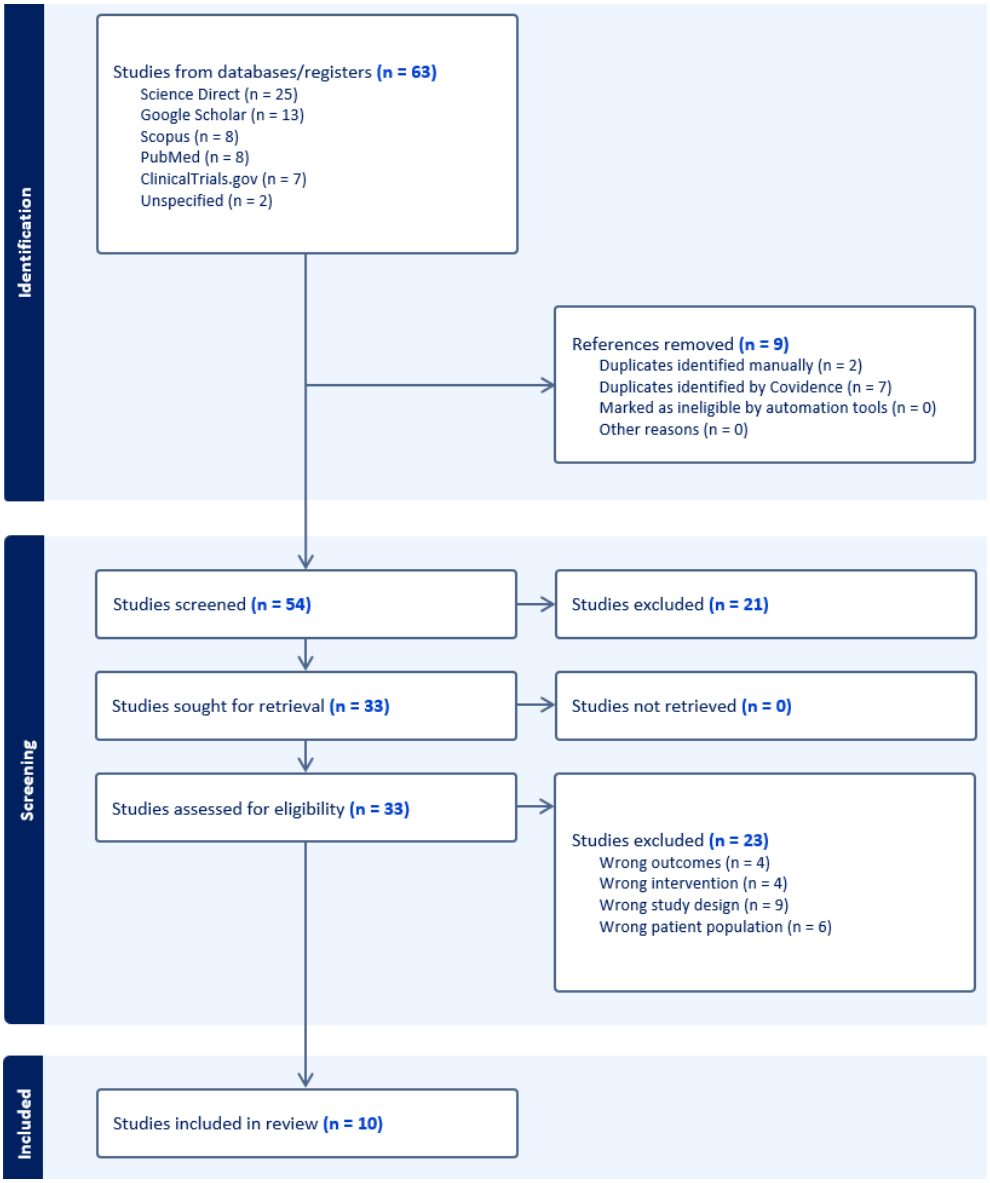


Fig 4: PRISMA Flow Diagram. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analysis

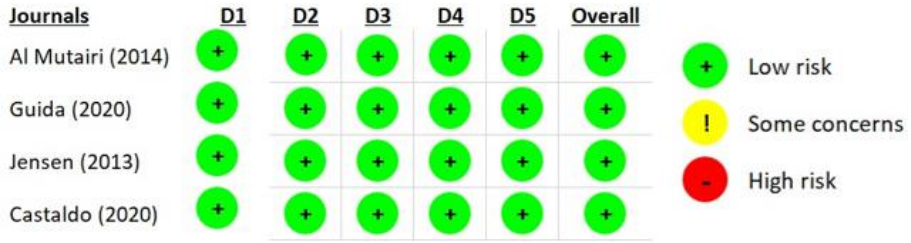
Table 1: Summary of Included Study Characteristics

No.	Author	Tittle (Year)	Aim of study (Study Design)	Population and intervention	Result and outcomes
			A. Vitamin D		
1.	Finamor., *et al* (Brazil)	A pilot study assessing the effect of prolonged administration of high daily doses of vitamin D on the clinical course of vitiligo and psoriasis (2013)	Assess the efficacy and safety of prolonged high-dose vitamin D3 treatment of patients with psoriasis and vitiligo (Clinical Trial)	For six months, nine psoriasis patients and sixteen vitiligo patients took 35,000 IU of vitamin D3 once daily, in addition to following a low-calcium diet (no dairy products or calcium-enriched foods, such as oat, rice, or soya "milk") and getting plenty of water (at least 2.5 L daily).	In all nine psoriatic patients, the PASI score increased significantly. In 14 of 16 vitiligo patients, repigmentation occurred between 25% and 75% of the time. Increases in urinary calcium excretion were within the normal range, and neither serum urea nor creatinine nor total nor ionized calcium changed. It is possible that high-dose vitamin D3 therapy is both effective and safe for psoriasis and vitiligo patients.
			B. Mediterranean diet		
2.	Phan., *et al* (French)	Association between Mediterranean Anti-inflammatory Dietary Profile and Severity of Psoriasis	Assessed the association between a score Mediterranean diet (MEDI-LITE) and the onset and/or severity of	Psoriasis patients were identified using a validated online self-completed questionnaire, and then stratified into three groups based on disease severity: those with severe	The data show that out of a total of 158,361 people enrolled in NutriNet-Sante, 35.735 (or 23%) filled out the psoriasis survey. In total, there were 27

		Results From the NutriNet-Sante Cohort (2018)	psoriasis. (RCT)	psoriasis, those with less severe disease, and those without psoriasis.	220 (or 76%) female respondents with a mean (SD) age of 47.5 (14.0) years. The prevalence of psoriasis was found to be 10.0%, or 3,557 people. In 878 (24.7%) cases, the severity of the condition was high, and in 299 (8.4%) cases, the onset occurred more than 2 years after the participant was added to the cohort. Psoriasis severity was found to be inversely related to MEDI-LITE score after controlling for potential confounders.
C. Weight Reduction					
3.	Jensen., *et al* (Denmark)	Effect of Weight Loss on the Severity of Psoriasis A Randomized Clinical Study (2013)	Examined the impact of weight loss on psoriasis severity in obese patients (Randomized Controlled Trials)	Plaque psoriasis patients over the age of 18 with a body mass index (BMI) of >27 made up the study population. Evaluated in 16 weeks. Participants N=58, Intervention group = 29(50%), Control group = 29(50%),	The Dermatology Life Quality Index (DLQI), which was used in the study to assess health-related quality of life, showed a significant decline in obese patients following weight loss with an LED (p 0.001) in the study. Additionally: Patients in the LED group had a mean weight change of -15.8 kg after 16 weeks as opposed to -0.4 kg in the control group.
4.	Bilberg., *et al* (Sweden)	The impact of a structured weight loss treatment on physical fitness in patients with psoriatic arthritis and obesity compared to matched controls: a prospective interventional study (2022)	To compare the fitness levels of psoriatic arthritis (PsA) patients who are also overweight or obese to those of similarly situated control subjects before and after weight loss treatment. (Controlled Intervention Study)	Population: patients with psoriatic arthritis (PsA) and an obese control group. Intervention patients: 46 with PsA Control participants: 52 Intervention: a 12-month very low-energy diet (VLED) weight-loss program	A 12-month weight-loss program had a positive impact on body weight and total body fat. It is thought that a significant weight loss that is accompanied by a loss of lean mass will have an adverse effect on muscle strength. No such result was made public in the current study. The lower extremity muscle strength in both groups significantly increased during the study period while the handgrip strength remained constant.
5.	Jensen., *et al* (Denmark)	Long-term effects of weight reduction on the severity of psoriasis in a cohort derived from a randomized trial: a prospective observational follow-up study (2016)	To examined the long-term trends in weight reduction and the severity of psoriasis in psoriasis patients (Cohort Study).	Psoriasis sufferers make up the population. Intervention: a 16-week weight-loss program that includes a 48-week weight-maintenance program, an intense low-energy diet (LED) for 8 weeks, and 8 weeks of regular food.	Significant reductions in the PASI score for psoriasis The severity of the psoriasis continued to improve during the course of the 48-week follow-up period. The weight loss program also enhanced metabolic indices and health-related quality of life.
6.	Al-Mutairi., *et al* (Tarek)	The effect of weight reduction on treatment outcomes in obese patients with psoriasis on biologic therapy: a randomized controlled prospective trial (2014)	To assess how diet-based weight loss affects the effectiveness of biologic treatments for psoriasis in obese patients. (Clinical Randomized Trial)	Population: All patients over the age of 18 who are overweight or obese. patients with moderate to severe psoriasis who were receiving biologic treatment Low-calorie diet and group acted as controls in the intervention group. 131 patients per group. With a PASI score of 20 to 50, all 262 individuals had moderate to	Significant reductions in the severity of the illness (PASI score) were seen in overweight psoriasis patients who underwent low-energy diet interventions. In contrast to the control group's response rate of 59.3%, the diet group's PASI response rate was 85.9%. Suggestion: In psoriasis patients who are overweight,

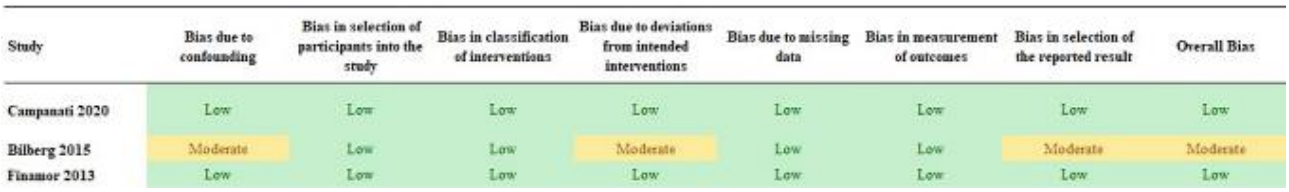
				severe psoriasis.	weight loss successfully treats both the skin disease and any concomitant disorders that are present.
D. Hypocalorie diet					
7.	Campanati., *et al* (Italy)	The effect of low-carbohydrates calorie-restricted diet on visceral adipose tissue and metabolic status in psoriasis patients receiving TNF-alpha inhibitors: results of an open label controlled, prospective, clinical study (2016)	Assessed alterations in the percentage of fat in the trunk region (TF%) and changes in visceral adipose tissue (VAT) within the context of a prospective, non-randomized, open-label clinical trial.	A total of 44 individuals diagnosed with moderate to severe psoriasis were included in the study. Among them, 20 patients received treatment with TNF-alpha inhibitors alone (designated as group 1), while 25 patients were administered TNF-alpha inhibitors in combination with a low-carbohydrate calorie-restricted diet (identified as group 2). The study assessed various parameters, including anthropometric changes, glycolipid metabolism, and PASI score, to evaluate the effects of the interventions on the patients.	The simultaneous administration of TNF-α inhibitors and a low-carbohydrate calorie-restricted diet yielded notable advancements in anthropometric indicators, glycolipid metabolism, and the severity of psoriasis.
8.	Guida., *et al* (Italy)	Energy-restricted, n-3 polyunsaturated fatty acids-rich diet improves the clinical response to immunomodulating drugs in obese patients with plaque-type psoriasis: a randomized control clinical trial (2013)	Conducted a randomized controlled trial to evaluate the efficacy of an energy-restricted diet that was enriched in n-3 polyunsaturated fatty acids (PUFAs) and low in n-6 PUFAs. The study aimed to assess the impact of this dietary intervention on metabolic markers and clinical outcomes in obese patients with psoriasis.	A total of 44 obese patients diagnosed with mild-to-severe plaque-type psoriasis, who were receiving immunosuppressive drugs and had not made any changes to their psoriasis therapy for approximately 5 months, were included in the study. The patients were randomly assigned to follow either their regular diet or an energy-restricted diet for a period of 6 months. The energy-restricted diet consisted of an intake of 20 kcal/kg/ideal body weight per day and was enriched with n-3 polyunsaturated fatty acids (PUFAs) at an average daily dosage of 2.6 grams.	Patients who followed the low-calorie, high n-3 polyunsaturated fatty acids (PUFAs) diet demonstrated a significant clinical improvement compared to the control group. The improvements were observed in various parameters, including itch scores ($p < 0.05$) and Dermatological Life Quality Index ($p < 0.05$). Additionally, the patients on the diet experienced a significant reduction in body weight ($p < 0.05$), waist circumference ($p < 0.05$), serum triglycerides ($p < 0.05$), serum total cholesterol ($p < 0.05$), and n-6/n-3 ratio intake ($p < 0.05$).
9.	Castaldo., *et al* (Italy)	Aggressive weight-loss program with a ketogenic induction phase for the treatment of chronic plaque psoriasis: A proof-of-concept, single- arm, open-label clinical trial (2019)	Evaluated the efficacy the effectiveness of a aggresive weight-loss program as the initial treatment for chronic plaque psoriasis. The program included an induction phase based on a ketogenic diet (Randomized Controlled Trial)	Adult patients who were overweight and had stable chronic plaque psoriasis participated in a 10-week weight-loss program. The program comprised two phases: a 4-week protein-sparing phase followed by a 6-week balanced phase.	The average weight loss achieved in the study was 12.0% (-10.6 kg). There was a notable decrease in the Psoriasis Area and Severity Index (PASI) score, which was initially 13.8 ± 6.9 (ranging from 7 to 32). The mean change in the PASI score was -10.6 (with a 95% confidence interval of -12.8 to -8.4), and this reduction was statistically significant ($P < 0.001$). The treatment resulted in a significant decrease ($P < 0.001$) in the affected body surface area, ranging from 1% to 7.4%. Itch severity also showed improvement, with a reduction of -33.2 points. Moreover, the Dermatology Life Quality Index score, which measures the impact of skin disease on the Dermatology Life Quality Index Score (-13.4 points).
E. Logamines in food consumption					
10.	Wacewicz-Muczyńska., *et al* (Poland)	Cadmium, lead and mercury in the blood of psoriatic and vitiligo	Estimated potential impact of dietary habits on the levels of cadmium (Cd),	Population: 60 patients with psoriasis, between the ages of 19 and 68	The study found significant differences ($p < 0.05$) in the levels of cadmium (Cd)

		patients and their possible associations with dietary habits (2021)	lead (Pb), and mercury (Hg) in the peripheral blood samples of patients diagnosed with psoriasis and vitiligo (Case-Control Study)		between patients with psoriasis and the control group. Psoriasis patients had higher levels of Cd compared to the control group. In the case of vitiligo patients, the concentration of lead (Pb) was significantly higher (50.04 ± 26.54 µg/L) than in healthy controls (36.04 ± 27.35 µg/L). psoriatic men, there was a significantly lower ratio of selenium (Se)/Pb, zinc (Zn)/Pb, and copper (Cu)/Pb compared to other groups. Vitiligo patients showed significantly lower values of the selenium (Se)/mercury (Hg) ratio compared to the control group ($p < 0.05$).



D1 Randomization process
D2 Deviations from the intended interventions
D3 Missing outcome data
D4 Measurement of the outcome
D5 Selection of the reported result

Fig 5: Summary of Study Quality Assessment of Randomized Controlled Trials Based on RoB2



Study	Bias due to confounding	Bias in selection of participants into the study	Bias in classification of interventions	Bias due to deviations from intended interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in selection of the reported result	Overall Bias
Campanati 2020	Low	Low	Low	Low	Low	Low	Low	Low
Bilberg 2015	Moderate	Low	Low	Moderate	Low	Low	Moderate	Moderate
Finamor 2013	Low	Low	Low	Low	Low	Low	Low	Low

Fig 6: Summary of Study Quality Assessment of Non-Randomized Controlled Trials Based on ROBINS-I

4. Discussion

Studies have shown that symptoms of inflammatory diseases can be improved by periods of fasting or low-energy diets by adopting different types of diets, intake of vitamin D and other minerals. Based on the review of the articles above, each intervention will be described that can affect the improvement in the severity of psoriasis.

a. Vitamin D and Psoriasis

In addition to topical corticosteroids, it is presently unknown if administering vitamin D externally is preferable to taking it orally to treat psoriasis (Matteo *et al*., 2020). Mammals can absorb vitamin D through their skin or consume it when they are exposed to sunshine or other UVB sources. 1,25-Dihydroxyvitamin D3 is the active form of vitamin D in the body. Over 90% of the body's vitamin D needs are satisfied by sunlight, which is the main source of vitamin D3. The immune system, the apoptotic process, and the differentiation and proliferation of keratinocytes in the skin are all regulated by the active form of vitamin D and its receptors (Barrea *et al*., 2017) [5]. Furthermore, there is strong evidence that the severity of chronic plaque psoriasis is correlated with the blood level of 25-hydroxyvitamin D. Vitamin D supplementation may help avoid psoriasis-related problems because it is hypothesized that low vitamin D levels are connected to both psoriasis and obesity (Bhat *et al*., 2022) [7]. The skin's production of vitamin D is stimulated by UV light. The features of vitamin D include immunomodulatory, anti-inflammatory, antioxidant, and antifibrotic actions, according to Martens *et al*. (2020) [22]. Even while oral vitamin D therapy did not significantly enhance patients' symptoms, the researchers came to the conclusion that vitamin D supplements may be able to lessen comorbidities associated with psoriasis. It was postulated that vitamin D could be very important in controlling immune and inflammatory pathways. According to the theory, low vitamin D levels, which can lower the amount of circulating regulatory T cells, could upset the immunological balance and lessen the inflammatory response in psoriasis. Since 1985, there have only been a few research that have looked at the effectiveness of oral vitamin D in psoriasis patients, leading to few and inadequate reviews (Stanescu *et al*., 2021) [32].

The keywords "psoriasis" and "Vitamin D" were used in the search strategy. Two papers were chosen after the entire texts were reviewed and the qualifying standards were taken into account. In none of these investigations did vitamin D supplementation have any statistically significant influence on the severity of psoriasis. (Jarret *et al*., 2018) [16] found no significant differences between the placebo and vitamin D groups using the Psoriasis Area and Severity Index (PASI), Physicians Global Assessment (PGA), Dermatology Life Quality Index (DLQI), and Psoriasis Disability Index (PDI) as measures of psoriasis severity at 12 months. The second trial, carried out (Ingram *et al*., 2018) [16], likewise showed no appreciable difference in PASI scores throughout the course of the 12-month study between the vitamin D3 supplementation group and the control group. Furthermore, there was no connection seen between serum 25(OH)D levels and PASI scores. The study's findings on whether more vitamin D3 reduces psoriasis were equivocal.

b. Mediterranean Diet

Fruits, bread, vegetables, legumes, cereals, fish, and extra virgin olive oil make up a major element of the Mediterranean diet. These foods are significant MUFA (monounsaturated fatty acid) suppliers. Egg, dairy, meat, and alcohol consumption should all be kept to reasonable levels (Bach-Faig *et al*., 2011). Due to the anti-inflammatory qualities of dietary fiber, antioxidants, and polyphenols, the Mediterranean diet significantly lowers chronic and systemic inflammation. These compounds are essential for reducing inflammation (Guida *et al*., 2014). According to several research, adopting Mediterranean diet treatments lowers the prevalence of chronic inflammatory diseases such atherogenesis, rheumatoid arthritis, and Crohn's disease (Matsumoto *et al*., 2018). The onset and/or severity of psoriasis may be affected by certain dietary variables.

The NutriNet-Santé program, a web-based cohort study that was started in France in May 2009, is where the research examined in this article was carried out. Participants have to be at least 18 and have access to the internet. On the website created specifically for this study (https://www.etude-nutrinet-sante.fr/), participants answered an online survey. The NutriNet-Santé study's purpose, layout, and methods have all been previously explained. Participants supplied information on their sociodemographic characteristics, food intake, lifestyle choices, anthropometric measures, health status, and levels of physical activity at enrolment and on a yearly basis after that (Phan *et al*., 2018) [27].

To all 158,361 individuals in the NutriNet-Santé cohort, an 11-item validated psoriasis self-questionnaire was distributed on January 10, 2017. The data was utilized to detect psoriasis instances and assess the severity of the condition over a two-year period. Psoriasis was divided into three categories using the MEDI-LITE score: severe, non-severe, and no psoriasis. In comparison to those without severe psoriasis (n = 839; 36%) and those without psoriasis (n = 9,915; 36%), those with severe psoriasis were more likely to have a MEDI-LITE score between 0 and 7, which indicates low adherence to the Mediterranean diet (n = 339; 46%). A substantial negative correlation between the MEDI-LITE score and the severity of the psoriasis was discovered by multivariable analysis. His study employed a bigger sample than a prior study (n=62 psoriasis patients) that found a link between following a Mediterranean diet, psoriasis severity (as determined by the PASI score), and blood levels of reactive C-protein (Barrea *et al*., 2016) [4].

The findings of this study support other studies that relate a proinflammatory diet to the development of psoriasis. The major impacts of diet on the immune system have been well studied in recent research. The general environment and nutrition have a direct impact on immune organs and cells in the gastrointestinal system. Particularly essential roles have been found for polyunsaturated fatty acids, omega-3 fatty acids, folate, and vitamins A, D, and E. Additionally, some diets can change the gut microbiota's makeup, which can lead to improper immunological responses such imbalances in T-helper type 17 cells and T-regulatory cells. Both gastrointestinal and systemic autoimmune diseases can be exacerbated by these immune responses (De Rosa *et al*., 2015) [11] According to the results of this study, a multidisciplinary strategy for treating moderate to severe psoriasis may be more successful if it includes an adjusted diet.

c. Obesity and Psoriasis Condition

Obesity increases the risk of chronic immune-mediated inflammatory disease psoriasis. According to studies, obesity worsens cardio-immune-metabolic complications, thereby increasing the risk of hyperlipidemia, type 2 diabetes, and nonalcoholic fatty liver disease. Furthermore, psoriasis also a risk factor associated with liver fibrosis. Dietary, psychological, and pharmacological interventions for psoriasis may be more effective if obesity is addressed through weight loss. According to studies, Patients with a higher BMI are more likely to develop new-onset psoriasis, and the severity of psoriasis is greater in obese people (Barros *et al*., 2022). Low-grade systemic inflammation is present in both obesity and psoriasis, which may explain their association. Proinflammatory processes generated by obesity may aggravate psoriasis in obese patients. (Al-Mutairi & Nour, 2014) [2].

A recent study found that psoriasis patients enjoy the advantages of a low-calorie diet, with a trend toward a reduction in the severity of illnesses and a substantial increase in quality of life. The decrease in obesity and associated cytokines may have contributed to the observed improvement in skin disease in this study. Some patients may develop obesity following the onset of psoriasis, possibly due to a specific cytokine environment that promotes inflammation. In addition, there is evidence that psoriasis patients may gain weight following the onset of the condition. In light of the potential benefits for skin disease severity and overall cardiovascular health, a comprehensive approach to treating psoriasis patients should include addressing obesity and encouraging weight loss. (Jensen *et al*., 2013) [1].

In a 2014 study by Al-Mutairi *et al*., A 24-week prospective, randomized clinical research looked at the effects of a low-calorie food intervention on obese psoriasis patients receiving biological therapy. The participants were divided into two groups: DIG, which followed a low-calorie diet plan, and control, which got no intervention. Weight loss enhanced treatment outcomes for obese psoriasis patients getting biological therapy, according to the study. A low-calorie diet and weight loss improved the efficacy of biological therapy, as measured by the Psoriasis Area and Severity Index (PASI). Correlation between BMI values and response to anti-TNF therapy, which is a highlighted therapy. Weight loss and dietary modifications may improve symptoms and lower serum lipid levels. (Al-Mutairi & Nour, 2014) [18].

Peter Jensen's randomized controlled trial found that obese

psoriasis patients who used LED to treat their condition lost weight. These findings lend credence to the hypothesis that a hypocaloric diet can ameliorate psoriasis symptoms as assessed by the PASI and DLQI. After 64 weeks, the improvements in psoriasis severity (PASI and DLQI) had persisted. from this study, the LED program can help obese patients with psoriasis lose weight quickly, and this weight loss can be maintained by most patients for a full year. At 1 year, even with some weight gain, the reduction in psoriasis severity that was initially a benefit of weight loss, plasma glucose count, and glycated haemoglobin was still present. Overweight psoriasis patients were also suggested to benefit from more frequent support meetings and dietary encouragement in order to sustain the behavioral changes in physical activity and diet that are essential to long-term weight maintenance (Jensen *et al*., 2013) [18].

In a single-arm, open-label experiment, a weight loss program was conducted for psoriasis patients, which involved a 4-week very-low-calorie protein-sparing ketogenic diet (VLCKD) followed by a 6-week hypocaloric low-glycemic index Mediterranean-like diet (hypo-MD). During the VLCKD phase, patients consumed a liquid formula made from milk protein, providing 1.2 grams of protein per kilogram of their ideal body weight, along with a small amount of carbohydrates from seasoned vegetables. In the hypo-MD phase, they followed a low-calorie, low-glycemic index Mediterranean-style diet. Significant improvements in both body weight and disease severity were observed in psoriasis patients who participated in this weight loss program. At the end of the VLCKD phase, there was a weight loss of 9.5% (8.3 kg), while at the end of the hypo-MD phase, the weight loss reached 12.0% (10.6 kg). Throughout the program, no serious adverse events were reported.It was noted that the severity of psoriasis and the patients' body mass index did not influence the extent of improvement in their condition. (Castaldo *et al*., 2020) [10].

In addition, obesity is frequently an emerging comorbid condition in psoriasis arthritis (PsA) patients. The severity of psoriasis is also shown to be higher in obese people, and studies show that the chance of acquiring psoriasis is higher in patients with a higher body mass index (BMI). Low-grade systemic inflammation is present in both obesity and psoriasis, which may explain their association. Proinflammatory processes generated by obesity may aggravate psoriasis in obese patients. Patients with PsA and obesity are more likely than healthy individuals to experience upper and lower body muscle weakness. This decrease in muscle function may be caused by the inflammatory nature of PsA, the accumulation of fat within the muscles, and the sedentary lifestyle frequently associated with obesity. (Bilberg *et al*., 2022).

Obesity has a negative effect on psoriasis and psoriasis arthritis (PsA), according to existing research. Obesity increases the risk of developing psoriasis, worsens cardio-immune-metabolic complications, and precipitates liver disease. Studies have revealed that implementing low-calorie diets and achieving weight loss can enhance the effectiveness of biological therapy in obese individuals with psoriasis. Additionally, it has been demonstrated that a combination of a very low-calorie ketogenic diet followed by a hypocaloric, Mediterranean-style diet can lead to improvements in both psoriasis symptoms and body weight. Furthermore, obesity has been identified as a risk factor for muscle weakness in patients with psoriatic arthritis (PsA). Therefore, for optimizing treatment outcomes and promoting overall health, comprehensive management of psoriasis and PsA should include the management of obesity and weight loss.

d. Hypocaloric Diet

Psoriasis is more common and more severe in people who are overweight. Studies have shown that the prevalence and severity of psoriasis are both increased in those who are overweight (Yamazaki, 2021). In order to lose weight, many people follow a hypocaloric diet, which consists of eating fewer calories than they burn. Obese psoriasis patients who are able to successfully lose weight often see a decrease in the disease's severity and, in some cases, a boost in treatment response and symptom management (Zuccotti *et al*., 2018) [36].

As an intervention, a low-calorie diet was administered in a number of randomized controlled trials involving patients who were either obesity or overweight. The Psoriasis Area and Severity Index (PASI) revealed a reduction in psoriasis severity following the dietary intervention (1.8 kcal/kg, respectively) (Castaldo *et al*., 2020) [10]. According to Guida (2013), psoriasis patients who reduced their body weight by eating a diet higher in healthy fats like omega-3 fatty acids and lower in unhealthy fats like trans fats saw an improvement in their clinical response to pharmaceutical therapy. Eighteen patients in the intervention group lost a considerable amount of weight as a result of the combination of the active diet, low intake of n-6 PUFA (meat, eggs, grains, cereals), and high intake of n-3 PUFA (seafood, such salmon, sardines, herring, and bluefish). The intervention group also saw reductions in body mass index and waist circumference. Total cholesterol, low-density lipoprotein cholesterol, and triglycerides in the blood all decreased significantly. The PASI and DLQI scores improved during the course of the trial, but the intervention group saw more gains from the combination of pharmacological therapy and an active diet than the control group did from drug therapy alone. More over half of the PASI in the intervention group had decreased after 6 months. Overall calorie intake was lower in the intervention group (47.914.326.43 vs. 27.61.8 kcal/kg).

Campanati *et al*. conducted a clinical trial in psoriasis patients who were administered a TNF-inhibitor and a low-carbohydrate, calorie-restricted diet to measure visceral adipose tissue and metabolic status. The study population was divided into two groups to assess the effects of TNF-alpha inhibitors on moderate to severe psoriasis. The first group (Group 1) consisted of 25 patients who received TNF-alpha inhibitors alone, while the second group (Group 2) included 25 patients who received TNF-alpha inhibitors along with a low-carbohydrate diet. Inclusion criteria for the study required participants to be 18 years or older, have a clinical diagnosis of psoriasis lasting at least 6 months, and exhibit active plaque psoriasis with specific criteria, such as body surface area (BSA) greater than 10%, psoriasis area index (PASI) higher than 10, and dermatitis severity index (DLQI) exceeding 10. The aim of the clinical experiment was to compare the effects of visceral adipose tissue (VAT) on anthropometric changes following TNF-alpha treatment with those resulting from a low-calorie diet in the two patient groups.

Inhibitors of tumor necrosis factor (TNF) showed no influence on VAT expression. Body weight (kg) (p 0.0001), body mass index (BMI) (p = 0.0001), waist circumference (WC) (p 0.0001), total body fat percentage (TF%) (p 0.0001),

value added tax (VAT) (p 0.0001), serum triglyceride (mg/dL) (p = 0.0018), and total cholesterol (mg/dL) (p = 0.0005) were substantially lowered. TNF-inhibitors utilized in combination with a low-calorie, carbohydrate-restricted diet have been shown to decrease the risk of weight gain, enhance glycolipid metabolism, and increase therapy responsiveness in psoriasis patients. In line with the findings of this study, treating psoriasis and the physical changes associated with it may benefit from a combination of medications and a strict diet (Campanati *et al*., 2017).

e. Logamines in food consumption

Wacewicz-Muczyńska *et al* (2021) evaluated that the consumption of certain foods may be related to the existence of certain logamines in psoriasis and vitiligo lesions. This study discovered a strong correlation between the frequency of consumption of pork, meat products, and canned fish in psoriasis patients and The study found that the levels of cadmium (Cd), lead (Pb), and mercury (Hg) were significantly present (p = 0.004, p = 0.0065, and p = 0.0067, respectively).The results of this investigation also demonstrated that the toxic ratio, selenium, zinc, and other substances in the blood of controlled patients varied. The research also showed that the blood of controlled individuals had different ratios of toxicants and selenium, as well as zinc and other components. in the blood of controlled patients.

The results of this study also showed that the toxicant and selenium ratios, as well as those of zinc and other elements, varied in the blood of controlled individuals. These similarities may provide information about the role that certain elements play in the onset and evolution of vitiligo and psoriasis. However, further research must be done to understand the mechanisms behind these relationships and the implications for treating and managing these types of skin conditions (Wacewicz-Muczyńska *et al*., 2021) [33].

According to Aggarwal *et al*'s Case Control Study (2021), patients with psoriasis showed greater blood levels of cadmium-zinc compared to the control group. According to the study's findings, psoriasis patients may experience more severe cadmium reactions. and more severe zinc availability within their bodies. Factors such as beetroot juice, mineral deficiencies, genetic factors and fatty food intake may all influence how psoriasis and vitiligo manifest in people with psoriasis and selenium sensitivity, respectively, in a controlled manner. However, Further research is required to comprehend the subtle connections and more sophisticated mechanisms between minerals, body weight, and present skin disorders. In addition, to prevent comorbidities from psoriasis, patients are advised to follow a diet or limit consumption of foods containing high fatty acids, such as consumption of pork, meat products, and canned fish. It is hoped that by removing cadmium (Cd), lead (Pb), and mercury from the diet, it can protect psoriasis sufferers from the underlying disease and help them achieve a better condition (Aggarwal *et al*., 2021).

f. Quality Assessment Analysis

We have conducted a quality assessment of the 10 journals that are the source of our review which consist of various research designs. We used different assessment tools for each research design. We have analyzed 4 RCT journals using the ROB-2 tool and obtained low bias results in all 4 journals, 2 case control journals using the Newcastle-Ottawa Scale (NOS) and the results are of good quality, 1 journal featuring a good quality cohort research based on the Newcastle-Ottawa Scale (NOS), 3 non-RCT journals used the ROBINS-I tool with 2 results including low bias and 1 moderate bias. So, in this study, we mostly use low-bias, or good quality, journals. because from the domain that assesses the bias both from sources, confounders, participant selection, deviations from the intended intervention found low results, meaning that these journals are journals of good quality and classified as low bias journals.

5. Conclusion

Psoriasis is chronic and multifactorial and requires a systematic approach to evaluate the interaction between nutrition, supplementation and weight loss. The purpose of the treatment of psoriasis is to prevent its onset or minimizes the severity of psoriasis, thus improving quality of life and diminishing psoriasis symptoms. The relationship between psoriasis and adiposity is bidirectional. It has been proved that weight loss and a healthful lifestyle can substantially decrease the PASI score.

The success of reducing the degree of severity requires looking at the causative relationship. Need to know clearly the factors that affect the reduction in the severity of psoriasis. Whether the success is due to the type of diet, or the weight loss, and whether the weight loss also works well in patients with normal weight, or the exercise that supports the results. From the above studies environmental factors including diet and nutrition including oral supplements (fish oil and selenium) and physical activity have been shown to manage psoriasis.

Treatment of psoriasis requires not only pharmacological therapy but also involves environmental factors, especially nutrition for the patient. Guidelines need to be made in the holistic treatment of psoriasis by taking into account nutritional factors.

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