Diet and psoriasis

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Abstract

Background: Patients with psoriasis have a growing interest in managing their disease through diet.

Objective: This review paper aims to analyze dietary interventions for psoriasis and their outcome.

Methods: Terms "psoriasis AND diet" were used to search PubMed database and 63 articles describing dietary changes influencing psoriasis were selected.

Results: Low calorie diet (LCD) improves Psoriasis Area and Severity Index (PASI) and Dermatology Life Quality Index (DLQI) in conjunction with topical or systemic therapy, although LCD was unsuccessful in maintaining disease remission when patients discontinued concomitant cyclosporine or methotrexate therapy. A fish oil diet improved baseline PASI of 7.7 to 5.3 at three months and 2.6 at 6 months compared to control (PASI: 8.9, 7.8, and 7.8, respectively). A randomized, double-blind, placebo-controlled study investigating selenium supplementation in psoriasis provided no PASI improvement. Zinc supplementation with concomitant betamethasone valerate 0.0025% ointment in a randomized, double-blind, placebo-controlled study provided a mean PASI of 11.2 in the intervention group and 8.0 in the control group with no significant difference between both arms. Gluten free diet and vitamin D supplementation were also efficacious dietary changes although results were mixed.

Conclusions: Dietary changes alone do not cause a large effect in psoriasis but may become an important adjunct to current first line treatments.

Keywords: psoriasis, diet, fish oil, hypocaloric, clinical trials

Introduction

Psoriasis is a chronic cutaneous inflammatory condition associated with obesity. Obese subjects have elevated IL17 and IL23, cytokines involved in the pathogenesis of psoriasis. IL17 and IL23 also increase adipocyte synthesis of TNF, IL6, and monocyte chemoattractant protein-1. The correlation between obesity, its cytokines, and psoriasis may impact disease incidence and flaring of preexisting psoriasis. The increased cytokines produce systemic inflammation increasing the risk of cardiovascular disease, hypertension, hyperlipidemia, and type II diabetes [1-6].

Body mass index (BMI) and psoriasis are positively correlated [7-12]. A prospective study reported an incident relative risk of 1.63 (95% confidence interval [CI], 1.58-2.61) in psoriasis subjects with a BMI≥35 in contrast to psoriasis subjects with a BMI between 18.5 and 24.9 [8]. These results have piqued interest in diet and dietary supplementation as a treatment modality for psoriasis. There is a growing interest in managing psoriasis through diet [1]. The purpose of this study was to review the efficacy of diet in psoriasis management.

Methods

A thorough PubMed search using the following search terms: "psoriasis AND diet" was conducted on September 27, 2018. Of the 366 search results found, 63 articles describing dietary changes influencing psoriasis were chosen (**Figure 1**). Articles were segregated into low calorie diet, fish oil diet, tryptophan, selenium, and other diets, gluten free diet, and vitamin D diet. A Jadad score was quantified to represent the level of evidence (**Table 1**), [13].

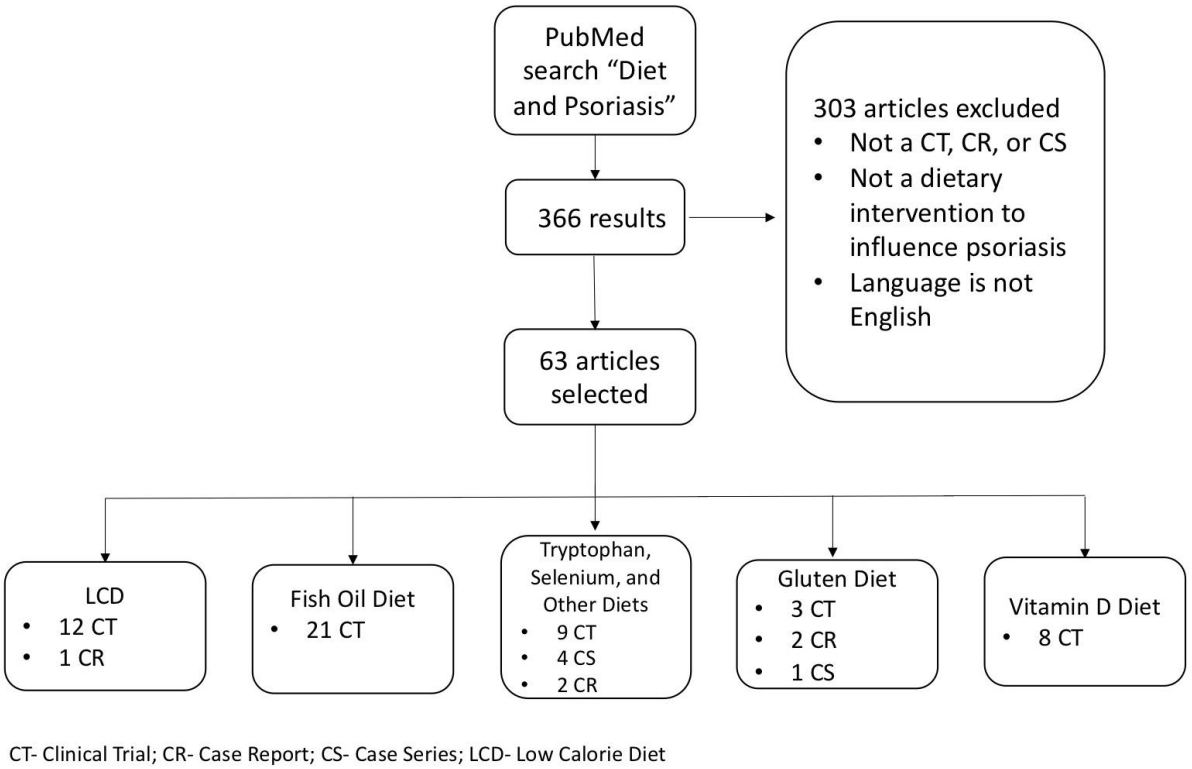

Figure 1. Flowchart of diet and psoriasis, PubMed search.

Results

Low Calorie Diet

Low calorie diet (LCD) was coined as a possible treatment of choice owing to the popular association between obesity and psoriasis. A prospective controlled trial randomized 82 hospitalized plaque-type psoriasis subjects to a four-week LCD (855kcal/day) or standard hospital diet (2100kcal/day). Both groups received unspecified topical therapy. The LCD consisted of 33.9g/day of proteins, 14.7g/day of fat, and 149.6g/day of carbohydrates (vegetables, fruits, rice, wheat bread, milk, juice, and water). Primary outcome was defined as very good (hyperpigmented or hypopigmented macules), good (slight erythema and silver scale), or weak (erythema and silver scale). Compared to control, the LCD group improved their total cholesterol (P<0.01), triglycerides (P<0.001), LDL (P<0.01), and clinical outcome (no P value reported). A very good clinical improvement was associated in subjects with decreased triglycerides, LDL, and total cholesterol (P=0.01, P<0.05, and P<0.05, respectively) whereas subjects with good clinical improvement were associated with decreased triglycerides and LDL (both P<0.05), (Table 2), [14]. A similar study was conducted constituting a low-calorie group in 10 plaque-type psoriasis subjects with a BMI>30 for 24 weeks. Both groups simultaneously received low or medium-potency topical corticosteroids. Mean reduction of body weight was 9.8% at week 24 (P<0.01). A 50% reduction in Psoriasis Area and Severity Index (PASI 50) was reported at week 4, 12, and 24 (20%, 50%, and 30%, respectively, all P>0.05), whereas a PASI 75 was met at week 12 only (20%, P>0.05). Mean PASI was 5.2 at week 4 (P>0.05), 3.2 at week 12 (P<0.05), and 3.8 at week 24 (P<0.05). The Dermatology Life Quality Index (DLQI) improved by 34.1% at week 4 (P>0.05), 62.5% in week 12 (P<0.01), and 40.4% by week 24 (P<0.05). Subjects failed adherence to low calorie diet after week 12 [15].

Table 1. Jadad criteria.

Questions	Points
Was randomization mentioned?	1 point
Was double-blind mentioned?	1 point
Was the method of randomization described?	1 point
Was the method of double-blinding mentioned?	1 point
Were subjects who withdrew or dropped out described?	1 point

A prospective, randomized controlled trial of 60 subjects greater than 18 years of age with plaque type psoriasis and a BMI>27 compared a particular LCD and normal routine dietary guidance. The LCD (Cambridge Diet; Cambridge Weight Plan) constituted 800 to 1000kcal/day of meal bars and sachets to make shakes, soups, and porridge for 8 weeks followed by 8 weeks of 1200kcal/day consistent with regular meals and two formula diets. The normal routine dietary guidance consisted of ordinary foods in concordance with national guidelines for a healthy diet. To prevent follow-up bias in the control group, all subjects were invited to complete the intervention group's dietary program after completion of the trial. Thirty subjects were randomized to receive an LCD and 30 subjects received a routine diet. All subjects were instructed to continue previous psoriasis treatments consisting of topical and systemic therapies and to maintain a similar level of exercise. Outcome was measured at week 4, 8, 12, and 16 using the PASI and DLQI. Compared to control, the intervention group reported a mean loss of 15.4kg at 16 weeks (95% CI, 12.3-18.5kg, P<0.001). The LCD group reported a greater improvement in PASI (-2.0, 95% CI, 4.1 to -0.1, P=0.06) and DLQI (-2.0, 95% CI, -3.6 to -0.3, P=0.02) than control. Adverse effects experienced in the LCD group included fatigue, mild headaches, constipation, dizziness, cold sensitivity, and hunger [16]. A 48-week extension of the trial reported PASI and weight loss deterioration by week 64 [17]. Other randomized controlled trials and case report described similar findings [18-22].

Numerous clinical studies have explored the combined therapeutic efficacy of an LCD and phototherapy or systemic therapy. A prospective randomized, investigator-blinded controlled trial exploring narrowband UVB and diet was conducted. Thirty subjects with plaque-type psoriasis and BMI>25 were equally randomized to receive an Ornish diet, South Beach diet, or no diet [23, 24]. All groups received thrice weekly narrowband UVB using TL-01 lamps (310-320nm) for 12 weeks. The Ornish group reported 8% of body weight loss while the South Beach group had 7% body weight loss. PASI improved by 78% in the Ornish group, 72% in the South Beach group, and 71% in the control group. PASI 75 rate reached 83% in the Ornish group (P=0.30), 56% in the South Beach group, and 38% in the control group. No adverse events were reported [25]. A similar 24-week investigator-blinded trial randomized 61 plaque-type psoriasis subjects with a BMI≥30 to a cyclosporine (2.5mg/kg/day) plus LCD group (1200-1600kcal/day) or cyclosporine (2.5mg/kg/day) only group. Moderate exercise was recommended in all subjects. Weight loss was correlated with improved PASI (Pearson correlation: 0.96; P=0.001). About 66.7% reached a PASI 75 in the intervention group, and 29.0% reached a PASI 75 in the control group at week 24 (P<0.001). PASI 50 was reached in 86.7% and 48.3% in the intervention and control group at week 24, respectively (P<0.001). Mean PASI score was 2.5±6.3 in the intervention group and 8.1±5.4 in the control group (P<0.001). After week 24, subjects discontinued cyclosporine but were instructed to continue with their recommended diet. At week 52, 80% of subjects returned to baseline [26]. A similar 24 week randomized, investigator blinded, controlled study explored the remission efficacy of LCD after successful treatment with methotrexate. Moderate-to-severe psoriasis subjects with a BMI≥30 and a maintained PASI 75 for 12 weeks using methotrexate were enrolled. After methotrexate cessation, 42 subjects were randomized to an LCD (1200-1600kcal/day) group or no dietary recommendation group. Compared to baseline, LCD group reported improved weight loss at week 24 (-9±2.4%, mean±SD, P<0.05), whereas the control group reported no weight change. Compared to PASI scores before initiation of methotrexate, both groups reported progressive worsening PASI at week 12 (P<0.001), week 24 (P<0.001), and week 36 (P<0.001) [27]. Similar positive findings were reported in psoriasis subjects on biologic therapy [28].

Fish Oil

Fish oil dietary supplementation was theorized to aid in psoriasis because fish oil contains eicosapentaenoic acid (EPA), a key metabolite involved in reducing inflammatory cytokines by replacing arachidonic acid [29-31]. To support this concept, 10 plaque-type psoriasis subjects with a

body surface area (BSA) affecting 5 to 60% were enrolled to receive 50ml of Max-EPA daily for 6 weeks (one subject received 25ml of Max-EPA and one subject received 50ml cod liver oil). All subjects received topical emollients. One subject continued etretinate 100mg daily. Eight subjects reported slight to moderate improvement in psoriasis through decreased redness and scaling (Table 3). Two subjects suffered from nausea [32]. A similar open-label clinical study enrolling 13 psoriasis subjects with greater than 10% BSA involvement were enrolled to receive Max-EPA and a fish oil diet for 8 weeks. The diet constituted fish, poultry, fruits, vegetables, grains, skim milk, alcohol, coffee, tea, and carbonated drinks. All subjects were instructed to apply an emollient (Unibase) twice daily. Psoriasis severity was measured and quantified by erythema, scale, and thickness on a 7-point scale (1 = absent, 2 = trace, 3 = mild, 4 = mild-moderate, 5 = moderate, 6 = moderate-severe, 7 = severe). Mild and moderate improvement was defined as a 1- and two-point improvement in each of the three categories, respectively. Compared to baseline (week 0), all parameters improved in scale ($P<0.001$), redness ($P<0.02$), and thickness at week 8 ($P<0.004$). Five subjects reported moderate improvement, three subjects reported mild improvement, and 5 subjects reported no or worsening improvement. Decreased pruritic sensation occurred in 5 subjects. No adverse effects were reported [33]. Eleven studies reported similar positive findings [34-44].

In spite of the above mentioned positive results, seven studies reported negative findings [45-51]. One open label study reported no improvement from fish oil supplementation in 24 plaque-type psoriasis subjects. Only one subject with pustular psoriasis improved [47].

A cross-over trial of 18 subjects with plaque-type psoriasis were initiated on 170g diet of white fish for four weeks followed by randomization to either continue the white fish diet or switch to a 170g oily fish diet (mackerel, herring, salmon) for 6 more weeks. The oily fish group reported moderate improvement whereas the white fish group reported no improvement. Plasma EPA was elevated in the oily fish group [52].

Tryptophan, Selenium and Other Diets

Initially reported in 1967, the efficacy of a tryptophan turkey diet was explored in psoriasis subjects. Twelve subjects with biopsy proven psoriasis were enrolled in a cross-over trial initially started on a 1-week regular hospital diet then switched to a two-month tryptophan diet. The tryptophan diet predominantly contained turkey with a total of 1,800 calories per day. No local or systemic therapy was initiated. Efficacy was defined as excellent (complete clearance), moderate (≤50% clearance), or no response. Excellent response was reported in 7 subjects, three subjects reported moderate response, and two subjects reported no response. Reinstitution of a normal diet exacerbated 8 subjects (Table 4), [53, 54]. Other studies exploring the efficacy of a turkey diet high in tryptophan reported no improvement of psoriasis after 8 to 22 days of treatment [55, 56]. Two case reports using a low tryptophan diet (100mg daily and 3.8mg/kg) and one case series using a low-protein diet reported moderate improvement of psoriatic plaques and arthritis after 3 to 6 weeks [57-59].

Owing to low plasma levels of selenium in psoriasis subjects, the efficacy of selenium supplementation was investigated by a randomized, double-blind, placebo controlled trial involving 65 psoriasis subjects [60]. Subjects were stratified to either 600µg of selenium, 600µg of selenium and 600IU of vitamin E, or placebo for 12 weeks. The trial reported no improvement in PASI [61]. Three similar randomized controlled trials and one clinical trial investigating UVB therapy concomitantly with selenium reported similar findings [60, 62-64]. Zinc supplementation in psoriasis yielded no improvement in PASI compared to placebo [65].

In a 12-week randomized, double-blind, placebo-controlled clinical trial investigating curcumin in mild-to-moderate psoriasis, subjects treated with topical methylprednisolone aceponate 0.1% ointment were randomized to also receive either two 500mg curcumin tablets twice a day or placebo. At week 12, more subjects in the curcumin group had disease improvement compared to control group as measured by PASI 50 (92% versus 88%), PASI 75 (48% versus 44%), PASI 90 (20% versus 8%), and PASI 100

(12% versus 4%), (No P value was provided). Median PASI improved greater in the curcumin group from baseline to week 12 (5.6 to 1.3; P<0.05) compared to control (4.7 to 2.4; P<0.05), [66]. Another study using a micronutrient supplement simultaneously with methotrexate reported 65% of subjects in the intervention group met a PASI 75 whereas 35% of control subjects met PASI 75 after 12 weeks of therapy (P=0.08), [67].

Other diets include a case series of 5 subjects initiated on a unique diet consisting of fish, lamb, fowl, fruits, vegetables, nuts, saffron tea, and slippery elm water. After 6 months of the dietary intervention, subjects reported a mean PASI improvement of 18.2±15.0 to 8.7±9.7. Three subjects concomitantly used a topical corticosteroid during the study [68].

Gluten-free Diet

Some evidence suggests an association between gluten sensitivity, celiac disease, and psoriasis [69-79]. To investigate the effect of a gluten free diet, an open label study enrolled 30 psoriasis subjects with elevated IgA antibodies to gliadin were started on a gluten free diet for three months followed by a normal diet for three months. All subjects were allowed to continue their topical or systemic psoriasis treatment. After a three -month gluten free diet, the mean PASI score in all 30 subjects improved from 5.5±4.5 to 3.6±3.0 (P<0.001). After discontinuation of the gluten free diet and initiation of the normal diet, 18 subjects initiated systemic or local therapy owing to worsening psoriasis (**Table 5**), [80]. A similar study in 16 palmoplantar pustulosis subjects initiated on a gluten-free diet reported complete clearance in one subject, mild improvement in two, moderate improvement in 8, and no improvement in 5 [81]. Another study reported failure to improve after a 6-month gluten free diet [82].

Vitamin D Diet

Vitamin D applied topically is an efficacious treatment option in psoriasis [83]. To explore the efficacy of oral vitamin D in psoriasis, an open-label study instructed 85 subjects to ingest 0.5µg of calcitriol daily followed by a 0.5µg dose increase every two weeks for a total of 6 months to three years. Mean baseline PASI improved from 18.4 to 9.7 at 6 months and 7.0 at 36 months (P<0.001), (**Table 6**), [84]. Other trials report small sample sizes and mixed results [85-91].

Discussion

Patients, healthcare providers, and researchers have a great interest in the dietary effects on psoriasis. Jadad score was quantified in all diets (**Tables 2-6**). Based on this review of dietary interventions, the evidence to support diet as a mainstay treatment is limited. Studies provided conflicting results and were limited by small sample sizes. Therefore, although there may be some benefit with diet, in general, diet does not have a large effect on treatment outcome (**Table 7**).

Although dietary intervention may not be a primary component of psoriasis treatment, it may serve as a useful adjunct. An LCD improved PASI scores and DLQI for 16 weeks in two separate prospective controlled trials. [7, 16] Caloric restriction causes insufficient arachidonic acid conversion to leukotriene and decreases oxidative stress, thereby explaining the efficacy of an LCD [31, 92-94]. However, patients had deteriorating results after week 16 making LCD impractical for many patients. A similar study described the worsening PASI 50, PASI 75, and DLQI after 12 weeks of an LCD secondary to nonadherence [15]. Difficulty complying to a strict diet can be a barrier to patient outcome. In a study measuring the level of adherence to a Mediterranean diet, the average adherence score was 4.6 (3.3-6.0) out of 10 [95]. A combination of LCD and a systemic agent including methotrexate and cyclosporine improved PASI but patients returned to baseline after discontinuation of therapy, suggesting improvement was dependent on medication or medication adherence rather than diet. A 24-week randomized control trial comparing an LCD and cyclosporine group to a cyclosporine only group reported greater PASI 75 rates in the former group than the latter (66.7% versus 29.0%, respectively; P<0.001) [26]. Diet may have improved PASI 75, but greater adherence to cyclosporine in the diet group may have improved PASI 75.

Several other studies have looked into the benefits of dietary supplementation including fish oil, tryptophan, selenium, zinc, or curcumin. Although addition of fish oil to the diet has been shown to improve psoriasis severity, results have been conflicting in that 11 studies reported positive results, whereas 6 studies reported negative findings making it difficult to draw clear conclusions [34-50]. Limitations of the aforementioned studies included small sample sizes [32, 33].

The role of tryptophan is unclear for psoriasis subjects given the mixed results. A two-month tryptophan diet produced excellent response in 10 subjects whereas a short-term diet led to no improvement [53-56]. A few case reports supported a low tryptophan diet which led to moderate improvement of psoriatic plaques and arthritis after only three to 6 weeks [57-59]. It is difficult to draw strong conclusions without further evaluation of tryptophan in a larger sample of patients.

Supplementation with selenium or zinc produced no PASI improvement in psoriasis subjects, whereas a double-blind, placebo-controlled clinical trial investigating curcumin had a more positive outcome [60-66]. Curcumin has anti-oxidant and anti-inflammatory properties that may improve psoriasis lesions [96]. The benefit of other dietary changes for psoriasis including gluten exclusion and vitamin D supplementation remains unclear [80, 81, 83, 84]. A study implementing a three month-gluten free diet improved PASI but a 6-month diet produced no improvement [80, 82]. Similarly, supplementation with vitamin D led to mean PASI improvement at 6 months and 36 months, but mixed results were seen in other trials [84-91]. To better understand the usefulness of vitamin D supplementation, we need to recognize the exact role of vitamin D in psoriasis, which still remains unclear.

The correlation between psoriasis, cardiovascular disease, and diabetes favors a dietary change in an effort to prevent life-changing comorbidities [1]. Dietary changes primarily intended to reduce weight may also influence efficacy of biologic therapy in psoriasis patients [97-101]. Psoriasis subjects weighing greater than 100kg receiving ustekinumab developed lower PASI 75 rates (PASI 75: 74.2% when receiving 90mg ustekinumab; PASI 75: 54.6% when receiving 45mg ustekinumab) than subjects less than 100kg [98]. Even weight loss during or after initiation of biologic therapy can improve PASI scores [20]. Disease remission that appears caused by diets may relate to the diet itself, but may also relate to spontaneous remission, psychological effect, or simultaneous use of topical or systemic medications [53].

Conclusion

Future dietary trials involving large sample sizes are needed to clarify the mixed results observed with dietary intervention in psoriasis. Better-designed studies may also help determine if there is a specific dose of dietary supplement beneficial for psoriasis patients. Dietary manipulation may not be intended as primary treatment for psoriasis, but there is potential to incorporate it with other first-line treatments to synergistically promote successful treatment outcomes and reduce incidence of life changing sequela including cardiovascular disease.

Potential conflicts of interest

Dr. Steven Feldman has received research, speaking and/or consulting support from a variety of companies including Galderma, GSK/Stiefel, Almirall, Leo Pharma, Boehringer Ingelheim, Mylan, Celgene, Pfizer, Valeant, Abbvie, Samsung, Janssen, Lilly, Menlo, Merck, Novartis, Regeneron, Sanofi, Novan, Qurient, National Biological Corporation, Caremark, Advance Medical, Sun Pharma, Suncare Research, Informa, UpToDate and National Psoriasis Foundation. He is founder and majority owner of www.DrScore.com and founder and part owner of Causa Research, a company dedicated to enhancing patients' adherence to treatment.

Dr. Adrian Pona, Wasim Haidari, and Sree Kolli have no conflicts to disclose.

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102.

Table 2. *Efficacy of low calorie diet.*

Authorship	Study Design	Intervention	Diet	Size	Duration	Result	Jadad Score
Rucevic et al. [13]	P, C	LCD vs hospital diet. Both received unspecified topical therapy.	LCD 33.9 g/day of proteins, 14.7 g/day of fat, and 149.6 g/day of carbohydrates (vegetables, fruits, rice, wheat bread, milk, juice, and water)	82	4 weeks	LDL and Total Cholesterol Improved (P<0.01) Triglycerides Improved (P<0.001) Clinical Improvement Improved (P-value not reported)	0
Roongpisuthipong et al. [14]	P	LCD with simultaneous low and medium potency corticosteroids	Not specified	10	24 weeks	Weight loss Mean reduction 9.8% at week 24 (P<0.01) PASI 50 Week 4, 20% of subjects (P>0.05) Week 12, 50% of subjects (P>0.05) Week 24, 30% of subjects (P>0.05) PASI 75 Week 4, no subjects (P>0.05) Week 12, 20% (P>0.05) Week 24, no subjects (P>0.05) Mean PASI Week 4, 5.2 at (P>0.05) Week 12, 3.2 (P<0.05) Week 24, 3.8 (P<0.05) DLQI Week 4, 34.1% improvement (P>0.05) Week 12, 62.5% improvement (P<0.01) Week 24, 40.4% improvement (P<0.05)	0
Jensen et al. [15]	P, R, C	LCD vs normal routine diet. Continuation of psoriasis treatment in addition to diet.	LCD 800-1000 kcal/day of meal bars and sachets for shakes, soups, and porridge for 8 weeks followed by 8 weeks	38	16 weeks	Weight loss Mean difference 15.4 kg in favor of intervention compared 0.4 kg in control	3

			of 1200 kcal/day consistent with regular meals and 2 formula diets. Routine Diet Ordinary foods in concordance with national guidelines for a healthy diet.			(95% CI, 12.3-18.5 kg; *P*<0.001) PASI LCD displayed mean change of -2.0 in PASI (95% CI, 4.1 to -0.1, *P*=0.06) DLQI LCD displayed mean change of -2.3 in DLQI (95% CI, -3.6 to -0.3, *P*=0.02)	
Jensen et al. [16]	P, R, C	Continuation of above mentioned 16 week study	Identical to above mentioned diet.	32	48 weeks	Weight loss Gradual weight gain of 4.9 kg PASI Continued to improve after week 16 until week 24. After week 24, PASI score deteriorated (-2.9 [95% CI: -3.9, -1.9]) DLQI Mean DLQI changed from -2.3 (week 0-16) to -1.9 (week 0-64)	3
Kimball et al. [24]	P, R, C	Ornish diet vs South Beach diet vs no diet. All received thrice weekly narrowband UVB.	Ornish Diet Low fat, vegetarian diet. No simple carbohydrates, oils, or alcohol. Complex carbohydrates are accepted. South Beach Diet Carbohydratewith low glycemic index, nuts, fish, chicken, low fat cheese, yogurt.	30	12 weeks	Weight Loss 8% in Ornish group 7% in South Beach group 0% in control PASI Improvement 78% in Ornish group 72% in South Beach group 71% in control PASI 75 Rate 83% in Ornish group (*P*=0.30) 56% in South Beach group 38% in control	2
Gisondi et al. [25]	P, R, C	Cyclosporine and LCD vs cyclosporine.	LCD 60% Carbohydrate, 25% fat, 15% protein. Milk, bread, pasta, rice, vegetables, fruits, water, fish, meat. No alcohol.	61	24 weeks	Weight Loss Correlated with improved PASI (Pearson correlation: 0.96; *P*=0.001). PASI 75 66.7%, intervention 29.0%, control (*P*<0.001)	2

						PASI 50 86.7%, intervention 48.3% control (*P*<0.001). Mean PASI 2.5 ± 6.3 intervention 8.1 ± 5.4 control (*P*<0.001)	
Del Giglio et al. [26]	P, R, C	LCD vs no diet. All subjects received methotrexate with PASI 75 improvement.	LCD 1200-1600 kcal/day. Diet intended to achieve 5-10% loss of initial body weight.	42	24 weeks	Weight Loss LCD group improved at week 24 (-9 ± 2.4%, mean ± SD, *P*<0.05). Control group displayed no improvement. PASI Maintenance Both groups developed progressive worsening at week 12, 24, and 36 (all *P*<0.001)	3
Naldi et al. [17]	R, C	Quantitative and qualitative diet and physical exercise (in effort to lose weight) versus weight loss education (15 min only) received at baseline. Concomitant systemic and topical therapy was allowed.	55% carbohydrate, 30% fat, and 15% protein in an effort to lose 5% of total body weight.	303	20 weeks	Median PASI (Week 20) Diet group reported 48% reduction (95% CI 33.3-58.3) Information group 25.5% reduction (95% CI 18.2-33.3) (*P*=0.02) PASI 50 (Week 20) 49.7% achieved in diet group (95% CI 41.7-57.6) 34.2% in information group (95% CI 26.7-41.7) (*P*=0.006) PASI 75 (Week 20) 24.5% achieved in diet group 19.1% in information group (*P*=0.25) PASI 100 (Week 20) 16.6% achieved in diet group 10.5% in information group (*P*=0.12)	3
Castaldo et al. [18]	CR	Very low calorie ketogenic diet for 4 weeks via NG tube	Low calorie, protein-based, ketogenic diet containing branched chain amino	1	14 weeks	Baseline PASI = 15 Week 4	0

		followed by 6 week low calorie, normal protein diet then switched to very low calorie ketogenic diet for another 4 weeks. Concomitant use of biologic therapy.	acids, glutamine and milk proteins (300 kcal/day). Normal low calorie diet (1200 kcal/day)			PASI = 2.4 Week 10 PASI = 0.4 Week 14 PASI = 0.3	
Bardazzi et al. [19]	P, OL	LCD with simultaneous biologic therapy	Unspecified LCD	33	8 months	4 Month Follow Up 27 subjects reported no change in body weight, 4 reported increased body weight and 2 reported weight loss. 10 subjects achieved PASI ≥75, 13 subjects achieved PASI 50-74, and 10 subjects reported PASI ≤50 8 Month Follow Up 4 subjects gained weight, 22 subjects did not lose weight, and 6 subjects lost weight. 14 subjects achieved PASI ≥75, 2 subjects achieved PASI 50-74, 2 subjects achieved PASI ≤50	0
Lithell et al. [20]	OL	One day normal hospital diet, then two day vegetarian diet (1200 kcal), followed by 11 days of a vegetarian broth diet (200 kcal), 3 days of a LCD (260-620 kcal) followed by 2 weeks of a vegan diet.	Vegetarian borth, vegetable drinks, berrier, teas, lentils, buckwheat, sunflower oil.	10	5 weeks	Some improvement during the vegan diet.	1
Al-Mutairi et al. [27]	P, R, C	LCD versus control. All subjects received biologic therapy	Vegetables, rice, wheat bread, fruit, water, skimmed milk, low-fat milk products	262	24 week	PASI 75 85.9% in diet group and 59.3% in control group at week 24 (P<0.001)	2
Zackheim et al. [21]	P, C, OL	LCD vs normal diet	LCD (500 kcal/day)	14	4-5 weeks	Worsening of all subjects in LCD group except one.	0

						Only 4 subjects displayed improvement in control group	

P- Prospective; C- Controlled; R-randomized; DB-double-blinded; OL-open-label; PC-placebo-controlled; AC-active-controlled; PG-parallel-group; DC-dose-comparison; LCD-low calorie diet; CR-case report;

Table 3. *Efficacy of fish oil diet.*

Authorship	Study Design	Intervention	Diet	Size	Duration	Result	Jadad Score
Maurice et al. [31]	P, OL	Fish Oil Dietary Supplement.	8 subjects received Max-EPA 50 mL and 1 subject received 25 mL (contains DHA, palmitic, and oleic acid). 1 subject received 50 mL cod liver oil.	10	6 weeks	Redness and Scaling Mild to moderate improvement.	0
Ziboh et al. [32]	P, OL	Fish oil diet with fish oil supplement.	MaxEPA (10.8-13.5 g). Fish, poultry, fruits, vegetables, grains, skim milk, alcohol, coffee, tea, and carbonated beverage.	13	8 weeks	Scale Improved (P<0.001) Redness Improved (P<0.02) Thickness Improved (P<0.004) Moderate Improvement Five subjects Mild Improvement 3 subjects No Improvement 5 subjects	0
Collier et al. [50]	CO	White fish diet for 4 weeks then randomized to continue the white fish diet or switch to oily fish diet for 6 weeks. At week 10, subjects in	White fish (cod, coley, whiting, haddock, sole, plaice) or Oily fish (mackerel, salmon, herring, sardine, pilchard, kipper)	16	10 weeks	Baseline PASI Group 1- 6.1 (95% CI 3.9-9.7) Group 2- 6.6 (95% CI 4.1-10.0) Week 4 PASI Group 1 (white fish diet)- 8.4 (95% CI 5.1-14.0) Group 2 (white fish diet)- 8.2 (95% CI 4.8-14.2) Week 10 PASI Group 1 (white fish diet) 9.7 (95% CI 5.9-16.1; P<0.01) Group 2 (oily fish diet) 7.3 (95% CI 4.6-11.6; P<0.01) Week 16 PASI Group 1 (oily fish diet) 8.2 (95% CI 4.6-14.4; P<0.01) Group 2 (white fish diet) 9.8 (95% CI 5.9-16.3; P<0.01)	1

		each groups switched diets for another 6 weeks.					
Schena et al. [33]	OL	Fish oil supplement	Cod-liver oil supplement (20 mL/day)	13	8 weeks	Almost complete skin clearance	0
Lassus et al. [34]	OL	2 capsules containing EPA and DHA three times a day. Subjects with arthritis continued anti-inflammatory medications	EPA (1122 mg/day) and DHA (756 mg/day)	76	8 weeks	Week 4 PASI Mean PASI 1.98 vs mean baseline PASI 3.56 (P<0.001) Week 8 PASI Mean PASI 1.24 vs mean baseline PASI 3.56 (P<0.001)	1
Kragballe et al. [35]	OL	MaxEPA supplement and fish oil diet	MaxEPA fish oil (30 mL/day), 100 µg selenium daily, fish, poultry, fruits (except banana), vegetables (avoid avocado), grain, coffee, tea, and skim milk.	26	4 months	Moderate or Excellent Improvement 58% of subjects Mild Improvement 19% of subjects No Improvement 23% of subjects	1
Kragballe[36]	OL	12 super gamma-oil marine capsules daily (contains linoleic acid, gammalinolenic acid, DHA, and EPA), 100 µg selenium daily and fish oil diet.	Super gamma-oil capsules, selenium, fish, poultry, fruits, vegetables (avoid avocado), cereal, skim milk, tea, coffee.	17	4 months	Excellent or Moderate Improvement 59% of subjects Mild Improvement 23% of subjects No Improvement 18% of subjects	1
Kettler et al. [46]	OL	Fish oil supplement while continuing topical treatment	MaxEPA 18 capsules a day (3.2 g EPA and 2.2 g DHA)	23	6-8 weeks	Marked Improvement 1 subject (80-90% clearing) No Improvement 25 subjects	1

Bittiner et al. [37]	DB, R, PC	Fish oil capsule versus olive oil capsule (placebo) while continuing topical therapy	MaxEPA containing 1.8 g of EPA.	24	12 weeks	Pruritus Itch improved in the EPA group vs placebo at week 12. (*P*<0.05) Erythema Greater improvement in EPA group vs placebo at week 12. (*P*<0.05) Scaling No difference in improvement between EPA group and placebo at week 12. (*P*>0.05) BSA No difference in improvement between EPA group and placebo at week 12. (*P*>0.05)	3
Bjorneboe et al. [44]	R, DB, PC	Fish oil capsules vs olive oil capsules (placebo)	MaxEPA (10 g fish oil; 18% EPA, 12% DHA, 30% n-3 fatty acid, 3% n-6 fatty acid)	27	8 week	No difference in clinical improvement between both groups	3
Soyland et al. [45]	R, DB, PC	Fish oil group vs corn oil group (placebo)	Six 1 g fish oil capsules per day (51% EPA and 32% DHA)	124	4 month	PASI No difference in both groups. (*P*>0.05) 4-point Erythema, Scale and Infiltration Score Compared to baseline, improvement in both groups were reported (*P*<0.05) Subjective Score of Redness, Itch, Scale, and Quality of Life No difference in both groups. (*P*>0.05) Infiltration Sign Improvement in fish oil group from baseline (*P*<0.01) Desquamation Sign Improvement in corn oil group from baseline (*P*<0.05) Redness Improvement in corn oil group from baseline (*P*<0.05) Scaling Improvement in corn oil and fish oil group from baseline (*P*<0.01)	2
Gupta et al. [47]	R, DB, PC	10 capsules of fish oil and betamethasone diproprionate cream applied BID versus olive oil and betamethasone	Fish oil MaxEPA (5.4 g EPA and 3.6 g DHA)	19	9 weeks; 3 weeks of fish oil and topical cortisone followed by 6 weeks of	Before Corticosteroid Discontinuation Improvement in psoriasis with no difference in both groups. After Corticosteroid Discontinuation Relapse of psoriasis in the fish oil group occurred in 4.9 weeks and 4.5 in the placebo group (*P*=0.4)	2

		diproprionate cream applied BID (placebo).			fish oil alone.		
Gupta et al. [38]	R, DB, PC	Fish oil capsules BID versus olive oil capsules BID for 3 weeks followed by fish oil capsules BID and UVB phototherapy BID versus olive oil capsules BID (placebo) and UVB phototherapy BID for 8 weeks then 4 weeks of fish oil BID or olive oil capsules BID.	MaxEPA (3.6 g EPA and 2.4 g DHA)	18	15 weeks	The fish oil group's severity score (based on redness, scale, and thickness) improved greater than placebo after UVB therapy, at week 11 (P=0.09). The fish oil group's severity score improved greater than placebo at week 15 without UVB therapy (P=0.001). Compared to baseline, the erythema, thickness, scale and BSA improved in the fish oil group at week 15 (P=0.02, P=0.006, P=0.008, P=0.0001, respectively) No significant changes occurred in the placebo group.	2
Oliwiecki et al. [48]	R, DB, PC	All subjects received placebo for 4 weeks then randomized to receive primrose oil, fish oil, and vitamin E or paraffin (placebo). All subjects applied 1% hydrocortisone ointment BID	Primrose oil (430 mg), fish oil (107 mg)	37	28 weeks	No significant difference in objective psoriasis severity throughout the 28 weeks except for improvement in the fish oil group at week 8 (P<0.05).	2

Guida et al. [39]	OL, R, PG	While all subjects simultaneous received systemic (adalimumab, etanercept, methotrexate, cyclosporine, infliximab) therapy one group received n-3 polyunsaturated fatty acid diet while other did not.	Seafood including salmon, sardines, herring, and bluefish, n-3 margarine, olive oil, fruits, vegetables. Avoid meat, eggs, grain, cereal.	36	6 months	PASI Baseline Intervention- 7.7 ± 3.7 Control- 8.9 ± 3.9 PASI 3 Months Intervention- 5.3 ± 4.3 (*P*<0.05 compared to baseline and 6 months) Control- 7.8 ± 4.1 (*P*<0.05 compared to intervention at 3 months) PASI 6 Months Intervention- 2.6 ± 3.0 (*P*<0.05 compared to baseline and 3 months) Control- 7.8 ± 1.9 (*P*<0.05 compared to intervention at 6 months)	3
Festugato et al. [40]	OL	Fish and poultry diet while simultaneously receiving systemic and topical therapy	Increase consumption of vegetables, legumes, beta-carotene rich food, cereal, fruit, stews, fish, chicken. Decrease consumption of beef, coffee, yerba mate, beef, barbecue.	43	2 years	88.37% subjects reported reduced erythema, scale, improved quality of life, and diminished outbreaks. 11.63% subjects reported no improvement.	0
Danno et al. [41]	P, R,	Etretinate 20 mg capsules daily versus etretinate 20 mg capsules and 1800 mg EPA daily. Subjects used topical corticosteroids simulatneously	EPA ethyl ester capsules	40	12 weeks	Excellent Improvement 9 subjects in EPA group and 3 subjects in etretinate alone group. (*P*<0.05) Moderate Improvement 4 subjects in EPA group and 8 subjects in etretinate alone group. Mild Improvement 7 subjects in EPA group and 7 subjects in etretinate alone group. Minimal Improvement No subjects in EPA group and 2 subjects in etretinate alone group.	1
Madland et al. [99]	R, DB, PC	Seal oil versus soy oil	Seal oil (2.4 EPA, 2.6 g DHA)	40	Week 6	No change in PASI	3
Balbas et al. [42]	P, OL, C	Two omega-3 fatty acid capsule and	Capsule contained 280 mg EPA, 40 mg DHA, 50 mg thyme extract, 50	30	2 months	Subjects in tacalitol group reported a PASI improvement by 3.5 points and 6.8 points in the omega-3 group at 2 months (*P*<0.0001)	1

		tacalcitol versus talcalcitol	mg olive leaf extract, 20 mg green tea extract, 7.5 mg zinc, 27.5 µg selenium)				
Kojima et al. [43]	P, OL	3.6 g of 90% pure EPA daily	EPA ethyl ester	7	6 months	Marked improvement in 2 subjects, moderate improvement in 4 and no improvement in 1 subject	1
Veale et al. [49]	R, DB, PC	Efamol marine capsules vs placebo	Capsules contain 240 mg EPA, 132 mg DHA, vitamin E	38	1 year	No improvement in psoriasis severity.	2
P- Prospective; C- Controlled; R-randomized; DB-double-blinded; OL-open-label; PC-placebo-controlled; AC-active-controlled; PG-parallel-group; DC-dose-comparison; CO-cross-over trial; EPA-eicosapentaenoic acid; DHA-docosahexaenoic acid;							

Table 4. *Efficacy of a tryptophan, selenium, and other diets.*

Authorship	Study Design	Intervention	Diet	Size	Duration	Result	Jadad Score
Spiera et al. [51, 52]	CO	Normal hospital diet than tryptophan diet.	Turkey, juice, coffee, potato, vegetables, fruits.	12	2-6 months	Excellent Response 7 subjects Moderate Response 3 subjects No Response 2 subjects	0
Petrozzi et al. [53]	CS	Tryptophan diet	Turkey	3	8-22 days	No clinical response in all 3 subjects	0
Ellis et al. [54]	CS	Tryptophan diet	Turkey	6	12-21 days	No clinical improvement in 5 subjects and slight improvement in 1 subject	0
Auckland[55]	CR	100 mg of tryptophan (daily dose 1000 mg)	Low level of tryptophan, vitamins, calcium, iron.	1	6 weeks	Marked improvement	0
Portnoy[56]	CR	3.8mg/kg of tryptophan (low tryptophan diet) with simultaneous use of triamcinolone 4 mg, ACTH 40 u BID, and beclomethasone diproproionate 0.025% ointment	Low level of tryptophan	1	3 weeks	Marked improvement	0
Zackheim et al. [57]	CS	Low protein diet vs normal diet vs low protein diet	Low protein diet consisted of 4.0 gm to 50 gm protein.	13	4-17 weeks	No improvement difference between all groups.	0

		transitioning to high protein diet	Vitamin supplements				
Fairris et al. [59]	R, DB, PC	600 µg selenium or 600 µg selenium and 600 IU of vitamin E or placebo	Selenium enriched yeast and d-alpha-tocopherol acetate	65	12 weeks	No PASI improvement in all groups.	5
Harvima et al. [61]	P, OL	400 µg selenium oral daily	Selenium yeast tablets	7	3 months	No PASI improvement at 3 months	0
Serwin et al. [62]	R, DB, PG, PC	Oral 100 µg selenium daily vs placebo while both groups receive simultaneously NB-UVB five times a week for 4 weeks	Selenomethionine	27	4 weeks	At 4 weeks, 47.34% of the selenium group and 55.56% of placebo group reached PASI 75 (P>0.05)	3
Serwin et al. [58]	R, DB, PC	200 µg of selenium daily versus placebo. Both groups received salicylic acid ointment and dithranol ointment.	Selenomethionine	22	4 weeks	Significant improvement of PASI score in intervention versus placebo group.	3
Burrows et al. [63]	R, DB, PC	45 mg zinc orally versus placebo. Both groups received betamethasone valerate 0.0025% ointment.	Soluble zinc sulfate 220 mg tablet	24	12 weeks	Mean PASI at 12 weeks was 8.0 in placebo group and 11.2 in zinc group (no statistical significance)	3
Kharaeva et al. [60]	R, DB, PC	Coenzyme $Q_{10,}$ vitamin E, and selenium versus placebo randomized to four groups, either two psoriatic arthritis groups or two erythrodermic psoriasis groups	Coenzyme Q10 (50 mg/day), vitamin E (50 mg/day), and selenium 48 µg/day.	58	30-35 days	The psoriatic arthritis interventional group reported greater PASI improvement than control (16 ± 6 vs 29 ± 10, respectively). The erythrodermic psoriasis intervention group reported greater PASI improvement than control (19 ± 4 vs 30 ± 5, respectively [P<0.05])	2
Brown et al. [66]	CS	Unique diet consisting of saffron tea, slippery elm bark water, and nutritional diet	Saffron tea, slippery elm bark water, fruits, vegetables, nuts, fish, fowl, lamb, whole grain bread and cereal, low-fat dairy products.	5	6 months	PASI improved from 18.2 ± 15.0 to 8.7 ± 9.7. Psoriasis Severity Score improved from 14.6 ± 7.8 to 5.4 ± 4.2	0

Antiga et al. [64]	R, DB, PC	Two 500 mg curcumin tablets twice a day and topical methylprednisolone aceponate 0.1% ointment or the topical corticosteroid and placebo	Curcumin	49	12 weeks	PASI 50 92% in active group and 88% in control PASI 75 48% in active group and 44% in control PASI 90 20% in active group and 8% in control PASI 100 12% in active group and 4% in control Median PASI Curcumin group improved from baseline to week 12 (5.6 to 1.3; $P<0.05$) compared to control (4.7 to 2.4; $P<0.05$).	4
Yousefzadeh et al. [65]	R, DB	Methotrexate 0.2-0.3 mg/kg/week versus methotrexate 0.2-0.3 mg/kg/week and micronutrient daily	Micronutrient includes folate, magnesium, iron, zinc, copper, manganese, selenium, chromium, iodine, vitamin A, D, E, K, C, B_1, B_2, B_3, B_6, B_{12}	30	12 weeks	Micronutrient group reported greater PASI improvement than placebo ($P=0.045$) 65% of intervention subjects met PASI 75 whereas 35% of control met PASI 75 ($P=0.08$)	4
P- Prospective; C- Controlled; R-randomized; DB-double-blinded; OL-open-label; PC-placebo-controlled; AC-active-controlled; PG-parallel-group; DC-dose-comparison; CO-cross over trial; CR-case report; CS-case series;							

Table 5. *Efficacy of a gluten free diet.*

Authorship	Study Design	Intervention	Diet	Size	Duration	Result	Jadad Score
Addolorato et al. [100]	CR	GFD	GFD avoiding barley, wheat, and rye.	1	1 month	Complete remission	0
Frikha et al. [75]	CR	GFD, calcium, and vitamin D	GFD, vitamin D	1	1 month	Complete remission	0
Zamani et al. [79]	CS	GFD	GFD	3	6 months	No improvement	1
Michaelsson et al. [77]	OL	GFD for 3 months followed by normal diet for 3 more months.	GFD	30	6 months	PASI 3 Months All GFD subjects mean improvement from 5.5 ± 4.5 to 3.6 ± 3.0 ($P<0.001$). PASI 6 Months Psoriasis exacerbation in 18 of 30 subjects	1

Michaelsson et al. [78]	OL	GFD	GFD	16	2 years	Complete Clearance 1 subject Moderate Improvement 8 subjects Mild Improvement 2 subjects No Improvement 5 subjects	0
De Bastiani et al. [76]	OL	GFD	GFD	8	6 months	6 subjects reached a PASI 75, 1 subjects reached PASI 100, and 1 subject reported no improvement at 6 months	1
P- Prospective; C- Controlled; R-randomized; DB-double-blinded; OL-open-label; PC-placebo-controlled; AC-active-controlled; PG-parallel-group; DC-dose-comparison; CO-cross over trial; CR-case report; CS-case series; GFD-gluten free diet;							

Table 6. *Efficacy of vitamin D supplementation in psoriasis.*

Authorship	Study Design	Intervention	Diet	Size	Duration	Result	Jadad Score
Perez et al. [81]	P, OL	0.5 µg of calcitriol daily followed by 0.5µg increase every 2 weeks and 800 mg calcium	Calcitriol and 800 mg calcium from diet	85	6 months – 3 years	Mean PASI improvement from baseline to 6 and 36 months was 18.4 to 9.7 and 7.0, respectively (P<0.001)	1
Morimoto et al. [82]	P, OL	1α -hydroxyvitamin D_3 orally	1α -hydroxyvitamin D_3 (1µg/day)	17	6 months	Complete remission occurred in 5 subjects, marked improvement in 4 subjects, moderate improvement in 4 subjects, slight improvement in 1 subject, no change in 2 subjects, and worsening in 1 subject.	0
Smith et al. [84]	P	Starting at 0.25 µg and rising to 2.0 µg $1,25(OH)_2D_3$ capsules per day	$1,25(OH)_2D_3$ capsules and <800 mg calcium diet/day	10	6 months	71% of subjects reported >25% improvement in psoriasis severity, 50% of subjects reported >50% improvement and 50% of subjects reported >75% improvement in severity.	0
Gaal et al. [86]	P, C, OL	Oral 0.25 µg BID Alphacalcidol versus control while both groups simultaneously received 10 mg methotrexate and NSAIDs	Alphacalcidol supplement	19	6 months	No significant PASI difference between groups	1

Finamor et al. [88]	P, OL	Daily oral vitamin D (cholecalciferol) with low calcium diet	35,000 IU of vitamin D, and avoidance of dairy products	9	6 months	PASI improved in all subjects (*P*=0.0023)	0
el-Azhary et al. [87]	P, OL	0.5 µg $1,25(OH)_2D_3$ oral daily then increased by 0.5 µg every 2 weeks until resolution. Subjects allowed to use triamcinolone 0.05% cream	$1,25(OH)_2D_3$ supplement daily and 800 mg calcium daily	8	6 months	No improvement in 3 subjects, mild improvement in 3 subjects, moderate and marked improvement each in 1 subject.	0
Takamoto et al. [83]	P	1.0 µg 1α-hydroxycholecalciferol daily with simultaneous use of topical corticosteroids	$1α(OH)D_3$	7	6 months	Marked improvement in 2 subjects, complete remission in 2 subjects, no improvement in 3 subjects.	0
Huckins et al. [85]	P, OL	Daily oral 0.5 µg followed by 0.25 µg increase every 2 weeks to reach maximum 2.0 µg of $1,25(OH)_2D_3$	$1,25(OH)_2D_3$	9	6 month	4 subjects reported marked improvement, 2 reported worsening improvement	1
P- Prospective; C- Controlled; R-randomized; DB-double-blinded; OL-open-label; PC-placebo-controlled; AC-active-controlled; PG-parallel-group; DC-dose-comparison; CO-cross over trial; CR-case report; CS-case series;							

Table 7. *Summary Table. [14-22, 25-28, 32-67, 77, 78, 80-82, 84, 85-88, 89-91].*

Diet	Comments
Low calorie diet	Although a low calorie diet improved weight loss, insufficient evidence supports the efficacy of a low calorie diet as monotherapy in psoriasis. Simultaneous initiation of a low calorie diet and systemic therapy, including cyclosporine and methotrexate, improved PASI, although improvement was likely related to systemic therapy. A low calorie diet may be recommended as an adjunct therapy in overweight or obese patient.
Fish oil diet	A fish oil diet as monotherapy in psoriasis demonstrated insufficient evidence in well-designed clinical trials. Concomitant psoriasis treatment with a fish oil diet and systemic therapy, including biologic therapy and narrowband UVB, expressed improved psoriasis severity. Improvement was likely related to systemic therapy. Well-designed clinical trials with valid and reliable outcome measures are necessary to gather further insight in the efficacy of a fish oil diet in psoriasis.
Tryptophan diet	Due to limited evidence from case series, case reports, and a small sample size, further studies are necessary to explore the efficacy of a tryptophan diet in psoriasis.
Selenium supplementation	Two randomized, double-blind, placebo-controlled clinical trials reported insufficient PASI improvement and 2 randomized, double-blind, placebo-controlled trials reported significant improvement in PASI. Due to mixed results, further investigation is necessary.

Zinc supplementation	One randomized, double-blind, placebo-controlled study reported no difference between zinc supplementation and placebo. Due to limited number of clinical trials, further investigation is necessary.
Curcumin supplementation	One randomized, double-blind, placebo-controlled clinical trial reported PASI improvement in both the curcumin and placebo group. Both groups applied a topical corticosteroid simultaneously. Due to limited number of clinical trials, further investigation is necessary.
Micronutrient supplementation	A randomized, double-blind clinical trial reported PASI improvement in the micronutrient group compared to the placebo group, although both groups received methotrexate concomitantly. Due to limited number of clinical trials, further investigation is necessary.
Gluten free diet	Two open-label clinical trials reported PASI improvement with a gluten free diet. Due to a limited sample size and lack of a comparison group, further investigation is necessary.
Vitamin D diet	Two open-label clinical trial supplementing calcitriol reported PASI improvement, whereas one randomized, open-label clinical trial supplementing alphacalcidol reported no significant PASI improvement. Well-designed clinical trials with valid and reliable outcome measures are necessary to gather further insight in the efficacy of a vitamin D diet in psoriasis.