Is a Low Glycemic Index Diet an Effective Treatment Regimen for Acne Vulgaris in Adolescents and Young Adults Ages 15-30?

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Is a low glycemic index diet an effective treatment regimen for acne vulgaris in adolescents and young adults ages 15-30?

Gina C. Tomkus, PA-S

A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies
Philadelphia College of Osteopathic Medicine
Philadelphia, Pennsylvania

December 20, 2013
Abstract

Objective:
The objective of this selective EBM review is to determine whether or not a low glycemic index (Low GI) diet is an effective treatment for acne vulgaris in adolescents and young adults ages 15-30.

Study Design:
Systematic review of two randomized, double blind, placebo controlled clinical trial and one parallel clinical trial published in peer-reviewed journals.

Data Sources:
Two randomized double blind clinical trials and one parallel clinical trial published in 2007, 2012, and 2010 respectively. The sources studying the use of a low glycemic index diet as a therapeutic intervention for acne vulgaris were obtained using PubMed, and OVID databases.

Outcome Measured:
Outcomes measured include acne lesion count using the Leeds grading scale with subjects holding significant power to detect a difference in the reduction of the lesions, independent dermatologist assessments, digital photographs, and subject self-assessments.

Results:
Kwon et al. (2012) found a significant decrease in the number and severity of lesions in the low glycemic diet group after 10 full weeks of dietary intervention. After 5 weeks of treatment significant changes were noted in patient self-assessment scores in both groups. Smith et al. (2007) found a 51% decline in mean number of total lesions in the low glycemic group as compared to 31% decline in the control group after a 12 week intervention, with differences being significant after an intention to treat model was used. The number of inflammatory lesions also significantly declined. On the contrary, Reynolds et al. (2010) found no significant difference in the number of lesion counts or acne severity after an 8-week therapeutic intervention with a low glycemic index diet.

Conclusions:
Kwon and Smith et al. both showed clinical significance that a reduction in the glycemic index of dietary carbohydrates may significantly improve the severity and lesion counts in patients suffering from acne. Reynolds et al. concluded that low glycemic index carbohydrates are not responsible for changes in acne severity, and implies that other dietary factors may play a role in the development of acne vulgaris.

Key Words:
Diet, acne, glycemic index
**Introduction**

There is some evidence to suggest that diet may play a role in the development of acne vulgaris. However, it is unclear whether dietary intervention may be considered as an effective therapy for this condition. This review will examine the literature available using low glycemic index (low GI) foods as a treatment option for those suffering from acne.

Acne vulgaris is the most common skin disease in the US and the most likely reason for young adults and adolescents to visit a dermatologist.\(^1\) It affects 40-50 million Americans and approximately 85% of people ages 12-24 years of age.\(^{1,2}\) This condition is responsible for a significant impact in the self-esteem of teens and young adults. Teens with severe acne are 2-3 times more likely to develop depression than their peers without acne.\(^3\) In addition, teens ages 12-18 suffering from acne are at an increased risk of suicide attempts.\(^3\)

The healthcare costs associated with acne are remarkable. Acne was responsible for 4.8 million physician offices visits per year.\(^1\) Women are 80% more likely to seek medical care for their acne than men.\(^4\) The majority of costs stem from the use of prescription drugs. However, over the counter products for the treatment of acne is a multi-million dollar industry. The market for acne treatment, including prescription and OTC products, is estimated to exceed $2.2 billion.\(^4\)

Acne is a common disorder causing significant inflammation and blockage of the pilosebaceous glands of the skin characterized by non-inflammatory (comodones) and inflammatory (papules, pustules, and nodules) lesions.\(^1\) It affects mostly adolescents after the onset of puberty, but can persist into young adulthood. Excess androgen production during puberty stimulates the production of dihydrotestosterone (DHT) causing significant
sebum production and hyperproliferation of keratinocytes.\textsuperscript{1,5} This can cause blockage of hair follicles and subsequent overgrowth of the bacteria \textit{Propionibacterium acnes} (\textit{P. acnes}).\textsuperscript{1,2}

A variety of medical treatments are available for this condition including both over the counter and prescription products. Some of the most commonly used remedies include topical and oral antibiotics, retinoids, benzoyl peroxide, salicylic acid, sulfur, oral contraceptives, and isotretinoin.\textsuperscript{2} Benzoyl peroxide is typically used as first line treatment for non-inflammatory acne.\textsuperscript{1} This product works by increasing epithelial cell turnover and releasing free-radical oxygen which decreases the number of bacteria and free fatty acids that can form in sebaceous glands.\textsuperscript{1} Retinoids are also another popular product and have a similar mechanism of action as benzoyl peroxide. Using these products may cause some irritating side effects such as excessive drying, peeling, and erythema to the skin.\textsuperscript{1}

Antibiotics such as the tetracyclines, clindamycin, erythromycin, and Bactrim DS are used to treat inflammatory acne and directly decrease the growth of the bacterium \textit{P. acnes} further inhibiting the production of free fatty acids. However, these products can cause significant gastrointestinal disturbances including nausea, vomiting, and diarrhea. In addition, notable side effects such as photosensitivity and skin discoloration should also be considered.\textsuperscript{6}

Perhaps one of the most popular items on the market to treat severe acne is isotretinoin. This drug works to decrease sebum production, decreases bacterial growth, and inhibits excessive epithelial cell turnover.\textsuperscript{6} Some of the most common side effects include chelitis, xerosis, epistaxis, pruritus, conjunctivitis, thinning of hair, hypertriglyceridemia, increased LFTs, arthralgia, decreased hemoglobin concentration, and increased platelet count.\textsuperscript{6} Another concerning issue with isotretinoin is it is a known teratogen. Every female patient that is prescribed this medication is required to participate in the iPLEDGE Program, which is signed
agreement between the physician, pharmacist and patient stating that no female patient can start therapy if pregnant, and no female patient currently taking this medication can become pregnant.6 Under this clause, a female patient of childbearing age taking isotretinoin must have two negative urine or blood pregnancy tests prior to taking the first dose, and subsequently a negative pregnancy test every month she picks up her prescription from the pharmacy. The patient must also agree to use two forms of contraception simultaneously for one month before, during, and after therapy.6

It has been postulated that a Westernized diet may also play a role in the development of acne. Studies have shown an association between the consumption of a high glycemic load diet and the development of chronic disease such as diabetes, obesity, heart disease, and certain cancers.7 Glycemic index (GI) is a numerical measurement of how quickly blood sugar and insulin levels peak and fall after eating a particular food using glucose (GI =100) as a reference point. An example of a high GI food includes white bread, angel food cake, and white rice, where a low GI food might include legumes, oats, and rye. Glycemic load is a value calculated by multiplying the glycemic index of the food by the amount of carbohydrates per serving. International guidelines of glycemic index and glycemic load values have been published by the American Journal of Clinical Nutrition and are used as a reference in both clinical and scientific practice. Recently, high glycemic load diets have also been linked with hyperinsulinemia and excess androgen production.8,9,10 It is known that these factors may contribute to the development of conditions such as acne, however, it is unclear whether a low GI diet may be a beneficial treatment for young people suffering from acne vulgaris.
Objective

The objective of this selective EBM review is to determine whether or not a low glycemic index diet is an effective treatment for acne vulgaris in adolescents and young adults ages 15-30.

Methods

Studies chosen included two randomized double blind control trials, and one parallel clinical trial (Table 1). Studies were selected using several criteria. The population included young adults ages 15-30 diagnosed with either mild, moderate or severe acne vulgaris.

The intervention studied was the adjustment of dietary intake with the majority of carbohydrates ingested classified as low glycemic index (Low GI). Daily dietary glycemic index and glycemic load were calculated from food records, and GI levels were obtained from reference tables published by Foster-Powell et al. The comparison was to maintain a regular diet and/or incorporate high glycemic index foods on a daily basis. Outcomes measured included improvement of acne lesions as measured by both patient and investigation by an independent dermatologist using several tools including subjective patient self-assessments, and the Leeds acne grading system. Severity, lesion count, and degree of inflammation were considered.

Key words used in the literature search included diet, acne, and glycemic index. All studies were published in English. All articles were published in peer-reviewed journals and were selected using PubMed and OVID databases. Inclusion criteria included patients ages 15-30 diagnosed with mild to severe acne, and randomized controlled trials. Exclusion criteria included patients under 15 and over 30, and recent treatment for acne within the past 6 months. Statistics used included p-values and change in mean from baseline.
<table>
<thead>
<tr>
<th>Study</th>
<th>Type</th>
<th># of Pts</th>
<th>Age</th>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
<th>W/D</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kwon(^3) (2012)</td>
<td>RCT</td>
<td>32 total pts from Korea; 24 males, 8 females</td>
<td>Control Group: 23.7 +/- 2.6 LGLD* group: 23.5 +/- 3.2</td>
<td>Age 20-27, with mild to moderate acne</td>
<td>0</td>
<td>LGLD diet: 25% pro, 45% low GI- CHO, 30% fats</td>
<td></td>
</tr>
<tr>
<td>Reynold(^6) (2010)</td>
<td>CT</td>
<td>58 total; boarding school in Sydney- all male</td>
<td>16.5 +/- 1.0</td>
<td>Acne severity scaled 1-3, stable wt x 3 mo, parental/guardian consent</td>
<td>Previous use of isotretinoin, antibiotics in past 1 mo, ETOH, illicit drugs, smoking, physical or mental illness, food allergy, vegetarian, previous GI surgery, black skin, final exams within next 2 mo.</td>
<td>15; 12 w/d and 3 omitted from data due to missing acne grades</td>
<td>Low GI diet modified per pt at school or home</td>
</tr>
<tr>
<td>Smith(^7) (2007)</td>
<td>RCT</td>
<td>43 total, RMIT University Melbourne- all male</td>
<td>LGL group: 18.2 +/- 0.5 Control Group: 18.5 +/- 0.5</td>
<td>Acne &gt;6 mo prior to recruitment, age 15-25</td>
<td>7 in control group, 5 in LGL group; 4 total lost to f/u. Intention to treat used.</td>
<td>7 in control group, 5 in LGL group; 4 total lost to f/u. Intention to treat used.</td>
<td>LGL diet: 25% pro, 45% low GI CHO, 30% fats</td>
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</tbody>
</table>
Outcomes Measured

Kwon et al. measured the number and overall severity of acne lesions using two independent dermatologists. The assessments were performed blind based on digital photographs taken at baseline and at each follow up visit at weeks 0, 2, 5, and 10. Evaluators used the Leeds revised grading scale produced by O’Brien et al. This is a systematic approach to classifying the severity of acne and is used as a grading tool for both practitioners and research purposes. Participants also completed subjective self-assessments at each visit on a scale of 0-10 with 0 classified as a disease free state and 10 being the starting point at their initial visit.

Similarly, Smith et al. used an independent dermatologist to perform an assessment and rating of the severity of acne by using the Leeds technique conducted at weeks 0, 4, 8, and 12. Lesions were mapped at each visit by placing a transparent plastic film and laser printed grid directly on the skin. Digital photographs were taken at baseline and at 12 weeks. Primary endpoints included changes in inflammatory lesion counts and total lesion counts. It was determined that 19 subjects per group would provide 80% power to detect a difference in the reduction of acne lesions.

Reynolds et al. measured the outcomes of acne severity and lesion counts on week 0 and week 8 using a grading system on a scale from 0-3 (0 = no acne, 1 = mild, 2 = moderate, and 3 = severe). A dermatologist blind to diet allocation provided the assessment granting at least 15 subjects per group >90% power to detect a change in acne severity. Digital photographs were also taken of all subjects at both visits.
Results

All trials included patients ages 15-30 with only one trial including females (Kwon et al). Kwon et al included only Korean patients recruited from an acne clinic, where the other two trials were set on college campuses in Melbourne, Australia. All studies shared exclusion criteria of any use of retinoids in the past 6 months. To maintain standard levels of energy intake, Smith and Kwon both developed a specific diet plan for the intervention group with 25% of calories coming from protein, 30% from fat, and 45% coming from low glycemic index carbohydrates. In contrast, participants in the Reynolds trial were asked to follow an “ad libitum” diet using written guidelines. All participants were asked to self-report dietary intakes in the form of food records.

Per patient self-assessments, Kwon et al. reports an improvement for both the control and low GI groups at the end of the 10-week intervention. At the final visit, scores had declined from 10 to 6.8 and 6.7 respectively (p = 0.01). Mean baseline acne scores per dermatologist assessment were 2.18 in the low GI group and 2.08 in the control group. A significant decline in acne grades to 1.60 (p=0.02) was observed in the low GI group (Table 2). Mean non-inflammatory lesion counts declined by 27.6% in the low GI group and 14.2% for the control group (p = 0.02, p = 0.04). Inflammatory lesion counts in the low GI group were significant after only 5 weeks of therapy (p = 0.03), and after full intervention decreased 70.9% from baseline (Table 3).

<table>
<thead>
<tr>
<th>Table 2. Acne Severity Kwon et al.</th>
<th>Baseline Scores</th>
<th>After intervention</th>
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<tbody>
<tr>
<td>Change in acne scores (severity) after intervention of 10 wks</td>
<td>Low GI</td>
<td>Control</td>
</tr>
<tr>
<td>Dermatologist scores</td>
<td>2.18</td>
<td>2.08</td>
</tr>
<tr>
<td>Patient self assessment</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

*a Only the low GI group demonstrated a significant decrease in acne grades. Difference in severity between both groups was also significant at final visit (p = 0.02)
Smith et al. reports a reduction in inflammatory and total lesion counts in both groups, with a greater reduction in the low GI group with the mean number of total lesions declining by 51% compared to 31% in the control group (p = 0.03). Inflammatory lesion counts declined by 45% in the low GI group compared to 23% in the control (p = 0.02) (Table 4). Results after 12 weeks of intervention remained significant after intention-to-treat analysis was applied.

Reynolds et al. reports an improvement in acne severity in both groups. After 8 weeks of treatment acne severity decreased 26% (p = 0.0004) on the low glycemic diet and 16% (p = 0.01) on the high glycemic diet. However, the difference between diets when comparing the acne scores from baseline did not reach significance after the intervention period (p = 0.15) (Table 5).
Discussion

While all three studies were able to show some improvement in acne symptoms with the intervention of a low GI diet, only two reached statistical significance in their results. These studies are the first of their kind using a dietary intervention as treatment for acne vulgaris. A low GI has been shown to be beneficial in other diseases such as diabetes and obesity, but it has never been considered a standard therapy for any disease.

It should be mentioned that Kwon et al. only studied the intervention in Korean patients while the latter two studies focused on students attending universities in Melbourne Australia. In addition, Kwon et al. included 8 females (n = 32) in their study, compared to the other studies using only male subjects. Differences in gender, ethnicities, and genetics may make it difficult to make comparisons between each investigation.

A common issue between each study was that all three relied on self-reporting of dietary intakes. This may result in under-reporting of actual intake due to subjects forgetting to log the foods they ate, or doing so inaccurately. In addition, when using dietary intake as an intervention, it is difficult to assess whether or not other nutrients such as dairy products, vitamin C, zinc, and vitamin A may have affected the results. While Reynolds and Smith et al. provided some staple foods, the majority of items in all studies were selected by the participants. Although instructions and diet plans were provided by a nutritionist, and food logs were analyzed for each participant, intakes of specific micronutrients were not accounted for and may have differed significantly between the groups.

Other limitations of all studies included small sample size and a short intervention time. Specifically, Reynolds et al. had a significantly shorter intervention period of 8 weeks compared to the others of 10 and 12 weeks. In addition, Reynolds et al. assigned the diets alternately in
order of recruitment where Smith and Kwon et al. assigned participants into groups using computer generated randomized numbers. Acne grading was performed by an independent dermatologist who was blind to diet allocation in all three studies. However, in Reynolds et al., the dermatologist became ill and a second dermatologist completed the assessments. Photographs were still graded by the ill dermatologist and an average of their scores were taken from the two grades to assess severity. Reynolds et al. also had a large drop out rate (26%) while Smith et al reported losses to follow up <20% with results still remaining significant after an intention to treat analysis was applied, and Kwon et al. had no participants withdraw from the study.

**Conclusion**

After review of all three studies, it can be concluded that there is a trend in the improvement of acne with a low glycemic index diet. However, due to the many factors that are involved in dietary intake it would be unjust to say that a low GI diet can be used to cure the condition at this time. Future study is warranted to evaluate the long-term effects of a low GI diet as well as the role of other nutrients and their effect on skin turnover. In addition, a more regimented dietary intake between participants is necessary to standardize nutrient intake. A common concern of all studies was the probable underreporting of food records. Future studies may consider working with schools to provide meals to participants involved in the study so that the nutrient intakes can be more closely matched.
References


