The Role Of Vegetarian Type Diets In The Management Of Rheumatoid Arthritis: A Literature Review

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July 27, 2012

ABSTRACT:

Objective: Dietary modification has been reported to have beneficial effects on patients suffering from rheumatoid arthritis. Specifically, a vegetarian diet has been associated with improvement in symptoms in those with RA. This paper will review the relevance clinical trials to determine the strength of those claims.

Methods: Using search parameters, this literature review identified four recent clinical trials that tested subjects with RA with some form of a vegetarian diet. All trials must have been within the past 15 years and have used actual diet modification, subjective, and objective pre and post-intervention measures.

Results: All four reported positive subjective findings, three of the trials using a control group. Only those lasting at least a year demonstrated objective improvement using disease markers. No trials demonstrated radiographic changes or changes in the rate of joint destruction measured by radiology.

Conclusion: More research needs to be done to better understand the pathway and the limitations of dietary modification, but sufficient evidence exists for clinicians to recommend some form of a vegetarian diet to their patients with RA for symptomatic relief. Claims should not be made that diet will cure the disease.

Key words*: rheumatoid arthritis, dietary modification, vegetarian diet, arthritis*

INTRODUCTION:

Rheumatoid arthritis (RA) is a chronic joint disease that involves synovial inflammation of the erosion of cartilage. This leads to the destruction of the joint over time. RA does not have a known etiology,[1] however research has demonstrated both genetic and environmental factors for the susceptibility and the development of the disease.[2-5] Among environmental factors are smoking, alcohol use, coffee consumption, and possibly obesity.[6,7] Other studies have linked RA severity and development to the consumption of red meat and animal fat in the United States,[8,9] although that link has been disputed by a study of nurses in the United Kingdom.[10] In Greece, high amounts of olive oil consumption were found to be correlated with a lowered severity of RA.[11,12] In Finland and the UK, researchers found that patients with high levels of antioxidants had lower subjective complaints than those patients with low levels of antioxidants.[13,14]

Since the 1920s, treatment for rheumatoid arthritis included diet changes. Research based on clinical observation in that time period suggested raw vegetables and high vitamin levels for the condition,[15,16] but no clinical trials were performed at that time, and the practice fell out of favor with medical rheumatologists. Over the past 30 years, more research has emerged supporting dietary manipulation for the relief of RA symptoms. Fasting, including water fasts and vegetable and fruit fasts, has shown significant symptomatic relief.[17-22] These benefits lasted only as long as the fast period, however. Case reports began reporting that vegetarian,[23,24] vegan,[25-28] and elimination diets[29-32] may be helpful for management of RA.

The mechanism for the amelioration of symptoms of RA has been illusory thus far. Three main hypotheses have been set forth.[33] First, that since RA is an inflammatory arthritis, foods that are pro inflammatory, specifically high in arachodonic acid, lead to increased amounts of eicosanoids in the blood stream.[34,35] While this hypothesis has significant support, a point against

it is that vegetarian diets are high in linoleic acid, which is a precursor to eicosonoid, same as arachodonic acid. Second, fasting and diet can change the microflora of the gut, changing the intestinal permeability and absorption, particularly of inflammatory agents that increase in the blood stream and work their way to the joints.[36] This hypothesis has gained considerable strength recently, as researchers have discovered that specific link in laboratory rats, standardizing diet while manipulating gut bacteria levels and makeup.[37] Lastly, that dietary modification leads to weight loss, decreasing symptoms of RA. This has been largely discounted, as more recent review research has controlled for weight reduction in subjects in clinical trials and concluded that the weight loss in test subjects had no statistical significance with either anti inflammatory effects or symptomatic relief.[38]

Regardless of the specific mechanism, clinicians need to rely more on clinical trials than anecdotal and case reports to recommend a treatment or course of action to patients. Chiropractors are musculoskeletal doctors and are exposed to patients with RA on a greater frequency that most other medical professionals, outside of rheumatologists. As such, they are in a greater position to oversee the management of RA. As doctors of natural medicine and healing, chiropractors need to understand if the research supports that recommendation of a vegetarian diet for patients with RA, and what the limitations of such an intervention would be.

The purpose of this literature review is to assess the claims that a vegetarian style diet is useful in the treatment of rheumatoid arthritis, both in terms of efficacy and clinical usefulness.

METHODS:

A literature search was performed, using PubMed and other scholarly search engines to identity literature using the search tags “rheumatoid arthritis,” “vegetarian,” and “vegan.” Of the

results, only papers representing original clinical trials were included. All studies were to have greater than 20 subjects and be published in the past 15 years. Using these criteria, four research papers were identified. Each will be discussed below.

DISCUSSION:

McDougall, et al. designed a study[39] to test a very-low fat vegan diet. This study was single blinded; the rheumatologist who examined the patients for objective measures was unaware of the details of the study. Twenty-four subjects with moderate to severe rheumatoid arthritis were involved in the study. Each of the subjects were examined by a rheumatologist for joint swelling and tenderness, and given visual analog scales, function limitation questionnaires, and asked to rate severity and duration of morning stiffness. Participants also had their erythrocyte sedimentation rate, C-reactive protein, and RA factor quantified through lab procedure. All of these measures established the starting baseline for all participants.

All participants were then placed on a vegan diet, which was also very low fat. No animal products or byproducts were in the diet, and no fats and oils were added to the foods outside their natural content. The diet was based off of beans, cereals, potatoes, rice, fruits, and vegetables. There were no caloric restrictions and participants were told to eat freely of the approved foods. To improve compliance, participants attended weekly meetings to be taught about the diet and how to make meals and menus based on the diet, as well as shopping and eating out advice. Participants reported on their diet through 4-day records and weekly checklists.

After four weeks, the lab tests, rheumatologic exam, and subjective questionnaires were repeated and scored. Compliance was 22 out of 24 patients. As measured, the diet moved participants from a carbohydrate/fat/protein intake of 49%/32%/17% to a 76%/10%/13%.

Although participants were not calorie restricted, there was an average of 3kg weight loss over the four week period, and energy intake dropped an average of 1450kJ. The lab tests had no significant improvement, although RA factor and CRP had nonsignificant decreases. The significant changes were in the symptomatology of the RA. Pain level dropped more than 31%. Joint tenderness improved 29%. Joint swelling decreased more than 18%. Severity of morning stiffness improved 26%, but there was only a nonsignificant decrease in the duration of morning stiffness.

The McDougall study was designed to test the hypothesis that rheumatoid arthritis could be controlled by diet, particularly a very low fat diet free of all animal products. In designing this study, the authors tried to make the study as near to life as possible, to be able to extrapolate the ability to use a similar intervention in clinical life. The diet was designed as one that avoided any known major reactive foods (with the exception of cereal grains), and animal fats and proteins, which are hypothesized to increase gut inflammation and allow increased permeability of those inflammatory complexes into the bloodstream and, therefore, joints. By imposing a vegan diet, the intestinal tract maintains proper permeability and stays in a non-inflammatory state. The authors note that a custom-made diet that identifies foods that are reactive and non-reactive is the ideal, but highly impractical for most clinical settings.

The study was designed to replicate the real world of clinical setting, and as such it had several major shortcomings from a methodological standpoint. First, the small sample size. The results of twenty-four participants, of whom 95% were women, cannot be properly applied to a large population such as the population with RA in the United States. Also, all were on stable dose of medication four weeks prior to the intervention, which standardizes for the study, but therefore does not measure what the intervention can do for those people who are not medicated

or avoiding medication or in acute stage of RA. Second, the length of the intervention. A four-week diet does not seem long enough to elicit changes of years and decades of a disease process. The ebb and flow of the disease is longer than that, so the study cannot conclusively show how the diet is effected by the natural course of the disease over months. Lastly, there is no control group. A control group would have allowed for accounting in cyclic changes and placebo affect. The control group could have also clarified how much of the results had to do with the reduced caloric intake, the reduced fat intake, the increased vegetable intake, and the reduced animal protein intake. Lastly, there is no long term follow up to determine how long the effects of this intervention benefit the patients.

Taken as a whole, this study demonstrates the need for further study with more rigorous methodology. But while this study has very limited research value, the clinical value is greater, due to the fact that the authors performed it in a similar fashion to a clinician would in the outside world. This article demonstrates that by simply placing a patient on a low fat, vegan diet, that patient has a good likelihood of having a decrease in symptomatology within a few weeks. This approach has the benefit of being easy, convenient, non-personalized, and high chance of compliance. Whether the positive results will be sustained remains unanswered by this research. Also unanswered is the effect of the diet on the disease itself, as apposed to the symptoms.

Nenonen et al. conducted a dietary intervention study[40] in Finland. Forty-three adults with moderate to severe rheumatoid arthritis were selected as subjects. All were in active stage of the disease. Patients were randomized into two groups, an intervention and a control. Baseline lab measurements included fasting blood, urine, and fecal samples for measurement of erythrocyte sedimentation rate and C-reactive protein. Other measurements were visual analog

scale for pain, number of swollen joints, number of painful joints, and a global patient assessment by a blinded rheumatologist.

The dietary intervention consisted of specialized “living food.” This diet was given to the patients and consisted of a vegan diet that was completely uncooked, as well as fermented wheat drink and wheatgrass drink. Although the components were provided for patients, a qualified dietitian also supervised preparation and tutored subjects daily on the living food diet. No animal products or byproducts were included in this diet. No caloric restrictions were intentionally placed on the subjects, but the subjects were provided the food components, which may have been limiting de facto. Seven-day dietary records were kept by the subjects, both in the experimental and control groups. This intervention was designed to go for three months, but eight patients stopped early at 2 months due to difficulties with the diet, which will be later discussed. The control group prepared their own omnivorous meals at home as normal without any kind of interference or training from any member of the study design.

At the end of the 2 or 3 month period, lab and questionnaire values were re-measured and scored. Standard statistical methods were used to compare the values of pre- and post-intervention as well as of the intervention group to the control group. Three months after the intervention, the values were once again obtained to see the longer term effects.

The results of the study were as follows. Serum protein of the intervention group was significantly lowered. Serum B12 was also lowered—an important effect in any vegetarian diet. Other lab values, such as ESR and CRP did not have a statistical difference between the intervention group and the control group. Although the diet was not hypo-caloric, subjects in the intervention group decreased an average of 9% in body weight.

In terms of subjective effects of the intervention, the authors note that most of the intervention group had positive subjective changes during the course if the diet, compared to the control group who had no change. Duration of morning stiffness appeared to be unchanged, but the number of painful and swollen joints had a significant decrease, and that decrease was maintained at least three months post-intervention for the follow-up. Fecal lactobacilli levels were higher in the intervention group and beta-glucuronidase activity was decreased during the study. Thus, the diet intervention had significant effect on both the subjective complaints of RA and the microflora of the gut in intervention subjects. Lab values associated with the inflammatory nature of the disease were unchanged.

Nenonen et al. designed this study to test their hypothesis that changing the microflora of the gut and colon would have a positive effect on the management of rheumatoid arthritis. They were testing the idea that RA is not affected by the diet so much as the bacterial effects of the diet, namely a diet should increase lactobacilli for beneficial effect. Their design of an extreme vegan diet of uncooked and fermented products reflects this hypothesis, compared to the traditional vegetarian or vegan diet.

The authors did a good job methodologically. Their sample size was not large, but was greater than 40, making it clinically useful. They used a single blind method, the only blinding possible on a food-based intervention. They also included a control group. The study took place over a longer period, two-three months, and follow up values were collected three months after the intervention concluded, which adds to the data of the long-term effects of the intervention diet.

The study was fairly strong in compliance, 19 of the 22 intervention subjects completed, but there were many adverse effects and at least two subjects who stayed in the study could not

fully comply with the full dietary requirements. The authors report that half of the subjects had nausea and diarrhea from the extreme diet. This caused two subjects to drop out within days and eight to drop out after two months. Others had adverse effects but continued the intervention. The authors note that while there were no serious side effects, and none of the effect to lasted beyond the end of the diet, this demonstrates that "extreme diets are not good for every patient."

This study demonstrates that an extreme vegan diet combined with fermented drinks can cause symptomatic relief in rheumatoid arthritis. Based on the methodology, sample size, and control group, the results are significant and should be considered clinically useful and of value. As far as the author's hypothesis, the diet did change both the microflora of the gut as well as subjective complaints, but the lab values that have been traditionally seen as objective disease markers were unchanged. The authors were not able to demonstrate, however, that the subjective improvements were based on changes in the lactobacilli as opposed to the consumption of a vegan diet. A second control group would be needed, one that has lactobacilli increase without change in diet, such as through probiotic supplementation.

The flaws in the study were not of method, but of diet. The extreme nature of the diet makes it difficult to use across the board with patients, both in terms of patient tolerance, and patient compliance. The study provided food and a dietitian met daily with the subject, something that would not be feasible in a clinical setting. With half of the subjects experiencing nausea or diarrhea, caution would need to be taken in recommending this diet and a clinician would need to follow up with the patient regularly.

Hafstrom et al. designed and ran a research study[41] in Sweden to test the effects of a gluten-free vegan diet as compared to a well-balanced diet in adults with rheumatoid arthritis.

Sixty-six adults with RA were recruited, none of whom had either tried dietary methods of disease control, and none of whom had any diagnosed food sensitivities or allergies. All were on the traditional medication regimen for RA, non-steroidal anti-inflammatory drugs (NSAIDs), oral glucocorticosteroids, and disease-modifying anti-rheumatic drugs (DMARDs). This study was single blinded, in which the observers of disease markers were blinded to which subjects were controls and which were in the test group.

Thirty-eight subjects were randomized into the vegan without gluten diet group, and the remaining twenty-eight were placing into a control group. All subjects were given vitamin B12 supplementation. The test group was placed on a diet with no animal products or byproducts. The diet also contained no gluten, a protein found in wheat and related grains. The diet consisted of vegetables, root vegetables, nuts and fruits. Calcium was provided by sesame milk. No wheat, millet, corn, or ride was allowed.

The control group was placed on a well-defined, but non vegan diet. The diet was designed by dieticians and represented a variety of foods from all food groups, balanced according to the recommendation for the general public.

Each group received a week of instruction from a dietician about their group diet. Compliance was measured by a dietary intake form, filled out by the subjects and analyzed by physicians, nurses, and dieticians.

At the beginning of the study, all subjects were tested for a baseline in the ACR20 response, a clinical assessment that includes a quantification of swollen and tender joints and level of C-reactive protein, IgA and IgG antibody levels against beta-lactoglobulin, and radiographic assessment of the arthritis joints for erosion. No subjective measures were taken for pain or global functionality.

These tests were repeated after three months, six months, and twelve months of the dietary intervention. Subjects who were noncompliant with the diet after at least one follow up were included in the results, but placed in a separate category of limited treatment. Those, the data analysis ended up comparing four groups, the control compliant, control noncompliant, vegan compliant, and vegan noncompliant.

Of the vegan group, 22 (58%) completed nine months of the diet. Twenty-five (89%) of the well-balanced diet control group completed nine months of the study. At the 12 month ending tests, 41% of the compliant vegan group had 20% of greater improvement on their ACR20 scores, compared to one member of the control group (4%). In analyzing the ACR20 subtests separately, CRP levels dropped but more than half (24.9 to 11.8 mg/l) for the vegan group, but no change for the control group. The control group experienced some improvement of swollen joints, but not sufficient to qualify for greater than 20% clinical improvement. In laboratory testing for immunoglobulin, the vegan compliant group experienced significant decrease in IgG and anti-beta-lactoglobulin levels compared to no change in the control or in the vegan noncompliant subgroup. On radiographic reexamination, both groups had clinically significant increased in erosion of the arthritic joints. There was no difference between the groups. The authors conclude that there is beneficial effect of patients being placed on a comparable diet for control of rheumatoid arthritis. Interestingly, the beneficial effects are on joint tenderness on swelling, but not on joint erosion. Also of note is that the lab values for CRP and IgG are lowered, but the disease progression as measured by joint erosion is unchecked.

Strengths of this study include both the existence of a control group, and subdividing the groups based on compliance prior to analyzing the data. The sample size was good at 66, and the length of time for the study was nine months and a 12 month follow-up. The authors made an

effort to ensure compliance by having a week of instruction at the beginning by dieticians, and having subjects maintain food forms. This helps keep compliance without making the study non-reflective of clinical realities. Because both groups were placed on a diet, this came as close as possible to being double-blinded as a dietary intervention can. Although patients knew which diet they were on, they did not know which diet was being studied. Also, the authors were able to demonstrate that the benefits of a vegan diet are based on the diet itself not on the health content, since the control group were eating a well-balanced, healthy diet, not a so-called "Western" diet, with all the health problems that term implies.

The authors also kept the measurements to objective disease markers, as opposed to any subjective measures. They also used a variety, such as radiograph, physical exam, and laboratory values. This ensured that the study measured what it claimed to, namely the effects of diet on RA, not merely the effects if diet on the symptoms of RA. This also virtually eliminates any placebo effect. However, at least a VAS would be helpful in determining if there was symptomatic improvement in those who experienced 20% or greater clinical improvement.

One flaw in the study was that compliance lasted through nine months, but the final follow up was at 12 months. This works for seeing any lasting effects post-diet, but exams and measurements should have also been taken at nine month in order to compare the values at diet completion with the values three months later. The data hints at this, specifically with the six-month values being better than the 12 month. At 6 months, when subjects has values taken while they were still on the diet, 46% of the vegan complaint, and 8% of the control complaint had 20% or greater improvement in ACR20, compared to 41% and 4% at 12 months. This demonstrates that the effects of dietary intervention are greatest while on the intervention, although the benefits do extend for at least a few months after terminating the diet.

This study is significant in that it demonstrates clinical improvement, including decreased lab markers of the disease. The previously discussed studied failed to show objective or laboratory improvement, despite showing remarkable symptomatic relief. This may be because the previous studies were either four weeks or three months. It seems reasonable to suggest that while symptoms may improve in as little as four weeks, a dietary intervention requires at least six month, if not longer, to demonstrate objective and laboratory improvement in the disease. However, radiographic evidence of joint erosion remains unchecked, even after a period of nine month to a year. This may mean that joint erosion continues in spite of changing levels of CRP and IgG, or it may mean that intervention requires even longer to effect erosion.

This study demonstrates compelling evidence for a vegan gluten-free diet in the management of rheumatoid arthritis, but questions remains whether the effects require both vegan and gluten-free, or merely vegan, since no efforts were made to differentiate between the two on this study.

Kjeldsen-Kragh designed and ran a clinical trial[42] to evaluate the effects of a vegetarian diet on rheumatoid arthritis. This trial is unique in that the dietary intervention was in staged, as opposed to a single diet imposed the entire time period. This trial also was conducted over a period of 13 months, with a follow up a year after completion. This makes the trial significant for effects of long term intervention as well as long term effects of intervention.

All patients were recruited in Norway and randomized into the treatment group and the control group. There were 27 subjects in the experimental group, 26 in the control, for a total of 53. Both groups were then sent away for four weeks, the experimental group to a health farm, and the control group to a convalescence home with comparable aspects of life to the health

farm. The intervention group was placed on a fast for 7-10 days. The fast consisted of only herbal teas, vegetable broth, carrot and potatoes juices, garlic and parsley. After the fast, subjects were placed on a vegan diet. No animal products or byproducts were allowed, and neither were gluten-containing grains. Also prohibited were citrus fruits and juices, strong spices, alcohol, tea and coffee. This diet continued from when the subjects were sent home after 4 weeks until the 3.5 month mark of the study. After that, patient could add in dairy, citrus, alcohol (except red wine), tea, and gluten foods if they had no adverse reaction in the first two days after introducing. Only one new food could be re-introduced every two days. In this fashion, the diet became a personally modified lactovegetarian diet between months 3.5 and 13. The members of the control group were allowed to consume their normal omnivorous diet during the entire 13 month period.

Subjective, clinical, and laboratory tests were taken at the initial intake of the subjects and after 1, 4, 7, 10, and 13 months, as well as one year after the completion of the study. The measures taken included pain, duration of morning stiffness, global assessment, grip strength, tender joints, Ritchie's articular index, swollen joints, weight, ESR, hemoglobin, CRP, platelet and white blood cell count, and albumin levels. At the same occasions as well as at 2.5, 5.5, 8.5, and 11.5, a dietitian collected a 24-hour recall of diet for all individuals in the study. No other measures were taken to measure or enforce compliance. According to the author, the positive effects seen by the fast would strengthen compliance to the subsequent diet.

By the conclusion of the trial, the experimental group had statistical improvement in almost all variables measured compared to the control group. Albumin and hemoglobin vales were no significantly different compared to the control. Interestingly, most variables showed drastic improvement by month one, and then maintained that improvement throughout the

remainder of the trial. C-reactive protein was particularly of note, since no other clinical trial showed statistical improvement in CRP values if the trial was any shorter than six months. Yet this trial demonstrates approximately 35% decrease from baseline, and maintains that with minor fluctuations throughout the next year.

The author notes that not all statistical improvement is significant for clinical value, so he further divided the group into the "responders" and "non-responders" based on clinically significant improvement above and beyond statistical. Of the 27 who improved statistically, 12 also improved sufficient to be termed "responders." This represents 44% of the group, comparable to the percent responders in Hafstrom's clinical trial. Of the control, two subjects also had clinical improvement (8%), also very similar to Hofstrom's findings.

A unique aspect of this trial is the one year follow-up. The subjects were free to go back to whatever dietary lifestyle they chose after the study. Of the 12 responders, all of them maintained the modified vegetarian diet. Of the non-responders (who had still demonstrated statistical improvement), half were still following the diet of the trial. Those categorized as responders were still maintaining significant improvement compared to the other two groups.

The clinical study demonstrated strong research methods. Patients were randomized, the study was single-blinded, multiple follow up measurements were taken, and a post-study measurements a year later. There was a sufficiently large sample size and the control and test groups were statistically similar at baseline. Other factors make this a valuable study. Compliance was maintained through demonstrating the value of being complaint. Subjects initially fasted, giving them subjective symptom relief prior to beginning a demanding and restrictive diet. This strategy seems to have been appropriate, as compliance to completion was

100% and of the responders, there was 100% compliance with the diet for a year after the conclusion of the study with no support or encouragement from the researchers.

This trial is the first to show laboratory and clinical improvements in less than six months. While the author does not discuss this point, it is possible that the beginning with fasting before moving to vegan played a role. As previously discussed, fasting has been demonstrated to cause significant improvement in the expression of RA in patients, but the effects do not last beyond the fast. By following up with the vegan diet, the ameliorating effects may have been greater than a vegan diet alone. Similarly, while the dramatic improvements in symptoms, clinical findings, and laboratory result happened during the vegan diet stage, those improvements were maintained throughout the modified vegetarian stage of the intervention. This may demonstrate that when treating rheumatoid arthritis with dietary intervention, it is best to begin with the most restrictive, and then to get less restrictive as time goes on, adding in foods that do not seem to worsen symptoms. This would create a personalized diet that is easier to maintain compliance to, but access the demonstrated benefits of restriction diets, such as vegan and fasts. The author has also given a good plan for creating a personalized diet without burdening clinicians to customize for every patient. The patient can be left to modify under certain guidelines, paying close attention to reactions as individual foods are added on a timeline.

Overall, this study demonstrates the most compelling evidence for a vegetarian style diet in the treatment of rheumatoid arthritis. This study also gives a pattern for clinicians to incorporate dietarian plans for their patients with RA.

CONCLUSION:

While anecdotal reports are plentiful and case studies are frequent, reporting the usefulness of a vegetarian diet for the management or even amelioration of rheumatoid arthritis, clinical studies are few. Even rarer are studies that properly employ rigorous methodological techniques of randomization, blinding, and controlled. Four clinical trials were reviewed in this paper, all of which were single blinded, and three were controlled and randomized. The four was included for its value of demonstrating the use of dietary intervention in a practical clinical setting. All four trials began with the hypothesis that a vegetarian diet would have a positive impact on rheumatoid arthritis. All the trials concluded that their hypothesis was supported by the trial.

From these trials, the hypothesis that the symptoms of rheumatoid arthritis can be decreased through diet seems supported. All trials found that the subjective symptoms and complaints in regard to the disease were improved, typically in as little as four weeks. Neither of the short term trials demonstrated significant improvement in laboratory or objective disease markers. However, both trials that lasted a year or longer did demonstrate improvement in objective, clinical disease markers, such as a decrease in CRP in the blood and a decrease in the both number and degree of swollen joints. This seems to suggest that subjective complaints can be treated in as little as a month, while objective measures take longer, perhaps six or nine months or longer. Only one study used radiographs as a measure in the trial, and within one year, the progression of disease based on joint erosion was no different from the control group. It remains unknown whether joint erosion requires a longer period of dietary modification, or if erosion is unaffected by dietary intervention.

The four diets in the trials were all distinct from each other. One was a very-low fat vegan diet that included cereal grains, one was an uncooked vegan diet supplemented with

fermented drinks, one was a vegan gluten-free diet, and the last was a vegan diet that evolved into a personalized vegetarian diet. It appears that, while all the diets were helpful, the personalized diet provides patients with the greatest freedom of food choices while still maintaining the benefits of the diet. Not all patients need a strict vegan diet, and foods can be added through slowing adding in and watching for reactions. Fermentation was a specific problem, with as many as half having adverse reactions. This diet was effective in the treatment of RA symptoms, however, for those subjects who could manage the diet. Compounded the issue is the clinical trial of Skoldstam et al, demonstrating subjective benefit of RA patients by using a Mediterranean diet.[43] The commonality of all of these diets is the avoidance of red meat and the reliance on an abundance of vegetables. This would seem to suggest that a vegetable-rich diet is crucial and other food products avoidance or inclusion should be based on patient preference and reaction, not on sweeping generalizations.

More research does need to be done, particularly comparing dietary interventions (vegan, vegetarian, Mediterranean), and testing the hypothesis about the changes in gut microflora versus the intrinsic health benefits of vegetables as the sources of the benefit of the diet. Larger studies should also be performed with a greater ethnic cross-section to explore any regional or racial differences. Lastly, more research is needed to determine if there is any long-term benefit from the diet, or if the diet must be continually maintained, which seems more likely.

The evidence seems sufficient for clinicians to recommend a vegetarian diet to patients suffering from RA. The minimal side effects compared to the clinical benefit justify this position. Patients should be advised that to gain more than subjective relief, that diet must be maintained for several months, and that diet does not represent a cure, but a decrease in the symptoms and, in some cases, the progression of the disease.

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