

The impact of nutrition and generally available products such as nicotine and alcohol on rheumatoid arthritis – review of the literature

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Abstract

Nutrition habits and diet may influence disease development and course. There are no specific recommendations related to rheumatic diseases for a diet that would facilitate treatment. However, some research results suggest that various nutrients may affect the health of patients, especially in the case of inflammatory rheumatic disease such as rheumatoid arthritis (RA). Scientists have been trying to find a relation between inflammatory rheumatic diseases and diet but have never come up with any firm conclusions that would help in determining the model of a diet for such patients. Nevertheless, there are some consistent results that refer to the influence of nutritional behaviours on symptoms of RA. The article presents a review of the research showing that certain nutrients may be beneficial for the course of disease among some RA patients.

Key words: rheumatic diseases, diet, nutrients, smoking, alcohol.

Introduction

There is no diet dedicated to rheumatic patients as is the case with other disorders such as diabetes or cardio-vascular disorders. Many diseases in rheumatology have one common denominator, which is the inflammatory processes taking place in the human body. Unpredictability in the course of inflammatory rheumatic diseases is another difficulty in daily life and treatment: there are periods of deterioration in symptoms or remissions.

Hippocrates asserted a long time ago that proper nutrition may reduce symptoms of a disease: “let food be thy medicine and medicine be thy food”. The phrase has been present in many papers for years although Hippocrates’s authorship is not so certain. Nevertheless, it is unquestionable that nutrition was an important part of human health used to fight diseases even in ancient times [1].

Facilitating treatment of rheumatoid arthritis (RA) through appropriate nutrition was a subject of interest for physicians and scientists in the 1920s and 1930s.

In the “Generic and Specific Influences of Nutrition in the Total Support of Arthritics” paper published in 1942 the authors Ralph Pemberton and C. Wesler Scull said that an active intervention must proceed against all destructive influences within a body: physical fatigue, anaemia, nervous or endocrine imbalance, faulty nutrition, postural defects, and focal infection. The authors asserted that proper nutrition should be an element of therapeutic programmes for people with inflammatory arthritis. Recommendations for a diet rich in proteins with reasonable amounts of fats and limited amounts of carbohydrates were based on results of research conducted in 1930 [2].

The discovery of antibiotics (penicillin, Alexander Fleming 1928) and its universal application as an effective and fast-acting medication against many diseases reduced interest of physicians, researchers, and patients in the associations between diet and symptoms of diseases. The issue of diets dedicated to inflammatory rheumatic diseases and other disorders captured the

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public's attention again in the 1980s and 1990s. It was discovered that there are certain benefits of changing nutritional habits for the treatment of inflammatory rheumatic diseases, particularly RA. They were associated with starvation diet limited to consumption of water only [3–5], vegetable and fruit juices [6–9], lactovegetarian diet (meat free, dairy consumption) [7, 9, 10], vegan diet (only plant derived foods) [10–16], and other restrictive diets (eliminating specific nutrients) [17–20].

Researchers of the 21st century working on rheumatoid arthritis and related nutrition are mainly interested in two aspects:

- the influence of nutrition habits on incidence risk of RA in the future,
- the influence of nutrition habits on reducing symptoms of RA among patients.

In the age of the Internet, we searched the most-used database, PubMed, by using keywords such as: “nutrition”, “diet”, “vegetarian”, “vegan”, “fasting”, “rheumatoid arthritis”, “RA”, and “rheumatic diseases” as single phrases and in any connection with: “nutrition in RA” and “diet in rheumatic diseases”. We found and looked at around 200 papers published from the early 1980s to 2018 and selected ones that referred to food products, not only minerals, and rheumatic diseases. Eventually, we chose 39 mostly original papers. The research results were listed according to the food products being evaluated, and we compared conclusions. The aim of the article is to present the opinions of researchers on what products are considered to be important in increasing the risk of developing RA and those that affect the course of the disease.

Factors increasing rheumatoid arthritis incidence risk

Research papers that try to associate new cases of a disease with past behaviours usually focus on: smoking, alcohol consumption, and various nutrition habits such as using large amounts of salt, consumption of meat, and coffee or limited consumption of fruit and vegetables. The studies were conducted using different methods, which made it more difficult to compare their results. We used data from pre-existing results of population research and evaluated risk factors for RA incidence. It is essential that there is access to health registers that gather information such as prophylactic examinations and incidence of diseases.

It is possible to link pre-existing declared behaviours with RA incidence in countries that run medical registers and gather data on pro-health behaviours. We can then evaluate the influence of smoking, consumption of alcohol, coffee, or a diet on developing RA in the future. Such

studies usually include at least one non-RA person with similar demographics for each RA-patient, to establish a control group [21–24].

The consumption of the following products was used to evaluate their influence on subsequent development of RA: meat [23–26], fish [21], coffee and tea [27–29], dairy [5, 15, 24], fruit and vegetables [24], olive oil, and alcohol [22, 30]. Some studies on food products also focused on nutrition ingredients such as omega-3 acids, vitamins, and macro- and microelements [23, 25].

The studies conducted in different centres have not provided any consistent results about the influence of specific products on the development and course of RA. If the results are not contradictory and present positive influence or its lack, then we may assume that the evaluated product does not increase the risk of RA. If RA is already developed, we assume that it does not deteriorate its symptoms. Such results referred to research on consumption of: fish, fruit and vegetables, olive oil, and alcohol [21, 22, 24, 30, 31].

Based on earlier studies of eastern populations, Chinese researchers conducted a cross-sectional multicentre study in 2012–2013 to investigate associations between dietary intake and risk of RA. Study participants included patients diagnosed with RA and healthy volunteers.

The results indicated that among the Chinese population, higher intake of carbohydrates and lower intake of dairy products, mushrooms, and citrus fruits may be associated with a risk of RA development [24].

Alcohol

The 2009 the Swedish EIRA study (Epidemiological Investigation of Rheumatoid Arthritis) and the Danish CACORA study (Case-Control Study on Rheumatoid Arthritis) proved that limited amounts of alcohol decrease the risk of RA incidence. Both studies compared consumption of alcohol among RA patients against a control group of non-RA patients matched according to age, gender, and place of residence. The respondents were asked to evaluate their average weekly consumption of alcohol with the number of drinks consumed. One drink equalled 16 grams of alcohol. Then the respondents were divided into four groups: non-drinking, low alcohol consumption (lower or equal to the median), moderate consumption (above the median but lower than 75th centile), and high consumption (over 75th centile). Both groups were also genetically tested for the presence of HLA-DRB1 allele that increases predisposition for RA development [21, 30].

There was another Swedish study conducted in 2003–2009 with results published in 2012, which used data from the register of mammogram examinations and the register of RA patients. It included women born be-

tween 1914 and 1948, who took part in two surveys about alcohol consumption in 1987 and 1997. It defined a glass of alcoholic beverage equal to 15 grams of alcohol weekly (one drink equalled 500 ml of beer, 150 ml of wine, or 50 ml of liqueur) as a measure of alcohol consumption. The results indicated that consuming at least three drinks a week over a period of at least 10 years lowers the risk of RA incidence by half compared with non-drinkers [30].

Coffee and tea

Studies on coffee consumption brought inconsistent results, especially on decaffeinated coffee, either confirming a relation with RA incidence or its lack [27–29]. The Iowa Women's Health Study (IWHS) evaluated the influence of caffeinated coffee, decaffeinated coffee, and tea consumption on the health of women with seropositive and seronegative RA [28]. The participants declared consumption of decaffeinated coffee, caffeinated coffee, and tea using the number of cups as a measure. The results indicated an increased risk of developing seropositive RA in the case of women drinking at least four cups of decaffeinated coffee a day. A similar amount of tea decreased the risk [28]. A study from Finland found a positive correlation between increased consumption of coffee and increased risk of seropositive RA incidence; however, no such relation was found in the case of seronegative RA [27]. The Nurses' Health Study (NHS), which referred to previous studies, evaluated the relation between coffee consumption and RA incidence. No relation was found [29].

Meat and meat products

Studies on how meat consumption influences RA have given inconsistent results [23–26, 31]. The NHS examined the influence of plant-based proteins, animal proteins, and iron. The respondents declared their nutrition habits until the moment of first RA symptoms. No significant correlations were found between various amounts of meat and iron consumption and RA incidence [25]. The results of the European Prospective Investigation of Cancer in Norfolk (EPIC) showed that higher consumption of proteins, regardless of their origin, fosters inflammatory processes. Individuals consuming the highest amounts of meat (over 87.8 g/daily) had more than a doubled risk of developing an inflammatory rheumatic disease [23].

Sodium intake

In 2015 researchers from Umeå University in Sweden presented results suggesting that a diet rich in sodium coupled with smoking increases the risk of RA incidence. The study divided participants in three groups:

smokers, ex-smokers, and non-smokers. Then they were divided into tertiles according to daily consumption of salt and the median for each tertile: low consumption – 1.51 g/daily, average – 1.88 g/daily, and high – 2.15 g/daily. Smokers and ex-smokers were qualified to the smokers' group. Thus, six groups were analysed: smokers and non-smokers within three different levels of sodium consumption. The amount of sodium consumed was calculated according to the declared consumption of meals in which salt was used. The study revealed that smoking together with high sodium consumption increases risk of developing RA [32].

The results of the study led to the conclusion that all products containing proteins (especially animal proteins) as well as arachidonic acid, salty fish, and cereal have the greatest influence on risk of developing RA.

Mediterranean diet

The interest in the Mediterranean diet as optimum nutrition for RA patients stemmed from the effect that it had on cardiovascular diseases. Studies on its positive impact on lowering incidence of cardiovascular diseases have been conducted since the 1960s. Some of the results include the pyramid of healthy nutrition based on the Mediterranean diet. Nowadays, the diet of Mediterranean region residents includes greater quantities of meat, and it is believed that the diet of Crete residents is the closest to the former model Mediterranean diet. The NHS (Nurses' Health Study) conducted in the United States in 1980–2008 and 1991–2009 aimed to find links between the Cretan Mediterranean diet and RA incidence among US female residents. The results were published in 2015. There were no statistically significant indications that a Mediterranean diet, considered a nutrition model, lowered the risk of RA incidence. Only a moderate alcohol consumption (5–9.9 g/daily) lowered the risk, whereas increased consumption of legumes increased the risk [33].

The impact of diet on disease symptoms

When the EULAR (European League Against Rheumatism) recommendations for treatment of early RA were being worked out, nine out of 14 participating rheumatologists were busy with issues of nutrition for RA. None of the existing studies has unequivocally proved an advantageous influence of specific diets on the course of the disease. The diversity of research in terms of assumptions, organisation, and its limited number were the reasons. However, it was observed that a vegetarian diet has positive influence on clinical variables, pain, and disease activity indicators. The recommendation for non-pharmacological support of RA treatment (Recom-

mentation 11) says that there is not enough evidence to conclude that a vegetarian diet has an advantageous influence on the course of RA. However, physical activity is recommended [34].

A distinctive feature of the existing studies conducted among RA patients is the diverse influence of consumption of specific products on the development of seropositive (with RF rheumatoid factor) and seronegative (without rheumatoid factor) types and in the presence or absence of ACPA antibodies. Studies divide RA patients according to the presence of rheumatoid factor or ACPA antibodies. Usually, if there are differences in how consumed products influence the development of RA, they usually refer to patients with a rheumatoid factor and ACPA antibodies. In the case of RA patients without RF and ACPA antibodies, the influence of examined nutrients is not observed [21, 22, 28, 29].

Studies on how nutrition may influence a disease course usually assume a specific diet over time for one participant and recruiting another participant with similar qualities, who keeps using a traditional diet, to establish a control group. Usually, the influence of restrictive diets is examined (e.g. vegetarian or vegan diet) or diets considered as healthy (such as the Mediterranean diet).

The authors of the Brigham RA Sequential Study mailed a survey to 300 subjects from a single-centre RA registry asking about consumption of 20 foods that make their RA symptoms better, worse, or unchanged. Almost a quarter of them replied saying that foods do affect their RA symptoms. Out of the 20 products listed, blueberries and spinach were most often reported to improve RA symptoms, while soda with sugar and desserts were most often reported to worsen it [35].

A survey from Poland conducted in 2012 found that rheumatic disease was affected by diet among 60% of respondents. However, only 10–39% of them confirmed this in the case of specific food groups listed in the survey, with groats (39% of respondents) and oily fish (32%) being assigned a positive influence most often. The respondents declared that they felt worse only after consuming alcohol (47%) [36].

A literature review provides information about the influence of various types of vegetarian diets on symptoms of rheumatoid arthritis (RA) and other rheumatic diseases [9, 10, 14]. However, there are numerous methodological issues related to them: small sample size, short observation period, lack of a blind sample, and a large percentage of withdrawals from participants. The essential element of a vegetarian diet is elimination of certain animal source foods; however, different types of vegetarian diets eliminate different elements. For instance, a lactovegetarian diet includes dairy while a lacto-ovo vegetarian also eats eggs, and a pescovegetarian di-

ets also adds fish. The most restrictive diet is veganism, which excludes all animal source foods (including milk and honey) [37–39]. It is believed that a starvation diet for 7–10 days induces anti-inflammatory effects. Starvation is recommended prior to going on a vegetarian diet [3, 4, 6–10, 16]. Recent research has revealed the benefits of starvation for an organism as a result of the cells' adaptive behaviour, which lowers the activity of inflammatory factors and optimises energy consumption [38].

However, the results of a Swedish study from 2002 indicate that a Mediterranean diet reduces disease symptoms. It included examination of 26 RA patients that were on a three-month Mediterranean diet and a group of 27 RA patients on their unchanged, regular diet. Both groups were evaluated for disease symptoms [40, 41].

The TOMORROW (Total management of risk factors in rheumatoid arthritis patients to lower morbidity and mortality) study being conducted in Japan since 2010 (planned until 2020) is attempting to identify the key elements of the Mediterranean diet responsible for improving RA symptoms. The already published part of the study included 208 RA patients and 205 healthy controls matched according to age and gender. The activity of a disease was measured with DAS-28 (assessment of 28 joints and ESR). The authors have concluded so far that daily consumption of monounsaturated fatty acids (part of a Mediterranean diet) may be responsible for improving RA symptoms [42].

Diets were also assessed in terms of their influence on risk of RA incidence, but no correlations were identified [32].

The researchers used different methods to minimise deviations among participants. They included ready-to-eat meals delivered to the home and a periodic stay in a resort serving food according to a specific nutrition program [10, 13].

The study conducted in Helsinki lasted three months and included 43 participants who were subjected to ambulatory treatment. Half of them had a special nutrition plan developed by a dietician while the control group's diet did not change. Despite the fact that participants from the first group had their meals delivered, as many as 10 out of 22 did not comply with the nutrition guidelines that were assumed by researchers [13].

A study from Norway that aimed to evaluate the influence of starvation and a vegetarian diet on RA patients included 53 RA patients – 27 in the experimental group and 26 in the control group. Both groups spent four weeks of the experiment in centres where they consumed either vegetarian or traditional meals. During the following 3.5 months the experimental group members were on a gluten-free vegan diet by themselves and then on a lacto-ovo vegetarian diet (no meat with eggs and dairy allowed).

The certainty about following the diet was limited only to the first four weeks spent in centres. The control tools during the remaining time of the experiment were limited to phone calls, taking notes, and ordering lab tests. A reduction in disease symptoms was observed among 44% of vegetarian diet followers. Return to a regular diet aggravated symptoms among 37% of respondents with RA. The results were published in 1991 [10].

A study from India, which tried to examine the influence of selected food products on disease symptoms, included 27 RA patients who did not use any medications aimed at affecting the course of disease. After a two-week diet excluding legumes, grains, milk, and plant proteins only 14 participants remained in the experiment. After another 10 months only three participants were still on the diet. Unlike other research, this study was not based on a restrictive diet but rather on adding products to a diet after cleansing the body. The initial diet that included vegetables, fruit, sugar, and refined oil was enhanced after two weeks by legumes and then by wheat or rice followed by dairy and then animal-sourced foods at the end: eggs, meat, and fish. The results revealed that patients do react to such modifications, but their reaction is different to different products. Out

of 14 participants 10 (71%) experienced reduction in disease symptoms. The results were published in 1988 [11].

The tables present research results referring to nutrition and described in this paper. Table I lists studies and factors that were evaluated and their influence on RA incidence. The population studies with large samples indicate that the RA prevalence rate is less than 1% among registered patients. This is consistent with the estimations from the World Health Organisation (WHO) [43]. Table II lists studies and the influence of diets on disease symptoms. Such studies were usually done at the end of the twentieth century, whereas the incidence rate of RA was usually a subject of research in the 21st century. Both tables exclude literature reviews [8, 12, 31, 34, 39], studies that included only a few participants and may be considered more like case studies [5, 6, 9, 14, 16, 20], and studies that evaluated effects of nutritional manipulation [11, 17, 18].

Conclusions

The reviewed studies that evaluated the influence of different diets and food products on increased RA incidence risk or, in the case of RA patients, on disease course and symptoms do not provide unequivocal answers to the question about recommended nutrition for RA patients.

Table I. Factors increasing the risk of developing rheumatoid arthritis

Study/Products	Publication year	Number of participants	Meat products	Fish	Coffee	Tea	Alcohol	Salt (sodium)
Sundstroem B, Johansson I, Rantapaa-Dahlqvist S [32]	2015	386	n/a	n/a	n/a	n/a	n/a	0/+ ¹
Hu Y, Costenbader KH, Gao X, et al. [33]	2015	174,638	n/a	n/a	n/a	n/a	–	n/a
Di Giuseppe D, Alfredsson L, Bottai M, et al. [30]	2012	34,141	n/a	n/a	n/a	n/a	–	n/a
Rosell M, Wesley AM, Rydin K, et al. [21]	2009	2,145	n/a	–/0 ²	n/a	n/a	n/a	n/a
Kallberg H, Jacobsen S, Bengtsson C, et al. [22]	2009	1,648	n/a	n/a	n/a	n/a	–	n/a
Benito-Garcia E, Feskanich D, Hu BF, et al. [25]	2007	82,063	0	n/a	n/a	n/a	n/a	n/a
Pattison DJ, Symmons DP, Lunt M, et al. [23]	2004	176	+	n/a	n/a	n/a	n/a	n/a
Karlson EW, Mandl LA, Aweh GN, et al. [29]	2003	83,124	n/a	n/a	– ³	–	n/a	n/a
Mikuls TR, Cerhan JR, Criswell LA, et al. [28]	2002	31,336	n/a	n/a	+ ⁴	–	n/a	n/a
Grant WB [26]	2000	x ⁵	+	n/a	n/a	n/a	n/a	n/a
Heliovaara M, Aho K, Knekt P, et al. [27]	2000	18,981	n/a	n/a	+	n/a	n/a	n/a

Source: authors' statement based on literature

n/a – not available; + increasing risk; – decreasing risk; 0 – not influence

¹Together with high consumption among smokers

²Seropositive RA/seronegative RA

³Caffeinated and decaffeinated coffee

⁴Only decaffeinated coffee

⁵Comparison of nutrition patterns in 15 countries

Table II. Influence of type of diet on the health status of people living with rheumatoid arthritis

Study/Type of diet	Publication year	Number of participants	Study with control group	Mediterranean diet	Vegetarian diet	Vegan diet	Elementary diet	Periodical starvations
Matsumoto Y, Sugioka Y, Tada M, et al. [42]	2018	208	Yes	+	n/a	n/a	n/a	n/a
Sköldstam L, Hagfors L, Johansson G [41]	2003	26	Yes	+	n/a	n/a	n/a	n/a
McDougall J, Bruce B, Spiller G, et al. [38]	2002	24	No	n/a	n/a	+	n/a	n/a
Nenonen MT, Helve TA, Rauma AL, et al. [13]	1998	22	Yes	n/a	n/a	+	n/a	+
Kavanaghi R, Workman E, Nash P, et al. [19]	1995	24	Yes	n/a	n/a	n/a	+	n/a
Kjeldsen-Kragh J, Haugen M, Borchgrevink CF, et al. [10]	1991	27	Yes	n/a	+	n/a	n/a	+
Hafstrom I, Ringertz B, Gyllenhammar H, et al. [3]	1988	14	Yes	n/a	n/a	n/a	n/a	+
Skoldstam L, Larsson L, Lindstrom F [7]	1979	16	Yes	n/a	0	n/a	n/a	+

Source: authors' statement based on literature

n/a – not available; + positive influence; – negative influence (exacerbation of symptoms); 0 – without influence

The results indicate that moderate alcohol consumption lowers the risk of RA or reduces its symptoms. Attention should be paid to the European Society for Clinical Nutrition and Metabolism (ESPEN) recommendations appearing in the following years, which contain nutritional recommendations for chronic diseases such as: inflammatory bowel disease, lung diseases, or nutrition of the elderly or in the intensive care unit and others. ESPEN recommendations may also be a guide to dealing with patients with rheumatic diseases, including rheumatism [44].

Some studies analysed in the article suggest reducing consumption of carbohydrates (sugars) and proteins, especially ones of animal origin. The existing studies fail to deliver unequivocal results that would make it possible to define a diet recommended for RA patients. It is indicated though that consumption of fish, fruit, vegetables, and olive oil may help in reducing disease symptoms. The inconsistent results of research leave patients only with an ability to observe themselves and their reaction to different food products.

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