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# Astaxanthin for Rheumatic Diseases: A Systematic Review

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**Abstract** Astaxanthin, a xanthophyll carotenoid, is an abundant carotenoid in marine organisms and a very potent natural compound with remarkable anti-inflammatory and antioxidant activity. Rheumatic diseases are inflammatory conditions with excessive oxidative stress. Since non-pharmacological therapy is expanding and natural ingredients are gradually introduced to the therapeutic argumentum of rheumatic diseases, astaxanthin might be a potential candidate. A systematic review on the topic disclosed only one study with some beneficial effects on Sjogren's syndrome. Supplementation with Ast might represent a good candidate to evaluate. Further studies on Astaxanthin are highly needed.

***Keywords:*** *astaxanthin, rheumatic diseases, anti-inflammatory, anti-oxidative*

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## 1. Introduction

Astaxanthin (Ast) is a reddish-orange compound that belongs to the carotenoid family, which is widely found in fishes such as sea bream and salmon and crustaceans such as crab and shrimp. An essential function of carotenoids such as Ast is to intercept the chlorophyll triplet state to prevent the formation of singlet oxygen or quench the singlet oxygen molecule directly [1,2]. Called the "king of Ketocarotenoids) [2], and being a member of the xanthophyll family as an oxygenated derivative of carotenoids, it can be extracted from lycopene-reach plant extracts.

In recent years, the potent antioxidant and anti-inflammatory actions of Ast have been implicated in preventive mechanisms for many disorders, such as endometriosis, fatigue, and dyslipidemia, but also for Parkinson's disease and cancer, and other diseases [3,4,5].

Considering that rheumatic diseases are inflammatory with excessive reactive oxygen species load [6,7], also linked to significant fatigue and dyslipidemia [8,9], it is fair to assume that Ast may have a role in rheumatic disorders.

## 2. Material and Methods

A thorough literature search in PubMed, Scielo, and LILACS without any lingual restriction to language was performed, spanning the period between January 1965 to April 2023. The following MeSH entry terms were used: "astaxanthin" AND "rheumatic" OR "rheumatologic" OR "systemic lupus erythematosus" OR "lupus" OR "fibromyalgia" OR "rheumatoid arthritis" OR "spondyloarthritis" OR "Sjögren's syndrome" OR "myositis" OR "systemic sclerosis" OR "vasculitis" OR "Takayasu disease" OR "Wegener's disease" OR "granulomatosis with polyangiitis" OR "Kawasaki's disease" OR "polyarteritis nodosa" OR "Livedoid vasculitis" OR Churg-Strauss" OR "eosinophilic granulomatosis with polyangiitis" OR "osteoarthritis" OR "gout" were used. The reference lists of the selected articles were analyzed to identify additional publications. Initially, two authors (JFC, Al) performed the literature search and independently selected the study abstracts. In the second stage, the same authors independently read the full-text articles selected by abstracts. PRISMA guidelines were followed [10].

## 3. Results

Only one paper fulfilled the inclusion criteria of the present systematic review after scrutinizing titles and abstracts [11]. In that article, Yamada et al. [11], evaluated the reactive oxygen species scavenging capacity of Ast on three models.

1. Human salivary gland epithelial cell line (HSY),
2. Salivary secretion in a mouse model of irradiation-induced salivary gland dysfunction, and
3. Ast supplementation, 12mg/day in 6 patients with Sjogren's syndrome for 2 weeks. Ast partially

suppressed oxidative stress in HSY cells.

In the mouse model, suppression of irradiation-induced hyposalivation was observed. Ast supplementation increased salivary output in both the Sjogren's syndrome and control groups. hexanoyl-lysine, an oxidative stress marker, was reduced after Ast intake, in the patients' saliva. The authors concluded that Ast might act as a reactive oxygen species scavenger, providing benefits to Sjogren's syndrome patients with impaired salivary secretion.

## 4. Discussion

Sjogren's syndrome is an inflammatory oxidative rheumatic condition [12], whereby Ast consumption was suggested to benefit the patients. The results of Yamada et al. [11] are encouraging, but, Ast was evaluated only in Sjogren's syndrome, and the study can't be extrapolated to another rheumatic entity. The strengths of the current study are, 1. utilization of international criteria for rheumatic disorders; 2. inclusion of all research on Ast in rheumatic conditions; 3. conducting a thorough literature search.

Taking into account the potential beneficial effects of Ast [3,4,5], (Figure 1) and the paucity of well-designed clinical trials, there is an urgent need for future research on the effects of Ast on rheumatic disorders. Nutritional interventions, to alleviate inflammation, oxidative stress and pains in rheumatic disease, are actually expanding [13,14,15,16,17,18,19,20]. Supplementation with Ast might represent a good candidate to evaluate.

In conclusion, only one study was found, demonstrating some benefit of Ast in Sjögren's syndrome patients. Further exploration of Ast supplementation in rheumatic disease is highly needed.

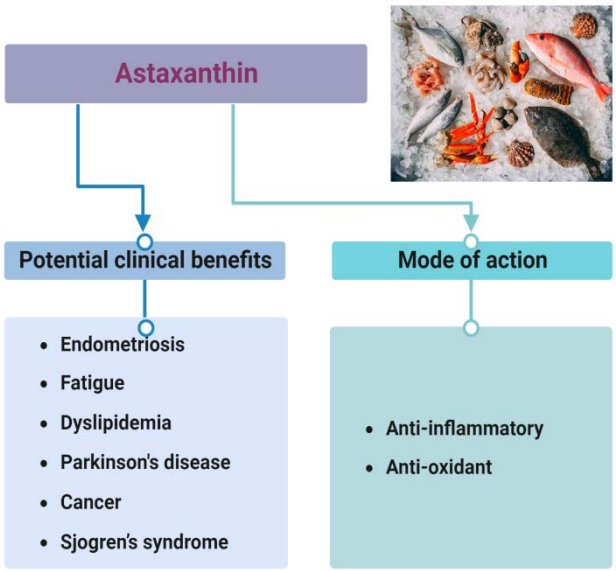


**Figure 1.** Potential clinical effects and mode of action of astaxanthin

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## Author's Contributions

JFC, AL: screened the literature, designed and wrote the manuscript, CB: screened the literature, and edited the manuscript. The three authors agreed to the published version of the manuscript.

## Disclosure of Interest

The author has no conflicts of interest to declare.

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