

DIETARY CAPSAICIN AND IMMUNE SYSTEM

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Abstract

Capsaicin is a chemical compound that was initially isolated from chili peppers in a crystalline form. It was discovered that capsaicin caused a burning sensation in the mucous membranes of the oral cavity and the gastrointestinal tract. In addition, it increases the secretion of gastric acid and stimulates the nerve endings in the skin. Hot foods, such as peppers and sauces, contain an ingredient called capsaicin. Capsaicin can be a very effective pain reliever and is even used topically for neuropathy pain. Hot peppers can boost your immune system, helping to ward off germs that can cause illness. Capsaicin is an active component of the immune system modulation and is an essential component of chilli peppers. They have also shown beneficial properties on organs in maintaining their health and condition. Studies on capsaicin's / chilli peppers efficacy in modulation of immune system, its anti-inflammatory properties, maintaining organ health, anti - carcinogen effects are collected and analysed. Besides having anticarcinogenic properties and killing tumor cells, capsaicin has been identified to have immune-modulating properties, being able to activate DCs through vanilloid receptor 1 (VR1). Previous studies showing its role in immunity, immune responses, reducing insulin spikes in diabetes are focused on. The mechanism of action of capsaicin on the human immune system discussed. Study concludes by providing knowledge regarding the potential of capsaicin and its sale as a potent immune booster.

Key words: dietary capsaicin, immune system, chilli peppers, health benefits, organ junction, chemopreventive function.

Introduction

Fixed prosthodontic treatment deals with the replacement of teeth by artificial substitutes that are not readily removable from the mouth. Its focus is to restore function, esthetics and comfort[1]The fixed partial denture (FPD) is one of the most commonly preferred treatment options for a single missing tooth.[2] FPDs were considered to be the best treatment choice for replacing a single missing tooth[3] Fixed prosthodontics treatment can range from the restoration of a single tooth to rehabilitation [4]

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The chilli pepper had already acquired a long history of use for medical, culinary and military purposes in Central and South America when Columbus got it to Europe in the 15th Century. It is a native plant in the Western hemisphere. These plants of the genus capsicum belong to the solanaceae family. The most widely adopted family of plants to come from the western hemisphere, it includes tomato, potato and tobacco plants. [1,2]. The pungent principle of chilli peppers is a mixture of closely related compounds called capsinoids. The chief among these compounds is the capsaicin, which is known by the Chemical name N-4 - hydroxy - 3-methoxyphenyl - 8 methyl - 6 - nonamide. The compounds are responsible for the heat-generation action. [3]. There is a wide range of "heat-associated with the species and rarities of capsicum. The biological benefits of capsaicin are related to its interactions with cutaneous neural receptors. The "hot" sensation while eating chillies arises because of the interaction of the capsaicin with the nociceptors surrounding the taste sensors of the mouth. It has been suggested that the attraction to foods containing capsaicin on other pain inflicting compounds results in the release of endorphins when the pain sensation arises from their heat sensors. [4][5,6]. The previous studies show capsaicin effect in modulation of immune responses.. Studies by Yu. R et al showing the overall health benefits of dietary capsaicin. The capacity of dietary capsaicin four dietary Strategies to improve health has increased. Similar studies by R Clark (2016) elaborates on the anticancer properties of capsaicin which acts potentially against human cancer. Another study by Berk T in 2000 focuses on the hot peppers and its content of vitamin A and Vitamin C which helps in boosting the immune system effectively and helps to ward off germs causing illness. It has also shown significant benefits in dealing congestion and phlegm. Similar studies by Singletary explain the various dietary sources of capsaicin containing foods and explain the properties and mechanism to various benefits offered. [7-9]. Capsaicin has known to reduce risks of organ dysfunction and keep a healthy body - functional state. Dietary capsaicin Shows significant features to enhance and boost the immune system. It also showed a potential factor to improve cardiac health, It has also been suggested of its analgesic, antipyretic and anti-inflammatory properties. [10]

The perspective that needs to be considered is that it can cause irritation to the mouth, stomach, intestines, some people may develop vomiting, diarrhoea and coughing. These are the observed effects due to excess capsaicin incorporated. Study by AMBode (2011) elaborates on the two faces of capsaicin showing the harmful effects pertaining to the negative face. It was shown to induce nausea, abdominal pain and in extreme cases even death. Considering the serious harmful effects it can cause, it has been found that the minimal lethal dose of capsaicin is 100 milligrams / kg body weight. It also has the capacity of reducing the density of epidermal nerve fibres in a reversible fashion, hence it has effects on muscles as well. Exposure of capsaicin to the eye produces tearing, pain, conjunctivitis and blepharospasm.[11]. The study focuses on the various health benefits offered by capsaicin and its role in modulation of the immune system. The study elaborates on its anti-inflammatory property, organ benefits and immune system. On analysing the various nutritional benefits of capsaicin, it is known to have the potential to reduce oxidative stress, which is a major factor behind a weak immune system. It is concluded that the phytochemical present can strengthen your immune system and immune cells to effectively fight against pathogens. Consuming a controlled substance, peppers included in daily intake can maintain overall health. [12]. The study aims at the array of health benefits by capsaicin and maintaining a healthy body.

Materials and methods

The study includes a detailed analysis of review and literature of about 33 articles emphasising on the sources of capsaicin, ingestion effects, health benefits, immune boosting capacity of capsaicin, quantity of capsaicin for potential benefits and its mechanism of action. The detailed study involves the article collection from search engines including Google scholar and pubmed. The articles are chosen based on their accuracy to the factors of capsaicin boosting immune response. Articles collected are based on health benefits and immune modulating capacity. Inclusion criteria for the study includes articles collected from 1996- 2020, articles related to health benefits, uses, effects, immune system and capsaicin, sources, history, potential effects. Exclusion criteria for the study includes the articles that explain the topical uses, harmful effects on overuse, its effect on topical applications, methods to extract medicinal capsaicin, and irrelevant data.

Dietary sources of capsaicin

Capsaicin is present in peppers produced by certain pepper plants including varieties called cayenne, green or red chilli, spur or tabasco peppers. Hot peppers, and other dietary sources include bell, cherry, cone, green/red Paprika. The hot peppers are known to contain 198,000 parts per million of capsaicin. The other sources

contain about 4000 parts per million of capsaicin. [13][14][15]. Ginger also contains capsaicin but in trace amounts. The dietary capsaicin transmits pain and heat, explaining its effect on the tissues of the oral cavity. Other sources of capsaicin containing pepper include sweet peppers because they are not spicy, but they contain capsaicin. Sweet peppers are produced by a pepper plant (*capsicum annum*). Common dietary sources- chilli peppers, hot chilli, jalapeno, piri-piri, habanero peppers, pepperoni, peppers rich in carotenoids. are all excellent sources. [16,17]

Health benefits

Spicy peppers / chilli peppers containing capsaicin have been used by American Indians for thousands of years. Modern research suggests that consuming capsaicin-rich peppers may have significant health benefits. Studies suggested that capsaicin helps control diabetes and lowers the risk of type-2 diabetes [18][19]. Some studies have shown potential benefits like warding off germs, kills bacteria, anti-immune modulatory effect, antipyretic effect, improves digestion, metabolism, triggers immune response, improves gut health [20,21]. A study by European Journal of clinical Nutrition found that some men who consumed chilli peppered in accurate quantities for four weeks showed lower resting heart rate and improvement in other markers of heart function. Hence capsaicin thereby shows significant health benefits and also improves organ function. A good immune system is a sign of a healthy body, capsaicin fulfils the criteria of enhancing body function [22][23][24].

Modulation of immune system and mechanism of action

Capsaicin has been essential to our understanding of physiological and pathological processes as well as relevance of TRPV1 Channels. Pharmaceutical formulations involving or targeting the capsaicin-activated receptor TRPV1 [25]. Capsaicin causes neurogenic inflammation and has analgesic and anti-inflammatory activities. Dendritic cells, a key cell type in immune responses, have the receptor for capsaicin, and involvement of this receptor has powerful immune consequences. Capsaicin thereby triggers the immune system and reacts with the cells of the immune system to fight conditions [26,27].

Capsaicin - Efficient for chronic conditions

The diverse potential of capsaicin and its many health benefits and effects on the immune system being discussed. This chapter suggests the various chronic conditions that capsaicin is capable of treating. Some conditions include: Rheumatic diseases - rheumatoid arthritis, chronic inflammatory conditions, arthritis, gastrointestinal disorders, improves blood circulation. Capsaicin is an effective antidepressant, it lowers blood pressure, helps treat autoimmune diseases, promotes weight loss. Capsaicin containing foods are capable of lowering blood cholesterol levels, and improve blood flow [28–30][31].

Capsaicin and gut health

Chilli peppers and spicy foods are probably the last preferred foods in cases of stomach ulcer or any discomfort in the gastrointestinal tract. The medical advice for people who have digestion problems is to avoid spicy/hot foods. The actual fact being spicy foods can actually heal the lining of the stomach and slow the production of excess acid. [32][33]

In fact, researches show that eating chilli peppers may even lower the fire list of ulcers. Chills and gingers have known to reduce stomach inflammation and treat gut-related diseases. The capsaicin containing foods improve bowel movement and help in treating gut-associated diseases like irritated bowel movement, constipation, inflammatory bowel disease. [34–36][37][38]

Chemopreventive property of Capsaicin

The anti-oxidant-, anti-inflammatory and immune-modulatory effect of Capsaicin might be related to 965 Chemopreventive property. Capsaicin has bioactive phytochemical in abundance in sources of red chilli and chilli peppers.[39]. Capsaicin induces apoptosis, inhibition- migration, proliferation and invasion of tumours. [40–42][43]. Capsaicin can be beneficial for a number of cancers like lung cancers, breast cancers, stomach cancers, colorectal, cervix, prostate and breast cancers [44–46].

Future scope

The brief overview shows the potential benefits of dietary capsaicin, which would encourage the future of incorporation of capsaicin in the diet regularly with the adequate quantities to obtain the desired benefits. Many researches have been put forth to treat various diseases like Poly cystic ovarian disease[47] and breast cancer[48], infections including stye [49], leprosy [50]. It can be by enhancing its immune properties and makes it a potential dietary source, especially for people in countries where diet including capsaicin rich foods is very minimal. Personal protective equipments like mask helps in prevention of spreading airborne disease [51]

Conclusion

Capsaicin contains phytochemical that exhibit numerous characteristics including anti-inflammatory activity, if it reduces the likelihood of inflammatory conditions like asthma, chronic peptic ulcer. From the detailed analysis of studies and exports, a conclusion can be drawn that capsaicin has a significant and potent role in immune boosting property They are rich in Vitamin A and C, bioactive phytochemicals, fights pathogens and strengthens immune cells. As a healthy immune system is a sign of a healthy body, capsaicin Provides the necessary benefit.

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Author contribution:

V Sri Sreshtaa, execution of the work, data collection, drafting of manuscript. Dr Leslie Rani : Concept and design of the study, validation of the data collection, revision and proof-reading of the review. Anjaneyulu K : validation of the data collection. Dr Brundha MP : Revision and proof-reading of the review

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