Japanese Journal of Gastroenterology and Hepatology

Review Article

Anti-Inflammatory Activity of Fruit Such as Berries on the Body

Jae Gon Kim[1] and Beong Ou Lim[2*]

[1]Ahn-Gook Health, LTD., Seoul 07445, Republic of Korea

[2]Department of Integrated Biosciences, College of Biomedical & Health Science, Konkuk University, Chungju 380-701, South Korea

Received: 10 Apl 2019
Accepted: 127 Apl 2019
Published: 09 May 2019

***Corresponding to:**

Beong Ou Lim, Department of Integrated Biosciences, College of Biomedical & Health Science, Konkuk University, Chungju 380-701, South Korea, Fax: +82-43-856-3572; Tel: +82-43-840-3570; E-mail: beongou@kku.ac.kr

1. Abstract

Many people are becoming more interested in their health. Every day, to increase their resistance against many diseases (including hypertension, diabetes, and obesity) and to keep healthy, people eat nutrients in the form of vegetables and fruits. Therefore, research into extracts from many kinds of vegetables and fruits is in progress, and the anti-inflammatory, anti-aging, and antioxidant effects that occur by various mechanisms are being revealed. The study of extracts from berries is well under way. There are many kinds of berries (including blueberries, acai, aronia, and marqui berries), and they are known as the most antioxidant-rich fruits, containing anthocyanin and various vitamins. In addition to their antioxidant effects, berries are known to increase immunity, reduce eye fatigue, regenerate signal transference in brain nerve cells, and help improve memory. Herein, we focus on the anti-inflammatory effects of berries, rather than the antioxidant activity that is already widely known.

2. Keywords: Inflammation; Anti-inflammatory effects; Berries; Plant extracts

3. Introduction

Since a long time ago, people all over the world have used natural drugs to treat diseases such as hypertension, diabetes, and inflammation [1-3]. Natural drugs are ingredients extracted from plants and trees. Recently, many people have begun to care more about their health [1] and have started taking health supplements. Many companies are attempting to make nutraceuticals, which are foods made mainly of ingredients extracted from plants. These have excellent effects on the anti-cancer, anti-diabetes (type 2), anti-hypertension, and antioxidant functions of the body [4-7]. The compounds that the plants have in common are polyphenols, anthocyanin, and flavonoids. These ingredients are being studied by many researchers [1]. Traditional medical methods using plant extracts are particularly well known in the East, and these traditional medicines and treatments with plant extracts have recently become a focus of scientific and clinical interest [8].

Inflammation is characterized as a general response to tissue damage caused by various harmful stimuli from biological, chemical, or physical factors. In previous studies, inflammation has been shown to activate various signaling pathways, such as those involving the Janus-activated kinase (JAK), phosphatidylinositol-3-kinase (PI3K), and mitogen-activated protein kinase (MAPK) families, in mammalian cells [ref]. In chronic inflammation, cytokines (IL-4, IL-5), chemokines, NF-κB, signal transducer and activator of transcription 3 (STAT3), inducible nitric oxide synthase (iNOS), and the cyclooxygenase enzyme (COX) are activated. Chemical anti-inflammatory drugs are mainly effective by suppressing the preceding mechanisms [9, 10]. Plant-derived extracts work through signals similar to those of chemical anti-inflammatory drugs [10]. Recently, the search for plant-derived extracts has become a promising reality, and scientific research is proving the efficacy of these extracts. This paper describes some fruit extracts that have a working mechanism similar to those of chemicals and help prevent disease.

4. Activity of Fruit-Derived Extracts

Modern-day people are discovering and taking various nutrients and ingredients known to be good for health and to

prevent diseases. Plant-derived extracts have long been known as the secret to health and longevity in the East, because they are known to have a variety of effects (anti-oxidation, anti-inflammation, anti-aging), including inhibiting the production of reactive oxygen species (ROS), preventing aging of the skin and improving the skin's anti-wrinkle properties, and improving blood circulation [1-13]. Recently, plant-derived extracts are being used to treat and prevent various diseases [4-13]. A typical example is the extract of ginseng, the efficacy of which has been verified against cancer and as an anti-inflammatory and antioxidant agent in many studies [7, 12, 13]. Additionally, extracts of many fruits have excellent effects as antioxidants, anti-inflammatory agents, and skin improvement therapies [13]. In particular, berries, which contain a lot of anthocyanin ingredients, are the most popular fruits, and many researchers are studying them. Their benefits are well known, and many people are eating a lot of berries to benefit from the anti-aging, anti-inflammatory, and antioxidant effects [1].

Inflammation is a complex biological process that the body initiates to eliminate pathological stimuli and promote healing. If inflammation persists for a long time, inflammatory diseases can occur as a result of chronic inflammation that disrupts the metabolism and causes cell stress [10]. These diseases include allergies, inflammatory bowel disease (IBD), asthma, and autoimmune disorders [10, 11, 14, 15]. For the treatment and prevention of inflammatory diseases, many researchers are working on pre-generational research and the development of new drugs. Some researchers are trying to prevent and treat diseases by using plant extracts. Plant-derived extracts have various ingredients that can prevent and inhibit disease. The compounds in plant-derived extracts are known as natural products. They are a rich source for the discovery and development of new drugs and the development of nutrients for health [10].

Berries are well known for their antioxidant properties and effectiveness in the prevention of anti-inflammatory diseases [1]. The berries of Euterpe oleracea Mart, Aronia melanocarpa, Vaccinium angustifolium, and Vaccinium macrocarpon are said to be the best antioxidants and contain a variety of vitamins and substances called anthocyanins [16, 17, 18, 19]. These fruits can boost immunity in humans, protect against aging by oxides, and suppress cancer [1, 7]. Blueberries, which contain large amounts of anthocyanins, have excellent anti-inflammatory effects, especially for the treatment of inflammatory diseases such as IBD [9, 20, 21]. Therefore, anthocyanins have been widely recognized for their potent antioxidant properties and ability to modulate gene control and important signal delivery pathways of some inflammatory enzymes and cytokines [20, 22]. For example, key indicators of IBD are increased oxidative stress and formation of the product of the pro-inflammatory mediator, but both iNOS and COX-2 enzymes are known to have a synergistic effect on the inflammation and its severity [23]. Another signaling pathway in intercellular processes is known to be induced by the activation of NF-κB, the STAT1 [24]. As described above, if the occurrence of IBD is activated in conjunction with oxidative action, it facilitates the generation of IBD. This suggests that it causes inflammatory cells to absorb oxygen around the affected area, release ROS, and produce chemicals in the inflammatory cells to promote inflammation. As a result, transcription factors, such as NF-κB, and activators are used to induce the activity of protein-1 (AP-1), which encodes the pro-chlorinated gene and induces an increase in cytokine secretion; this process, in turn, cycles continuously, causing oxidative and inflammatory stresses [Figure 1]. Polyphenols and anthocyanins from berries play a role in preventing this repetitive signal pathway from being suppressed or generated [1, 16, 17, 18, 19].

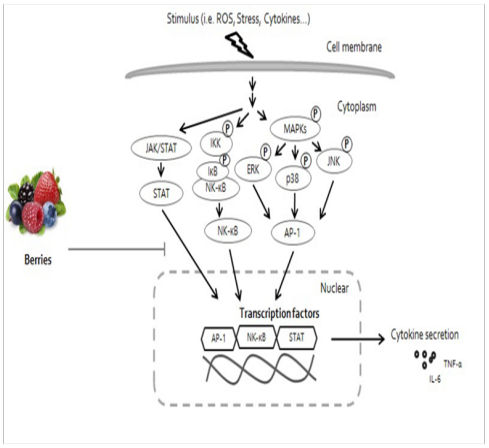

Figure 1: Intracellular signal pathway of berries.

4.1. Clinical studies of berries

A number of basic studies have been conducted by using cells and animals to determine the efficacy of berries. Many researchers are studying how to make berries easier to consume by making them into highly concentrated products that are unlike the berries themselves [1, 26].

Research involving animal and human studies is increasingly identifying the role of certain whole fruits, such as berries and pomegranates, and of bioactive polyphenols that alleviate arthritis symptoms [1, 11, 16, 17, 18, 19]. In a comparative study on the potential of antioxidants among the world's consumed fruits, extracts from berries, apples, and oranges have higher levels of antioxidants than the extracts from red grapes and oranges.

Previous studies involving a comparison of berries have shown that the effect of a phenolic compound depends on its structural characteristics and that berry extracts have a good protective effect against inflammatory conditions, such as arthritis [11]. In a study comparing USDA data, Basu et al. [11] reported that blueberries, acai, aronia, and marqui berries, and black raspberries showed higher levels of anthocyanins than dried cranberries.

5. Conclusions

This paper has briefly described the pathological activity and efficacy of some extracts from fruits. The antioxidant and anti-inflammatory effects provided by the pathological activities of well-known berry extracts have been described. Although the effectiveness of extracts from berries has been proven, there are still many fruit extracts that are not well known for their efficacy. If the extracts of various fruits are found to be effective, it will be the basis for the development of good nutrition and new drugs.

6. Acknowledgments

This work was supported by Grant (117073-3) from the Korea institute of Planning and Evalution for Technology in Food, Agriculture, and Forestry.

References

1. Joseph SV,Edirisinghe I, Burton-Freeman BM Berries. Anti-inflammatory Effects in Humans. J Agric Food Chem. 2014; 62: 3886-3903.

2. Gratchev A, Sobenin I, Orekhov A, Kzhyshkowska J. Monocytes as a diagnostic marker of cardiovascular diseases. Immunobiology. 2012; 217: 476-482.

3. Rosenberg P B. Clinical aspects of inflammation in Alzheimer's disease. Int Rev. Psychiatry. 2005; 17: 503-514.

4. Jennings A, Welch AA, Fairweather-Tait SJ, Kay C, Minihane AM, Chowienczyk, et al. Higher anthocyanin intake is associated with lower arterial stiffness and central blood pressure in women. Am. J ClinNutr. 2012; 96: 781-788.

5. Cassidy A1, Mukamal KJ, Liu L, Franz M, Eliassen AH, Rimm EB. High anthocyanin intake is associated with a reduced risk of myocardial infarction in young and middle-aged women. Circulation. 2013; 127: 188-196.

6. Wedick NM, Pan A, Cassidy A, Rimm EB, Sampson L, Rosner B, et al. Dietary flavonoid intakes and risk of type 2 diabetes in US men and women. Am J ClinNutr. 2012; 95: 925-933.

7. Cutler GJ1, Nettleton JA, Ross JA, Harnack LJ, Jacobs DR Jr, Scrafford CG, et al. Dietary flavonoid intake and risk of cancer in postmenopausal women: the Iowa Women's Health Study. Int J Cancer. 2008; 123: 664-671.

8. Robertovna GE, Alexeevich KD, Alexeevich SA, Petrovna GM, Kenzhebaevna OK. A Traditional Medicine Plant, Onopordumacanthium L. (Asteraceae): Chemical Composition and Pharmacological Research. Plants. 2019.

9. Pereira SR, Pereira R,Figueiredo I,Freitas V,Dinis TC. Almeida LM Comparison of anti-inflammatory activities of an anthocyanin-rich fraction from Portuguese blueberries (Vacciniumcorymbosum L.) and 5-aminosalicylic acid in a TNBS-induced colitis rat model. PLoS One. 2017; 12:e0174116.

10. Tan WSD, Liao W1, Zhou S1, Wong WSF2.. Is there a future for andrographolide to be an anti-inflammatory drug? Deciphering its major mechanisms of action. Biochem Pharmacol. 2017; 139: 71-81.

11. Basu A, Schell J,Scofield RH, Dietary fruits and arthritis. Food Funct. 2018; 9: 70-77.

12. Hügel HM, Jackson N, May B, Zhang AL, Xue CC. Polyphenol protection and treatment of hypertension. Phytomedicine. 2016; 23: 220-231.

13. Ghimeray AK, Jung US, Lee HY, Kim YH, Ryu EK, Chang MS. In vitro antioxidant, collagenase inhibition, and in vivo anti-wrinkle effects of combined formulation containing Punicagranatum, Ginkgo biloba, Ficuscarica, and Morusalba fruits extract. ClinCosmetInvestigDermatol. 2015; 8: 389-396.

14. Ikhsan M,Hiedayati N, Maeyama K, Nurwidya F. Nigella sativa as an anti-inflammatory agent in asthma. BMC Res Notes. 2018; 11: 744.

15. Behera JP, Mohanty B, Ramani YR, Rath B, Pradhan S. Effect of aqueous extract of Aeglemarmelos unripe fruit on inflammatory bowel disease. Indian J Pharmacol. 2012; 44: 614-618.

16. Garzón GA,Narváez-Cuenca CE,Vincken JP,Gruppen H. Polyphenolic composition and antioxidant activity of açai (Euterpeoleracea Mart.) from Colombia. Food Chem. 2017; 217: 364-372.

17. Denev P,Ciz M,Kratchanova M,Blazheva D. Black chokeberry (Aroniamelanocarpa) polyphenols reveal different antioxidant, antimicrobial and neutrophil-modulating activities. Food Chem. 2019; 284: 108-117.

18. Stote K, Corkum A, Sweeney M, Shakerley N, Kean T, Gottschall-Pass K. Postprandial Effects of Blueberry (Vaccinium angustifolium) Consumption on Glucose Metabolism, Gastrointestinal Hormone Response, and Perceived Appetite in Healthy Adults: A Randomized,

Placebo-Controlled Crossover Trial. Nutrients. Nutrients. 2019; 11(1).

19. Abeywickrama G, Debnath SC1, Ambigaipalan P, Shahidi F. Phenolics of Selected Cranberry Genotypes (Vaccinium macrocarpon Ait.) and Their Antioxidant Efficacy. J Agric Food Chem. 2016; 64: 9342-9351.

20. Huang W, Yan Z, Li D, Ma Y, Zhou J, Sui Z. Antioxidant and Anti-Inflammatory Effects of Blueberry Anthocyanins on High Glucose-Induced Human Retinal Capillary Endothelial Cells. Oxid Med Cell Longev. 2018; 2018: 1862462.

21. Wu LH, Xu ZL, Dong D, He SA, Yu H. Protective Effect of Anthocyanins Extract from Blueberry on TNBS-Induced IBD Model of Mice. Evid Based Complement Alternat Med. 2011; 2011: 525462.

22. Piberger H1, Oehme A, Hofmann C, Dreiseitel A, Sand PG, Obermeier F. Bilberries and their anthocyanins ameliorate experimental colitis. MolNutr Food Res. 2011; 55: 1724-1729.

23. Yue B, Ren YJ, Zhang JJ, Luo XP, Yu ZL, Ren GY, et al. Anti-Inflammatory Effects of Fargesin on Chemically Induced Inflammatory Bowel Disease in Mice. Molecules. 2018; 23: E1380.

24. Shi L, Lin Q, Li X, Nie Y, Sun S, Deng X, et al. a garlic organosulfur compound, ameliorates gut inflammation through MAPK-NF-κB/AP-1/STAT-1 inactivation and PPAR-γ activation. MolNutr Food Res. 2017; 61.

25. Qomaladewi NP, Aziz N, Kim MY, Cho JY. Piper cubeba L. Methanol Extract Has Anti-Inflammatory Activity Targeting Src/Syk via NF-κB Inhibition. Evid Based Complement Alternat Med. 2019; 2019: 1548125.

26. Del Bo' C, Martini D, Porrini M, Klimis-Zacas D, Riso P. Berries and oxidative stress markers: an overview of human intervention studies. Food Funct. 2015; 6: 2890-2917.