ISSN: 2573-962X

Review Article

Journal of Pharmaceutical Research

Phytochemicals and Medicinal Uses of Red Raspberry: A Review

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Submitted: 22 Apr 2020; **Accepted:** 02 May 2020; **Published:** 11 May 2020

Abstract

In western countries, Red Raspberry is the most common fruit used for its medicinal and therapeutic activity. Red raspberries are the good sources of antioxidant polyphenols which have wonderful preventive action against chronic diseases. Ellagitannins and anthocyanins are the most important polyphenolic components of raspberries that have most effective anti-oxidant action. Besides secondary metabolites i.e. phytochemical in the form of polyphenols, Red Raspberries also have presence of various crucial micronutrients like fibers, vitamin C and potassium. Although literature shows very few human studies, we review and summarize some available writings that clarify the potential health benefits and antioxidant action of major polyphenols of red raspberries.

Keywords: Anti-Oxidant Activity, Anthocyanin's, Chronic Disease, Ellagitannins, Health Benefits, Polyphenols, Red Raspberry

Introduction

The unique red raspberries are the fruits of plant Rubus idaeus belonging to the family rosaceae, was believed to be first collected by the people of Troy in the foothills of Mt Ida [1]. The fruits are native to Eastern Europe and North Asia, raspberry Latin name Rubus idaeus means 'bramble bush of Ida' as name hold another story for its naming when the Olympian Gods were looking for berries on mount Ida [2]. It is believed that raspberries to be first cultivated by Romans somewhere around fourth century AD as expressed by Palladio Opus agriculturae [3].

'Malahat' is a new flarican-fruiting-red raspberry has replaced its 'Willamette' parent as the most widely planted red raspberry cultivar in the Pacific Northwest (PNW) [4]. Red raspberry individual fruit weighs 3-5 g and is made up of around 100 drupelets. The fruit is a tart, sweet, red in color. The fruit has both nutritional and medicinal values.

Figure 1: Red Raspberries

Methodology

The review was conducted by searching various database of PubMed, Google Scholar, Science Direct for research and review articles and books relevant to terms or combination of terms:" Raspberry, Raspberry Ketones, medicinal properties, therapeutic values, etc. The search was not limited by date but to all connected publications.

Phytochemicals of Red Raspberry

Plants provide most of the time not only the required nutrient but also active phytochemicals that help in prevention against many diseases. Secondary metabolite is another name of plant phytochemicals, are non-nutritious in nature and generated by plants through various chemical pathways and are mostly beneficial for human being [5-7]. The list of phytochemicals of red raspberry contains mainly two polyphenols which includes anthocyanin and ellagitannins content. Also present gallotannins, flavonols in free and conjugated form e.g. Quercetin and kaempferol. Besides polyphenols, other phenolic compounds present are in the form simple phenolic acids such as hydroxycinnamic acids e.g. Caffeic, p-coumaric acid and ferulic acid and hydroxybenzoic acids e.g. Ellagic acids and p-hydroxybenzoic acids to complex polyphenols (condensed and hydrolysable tannins) [8-10].

The polyphenols in red raspberry are distinguished basically by their anthocyanins and ellagitannins contents. The ellagic acid derivative in red raspberry present in three different forms as ellagitannins in which hexahydroxydiphenic acid forms esters with sugars as free ellagic acid and as ellagic acid glycosides [11]. Sanguiin H-10 and lambertianin are the main ellagitannin present in raspberries [12]. Anthocyanins have structures of C6-C3-C6 which contributes for red color of raspberries. The main anthocyanins present in raspberries are cyanidin-3-sophoroside, cyaniding-3, 5-diglucoside, cyaniding-3(2^G-glucosylrutinoside), cyaniding-3-glucoside, cyaniding-3-rutinoside, pelargonidin-3-sophorside, pelargonidin-3-(2^G glucosylrutnoside), pelargonidine-3-glucoside and pelargonidine-3- rutinoside [13-16]. The antioxidant property of anthocyanins thus assure health benefits of red raspberries.

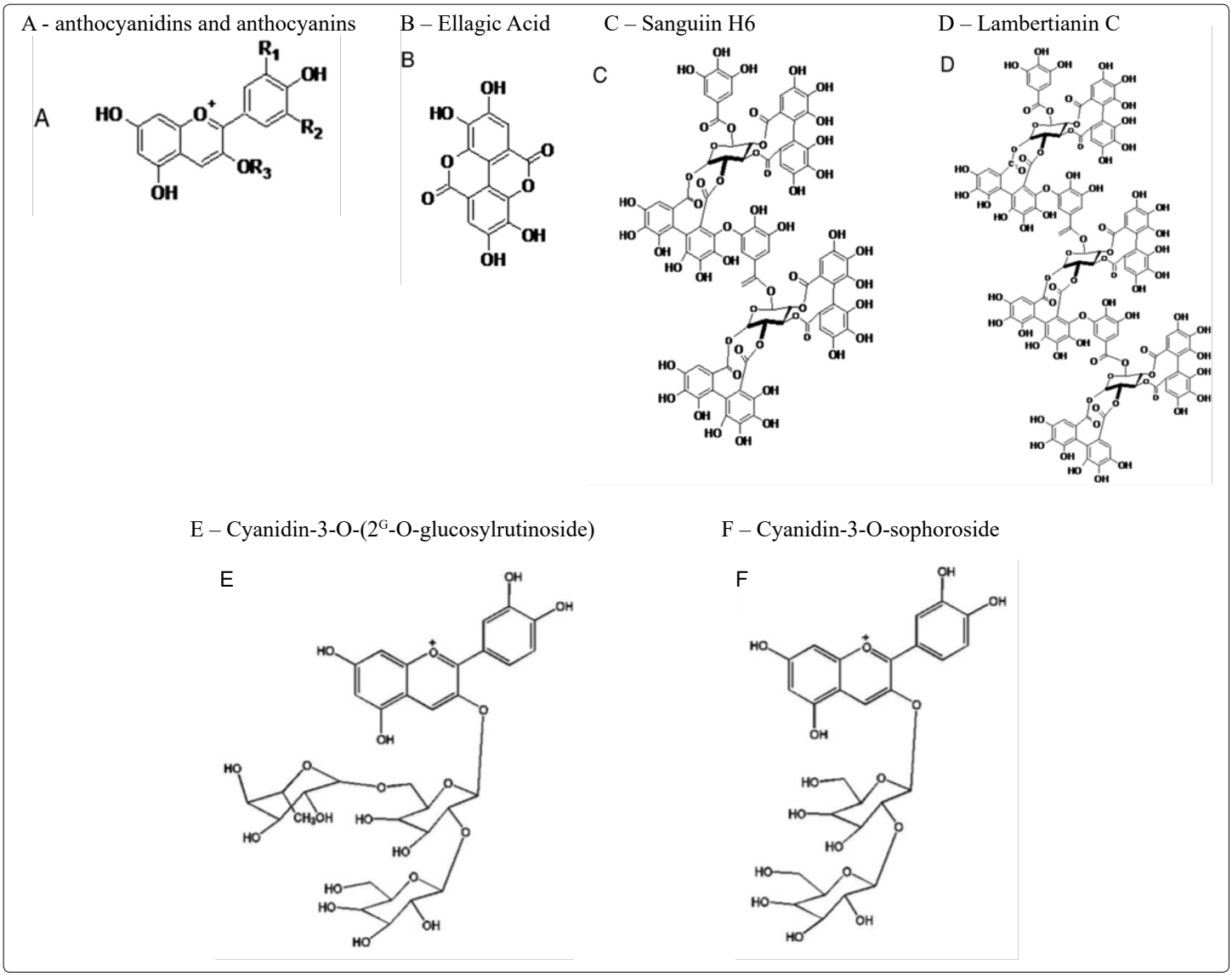

Figure 2: Structures of major Polyphenols of Red Raspberries

Bioavailability of Polyphenols of Raspberries

Bioavailability is defined as absorption and transport of the drug moiety to the site for its particular effect and it depends on factors like absorption, metabolism, distribution and excretion after drug administration [17,18].

Red Raspberries Health Benefits

The polyphenols of red raspberry have multiple biological activities. The prominent polyphenols of berries are hydrolysable tannin like ellagitannins and anthocyanins. Most of the polyphenols have been found reducing the risk of some chronic diseases like diabetes mellatius, obesity, cardiovascular disease, cancer, etc. [19-21]. The antioxidant actions of berries are well known, and they top the list with highest AOC (Antioxidant Capacity). AOC affirms the indication of existence of beneficial bioactive components in food items [9]. The anti-oxidant properties of red raspberry have much scope for health benefits and effective against many diseases. The next few paragraphs review the research and review articles published over the past few years that show the biological benefits of red raspberry.

Cardiovascular Disease

Cardio-vascular disease is becoming one of the main killer diseases across the world. The anti-oxidant property of red raspberry had an effective role in treatment of cardio-vascular diseases, apart from this the beneficial health factor of red raspberry also contribute in prevention against the disease [22-24]. Some factors responsible for the cardiac disease are oxidative stress, inflammation, endothelial dysfunction and its participation in development of atherosclerosis and regulation of blood pressure [25]. The anthocyanin's in raspberry help in improvement of endothelial function by its protective action on endothelial cells with less oxidative stress [26-28].

Diabetes Mellitus and Raspberries

The metabolic disorder caused by improper insulin secretion and defective insulin action results in causing diabetes mellitus which is becoming major global issue currently [29]. Diabetes mellitus give rise to various diseases like peripheral vascular diseases, cardio vascular diseases, chronic kidney diseases, diabetic foot

ulcers, retinopathy [30-32]. The polyphenols as anthocyanin's in red raspberry and ellagic acid stimulates insulin secretion in animals [33]. Also, cyaniding-3-glucoside helps in reducing fasting glucose and increased insulin response in diabetic animal models [34,35]. More additional research is required to make sure the potential role of red raspberry in prevention of diabetes mellitus.

Obesity

Obesity, at present, is common health problem all over the world. Obesity results in development of other serious health issues like increased blood pressure, type 2 diabetes, sleep disorders, CVDs, some type of cancer, brain stroke, osteoarthritis, non-alcoholic liver disease [36-38]. Obesity increases oxidative stress through mechanism like peroxisomal fatty acid oxidation, disorganization of mitochondrial oxidation, damaged antioxidant defense system and increased utilization of oxygen. Red raspberry's anthocyanins acts as an anti-obesity agent by changing lipid metabolism as by enhancing lipolysis in adipocytes [39,40].

Cancer

The most common cause for cancer is DNA damage. Cancer cells grow in uncontrolled way affecting normal tissues and other body organs and in due time spreads throughout the whole body. There are different kinds of cancers like breast, prostate, lung, brain, and colon etc. Polyphenols of raspberry have protective action against cancer development, especially in colon cancer and intestine cancer [41-43]. The distinctive phytochemical format of raspberry have beneficial antioxidant action which helps in free radical scavenging activity [28]. Ellagitannins and anthocyanins as a main antioxidant phytochemical of raspberry also present tumor proliferation inhibitory properties [44].

Alzheimer Disease

Alzheimer is the most familiar kind of dementia. The onset of disease is associated with memory loss, slowness in cognitive function and sometimes early death [45,46]. The cluster of factors like increased blood pressure, unbalanced glucose and insulin metabolism, obesity, dyslipidemia and raised systemic inflammation linked to cognitive deterioration, dementia and growth of Alzheimer disease [47-50]. The main neurological features of Alzheimer disease composed of intracellular neurofibrillary coils that consists of phosphorylated τ protein, extracellur plaques that contain amyloid-**β** protein and conspicuous impairement and reduction of neurons and synapses in cortex and hippocampus [51,52]. In order to avoid the possibility of Alzheimer condition there is a need to minimize peripheral inflammation and reinstate insulin receptivity which will ultimately help in age related cognitive function declination [53,54]. We know that raspberry is richly blessed with polyphenols which helps in reducing oxidative stress, inflammation and improvement in insulin signaling there is promising chance for treatment for Alzheimer disease.

Summary and Conclusion

Red raspberry represent itself as a one of the best dietary source with plenty of essential micronutrient and most essential bioactive polyphenols in the form of anthocyanin's and ellagitannins. The most prominent action of red raspberry is its anti-oxidant action which plays important role in the treatment of cardio vascular disease, diabetes mellitus, obesity, cancer, Alzheimer disease. Most of the therapeutic studies are performed on animal, very limited data is available on humans, so there is need of studying the effects of bioactive polyphenols on human so that one can get the maximum beneficial effects of red raspberries.

Acknowledgement

The authors would like to express her thanks to the SPER Jamia Hamdard for their constant support.

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