

THE POSSIBLE CARDIOPROTECTIVE EFFECTS OF ARISTOTELIA CHILENSIS (MAQUI BERRY)

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Abstract

Cardiovascular diseases such as myocardial infarction, thrombosis, and cerebrovascular diseases are commonly found nowadays. It accounts for approximately one-third of death in the world. Platelet has a critical role in cardiovascular events. It was found that some antioxidants in fruits and vegetables might inhibit platelet aggregation and minimize the risks of cardiovascular disease. *Aristotelia chilensis* is one of the fruits that has high antioxidant content such as polyphenols, anthocyanin, and flavonoids. This paper aims to describe the possible cardioprotective effects of *Aristotelia chilensis* (Maqui Berry). Method: This is a narrative literature review. Articles were selected from PubMed, Science Direct, and Google Scholar. Result: Some studies revealed that *Aristotelia chilensis* benefits cardiovascular such as reducing glucose index, diabetes, and obesity. Therefore, it might have antiplatelet activity. The bioactive compounds in the maqui berry are phenolic acid, flavonoid, and anthocyanin. These compounds show multiple targets in the platelet in the form of the inhibition of thrombin, thromboxane, adenosine diphosphate (ADP), and GPVI receptor. Another possible mechanism is by stimulating platelet aggregation. However, more studies are needed to explore the action of maqui berry extracts.

Keywords: *Aristotelia chilensis*, cardiovascular disease, maqui berry

A. INTRODUCTION

Cardiovascular diseases such as myocardial infarction, thrombosis, and cerebrovascular diseases are commonly found nowadays. It accounts for approximately one-third of deaths in the world. Platelet has a critical role in cardiovascular events. It was found that some antioxidants in fruits and vegetables might inhibit platelet aggregation and minimize the risks of cardiovascular disease. *Aristotelia chilensis* is one of the fruits that have high antioxidant content such as polyphenols, alkaloids, ferulic acids, anthocyanin, and flavonoids (García-Milla et al., 2024).

The *Aristotelia chilensis*, also known as Maqui berry, grows well in southern Chile. It has 150 calories per 100 g, with a low protein and high fiber content. The seeds contain monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs). Therefore, it might be beneficial for glycemic and metabolic control and prevention against oxidative stress (García-Milla et al., 2024; Salar et al., 2020).

Cardiovascular disease is associated with impaired endothelial function. Antioxidant content in the Maqui berry might reduce inflammation, improve heart health (aortic endothelium), and control blood glucose. In a study by Martin in 2020, it was shown that water-soluble components

of maqui berry might modulate nitrite oxide (NO) production in a hyperinsulinemic and hyperglycemic condition, including improved endothelial function. Maqui berry might cause vasorelaxation of NO (Martin, 2020).

This paper aims to describe the possible cardioprotective effects of *Aristotelia chilensis* (Maqui Berry).

B. RESEARCH METHOD

Method: This is a narrative literature review. Articles were selected from PubMed, Science Direct, and Google Scholar. The publication date is within 10 years (2014-2024).

C. FINDINGS AND DISCUSSION

Atherosclerosis is the main cause of cardiovascular diseases. Cardiovascular disease is responsible up to 70% of death worldwide. Although some new medicine for cardiovascular disease are developed, they might cause intolerance and side effects. Therefore, natural active compounds are studied as complementary treatment based on phytochemicals. Phenolic compounds might counteract the development of atherosclerosis: dyslipidemia, and oxidative and inflammatory-stress. The selection of phenolic compounds needs further scientific explanation and studies (Toma et al., 2020).

Phenolic compounds might regulate lipid metabolism and balance the oxidative through epigenetic, translational, and transcriptional mechanisms. Lipid absorption is inhibited in the small intestine. Cholesterol excretion is stimulated through small intestine or gall bladder. Antioxidant and anti-inflammatory effects are shown by the inhibition of inflammasome and stimulation of antioxidants enzyme. Although herbal medication might have lower side effects compared to synthetic medicine, longer and larger studies are needed to confirm the data. Plants' active compound are more beneficial in extract form compared to the molecular components (Toma et al., 2020).

Another benefits of these colored flavonoids is neurological activity. Preliminary data revealed that maqui berry might reduce nociceptive pain. This study used various doses of maqui berry powder which contains 1.6% anthocyanin. The routes of administration were parenteral and enteral. The study used a nociceptive pain model in mice. Gastric damage analysis was explored as possible side effects of anti-inflammatory medicine. Anti-nociceptive pain was shown using parenteral and enteral administration of maqui berry (Agulló et al., 2021).

Maqui berry belongs to the *Elaeocarpaceae* family. It grows mostly in southern and central America, i.e. Argentina and Chile. The fruit is edible with dark purple color and rich in antioxidants. It contains anthocyanins (includes delphinidins) (Figure 1). There were 19 polyphenolic compounds in maqui berry, i.e. anthocyanins (eight compounds, mostly delphinidins), flavonols (10 compounds, mostly quercetin), and ellagic acid. Anthocyanins composition is more than 80% than total polyphenols. Those bioactive compounds reveal a strong antioxidant power, anti-inflammatory, anticancer, and inhibitory activity on the enzymes in metabolic syndrome. However, the bioavailability of anthocyanins is low (around 1%). It might be due to cellular uptake in the intestine, limited stability, and a low absorption rate in the alimentary tract (Eker et al., 2020; Schön et al., 2018). Maqui berry is one of the healthiest fruits due to rich bioactive compounds contents such as tannins, stilbenes, flavonoids, anthocyanins. The main phenolics in maqui berry are ellagic

acids, protocatechuic, and gallic. Meanwhile, the main flavonoids in the free form are quercetin and myricetin. The predominant anthocyanins were delphinidin. The main component is delphinidin-3-glucoside (Fredes et al., 2018; Robert & Fredes, 2015).

Some health benefits of maqui berry extracts are as follows: anti-photoaging, the inhibition of low-density lipoprotein oxidation, anticarcinogenic effects, antimicrobial, antihemolytic, cardio-protection, prevention from atherosclerosis, obesity control, inhibition of adipogenesis and diabetes symptoms (Ortiz et al., 2020; Waciewicz-Muczynska et al., 2023).

Maqui has beneficial effects on oxygen radical absorbance, intracellular oxidative stress reduction, and xanthine oxidase inhibition. The polyphenolic fraction (mostly anthocyanin) accounts for the antioxidant activity. Anthocyanin also shows powerful anti-inflammatory effects. The enzymatic (pectinase) pretreatment gives the highest extraction of anthocyanins and polyphenols (Moskwa et al., 2023).

Temperature, pH, and O₂ concentration are some important external factors in the anthocyanin degradation. Anthocyanin is degraded by *Bifidobacterium* spp. and *Lactobacillus* spp. in the intestine (Andrade et al., 2024). The oxygen radical absorbance capacity (ORAC) value of maqui berry is higher than strawberry, blueberry, and blackberry. This condition makes maqui berry beneficial as anti-inflammatory, prevention of Alzheimer's disease, and anti-diabetic (Quispe-fuentes et al., 2017).

Anthocyanins are pigments belonging to the flavonoids. They are beneficial as antioxidants that might minimize the cardiovascular disease, cancer, neurodegenerative, and diabetes risks. External environmental conditions influence the stability and color of anthocyanin. Anthocyanin has low bioavailability. Gut microbiota-modulating and antioxidant properties enable anthocyanin in minimizing the risk of diabetes, cardiovascular diseases, neurodegenerative diseases, obesity, diabetes, other metabolic syndromes, and cancer. Anthocyanins have a critical role in enhancing the proliferation of probiotics such as *Bifidobacterium* and *Lactobacillus*, and inhibiting the growth of *E. coli*, *S. aureus*, and *Salmonella*. Anthocyanins might upregulate antioxidant enzymes and attenuate proinflammatory cytokine production (Saini et al., 2024).

Berries contain the highest amount of anthocyanin among other fruits. Anthocyanins undergo degradation due to diverse external environmental factors. Modifying the chemical structure (acylation) and combining them with proteins and polysaccharides might form stable complexes, improve solubility and bioavailability. Encapsulation protects pigments during digestion and helps the delivery to the colonic microbiota. However, the encapsulation process is quite expensive. Combining anthocyanin-rich fruit, grains, and vegetables into the diet might be beneficial for health. Anthocyanins (color pigments) show anti-inflammatory and antioxidant effects (Saini et al., 2024).

Cardiovascular disease risks increase due to the occurrence of metabolic syndrome. Metabolic syndrome consists of diabetes, high blood pressure, visceral obesity, and hyperlipidemia. In the metabolic syndrome patients, there are some alterations in metabolism of heart, liver, pancreas, and brain. The recommendation for metabolic syndrome patients are exercise, increase vegetables and fruits intake, and reduce consumption of high saturated fatty acids foods, simple sugar, and processed foods. Increased berry intake might reduce the risk of cardiovascular disease (Tudies et al., 2022). Studies revealed that blackberry consumption, including maqui berry, has reduced the risks of cardiovascular disease, diabetes, and obesity. In a study by Leonela et al. (2023), it was shown that 2-weeks administration of maqui berry reduced blood fasting glucose, weight gain, total blood cholesterol, insulin resistance, triacylglycerides, and blood pressure impairment in the diet-

induced MetS model in male and female rats. Maqui berry attenuates the concentration of malondialdehyde (MDA) and the activity of super oxide dismutase (SOD) (Leonela et al., 2023). Impairment of adipose tissue, accumulation of lipids in heart, liver, kidney, and pancreas cause obesity and other metabolic disorders. Inflammatory adipokines as circulating prooxidative are increased (Sanz-lamora et al., 2022).

Polyphenols as dietary antioxidants, have shown many beneficial health effects. Polyphenols can regulate insulin sensitivity and glucose homeostasis by stimulating insulin secretion, reducing hepatic glucose output, and inhibiting glucose absorption in the intestines. These mechanisms of action might prevent the diseases caused by the reactive-oxygen-species (ROS), i.e. type 2 diabetes mellitus, insulin resistance, and mitochondrial dysfunction. Apoptosis might be induced in cancer cell due to polyphenol administration. Furthermore, polyphenols might induce hypolipidemia (Sanz-lamora et al., 2022).

Nutritional Characteristics of maqui berry depends on the fruit preparation, i.e. fresh, dried, or juice. Maqui berry has the highest fiber content among other berries like blueberry, blackberry, and raspberry. It contains calcium, iron, phosphorus, and potassium (García-Milla et al., 2024). The purple color of maqui berry is caused by delphinidin. It is highly active in aglycone form (Figure 2) (Husain et al., 2022).

Delphinidin and its glycosylated derivatives are ligands of some metabolic parameters such as α -glucosidase, PPAR- α , and PPAR- γ . Anthocyanin glycosides and aglycones at low concentration could simultaneously act on different MetS targets. Therefore, these compounds might be used as coadjuvants to manage metabolic syndrome patients. Maqui berry has reduced weight increase, hyperlipidemia, hypertension, and hyperglycemia in the murine model (Leonela et al., 2023).

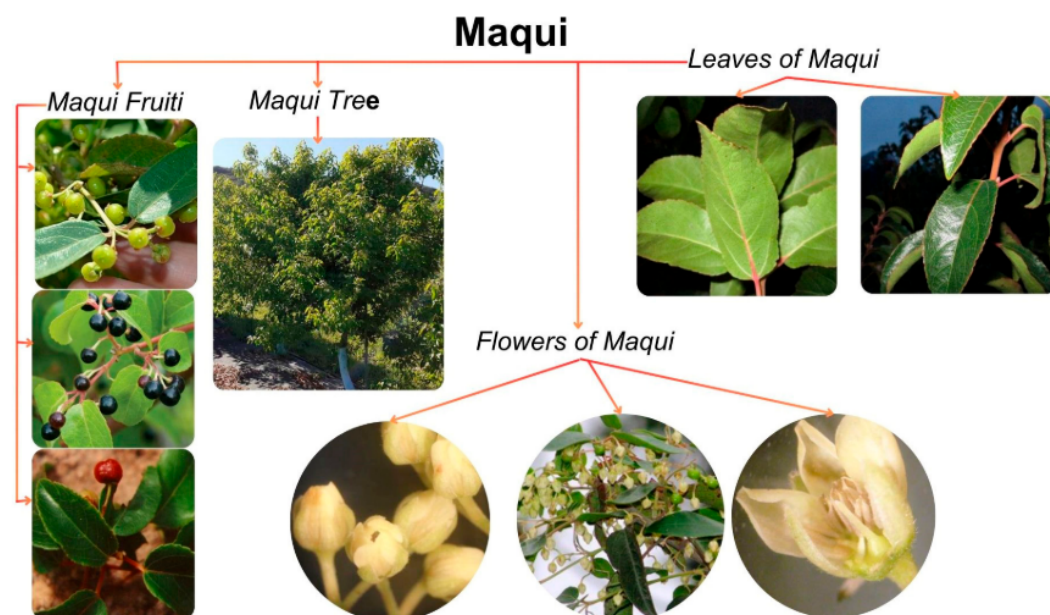


Figure 1. Maqui Berry (García-Milla et al., 2024).

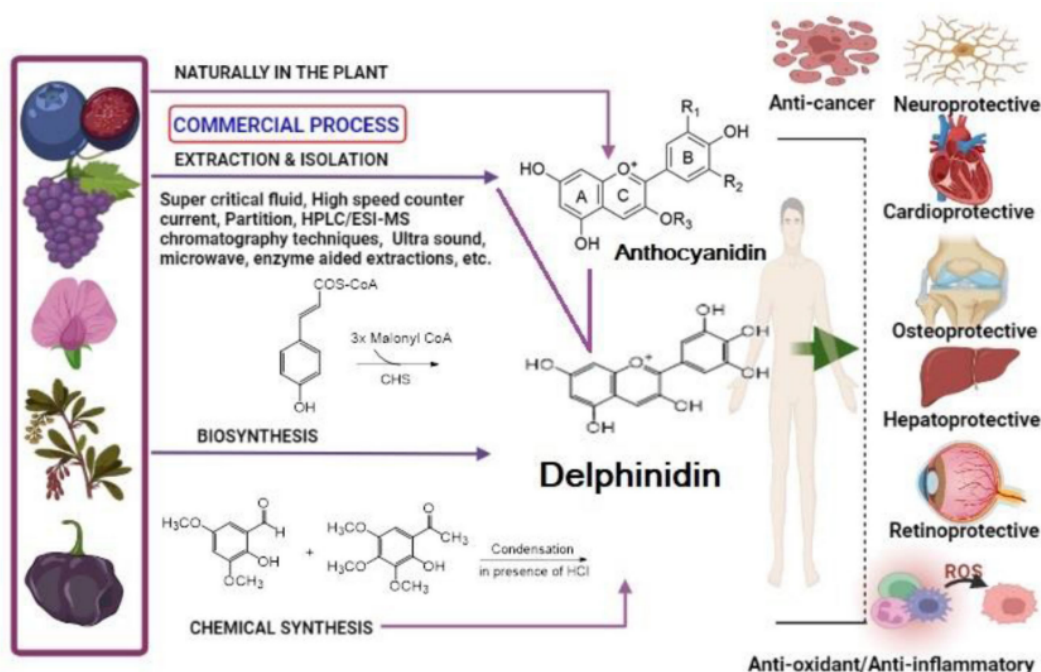


Figure 2. The mechanism of action of delphinidin (Husain et al., 2022)

Some studies revealed that *Aristotelia chilensis* benefits cardiovascular such as reducing glucose index, diabetes, and obesity. Therefore, it might have antiplatelet activity. The bioactive compounds in the maqui berry are phenolic acid, flavonoid, and anthocyanin. These compounds show multiple targets in the platelet in the form of the inhibition of thrombin, thromboxane, adenosine diphosphate (ADP), and GPVI receptor. Another possible mechanism is by stimulating platelet aggregation. However, more studies are needed to explore the action of maqui berry extracts (Rodríguez et al., 2022). Flavonoids might modulate the signaling pathways, activate transcription, regulate gene expression, and protein factors (Bribiesca-cruz et al., 2019).

D. CONCLUSION

In conclusion, the possible cardioprotective effects of maqui berry might be due to the active compounds such as flavonols, anthocyanins, and ellagic acid. Maqui berry might improve endothelial function and cause vasorelaxation of NO. Anthocyanins (color pigments) show anti-inflammatory and antioxidants effects. However, further studies are needed to explore more regarding the dosage, interaction, and duration to give optimal result.

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