

## ACE Inhibitory Effect of Strawberry

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Cardiovascular disease is the cluster of syndromes of blood vessels and heart that consist of hypertension, coronary heart disease, rheumatic heart disease, congenital heart disease, Cardiomyopathies, cerebrovascular disease, peripheral vascular disease and heart failure. Strawberry (*Fragaria x ananassa*) is produced in marketable scale because of the use of chemicals to retain the quality of fruit during storage and transport is prohibited, high perishability and short postharvest life. In, adults, the leading cause of cardiovascular disease is hypertension. It affects approximately 18% in Pakistan. As increase in blood pressure increases the threat for cardiovascular disease mortality. ACE inhibition is an important target for hypertension management. It was observed that the purified ellagitannins had higher ACE inhibitory activity than ellagic acid and strawberries (Lee, 2006).

**Keywords:** Cardiovascular Disease; Strawberry; *Fragaria x ananassa***Health**

Health is not just the absence of disease/infirmity, it is also the state of complete mental, physical and social well-being [1].

**Cardiovascular disease**

Cardiovascular disease is the cluster of syndromes of blood vessels and heart that consist of hypertension, coronary heart disease, rheumatic heart disease, congenital heart disease, Cardiomyopathies, cerebrovascular disease, peripheral vascular disease and heart failure [2].

**Hypertension**

A condition in which the blood vessels have stubbornly raised pressure. Blood is carried from the heart to all parts of the body in the vessels. It pumps blood into the vessels each time when the heart beats. It is a high or raised blood pressure. By pushing the force of blood against the walls of arteries as it is pumped by the heart, blood pressure is created. The harder the heart has to pump, the higher the pressure [3].

**Strawberry (*Fragaria x ananassa*)**

*Fragaria chiloensis* and *Fragaria virginiana* are two native species which are hybrid of the major cultured strawberry (*Fragaria x ananassa*). The breeders of strawberry (*Fragaria x ananassa*) are engrossed on cultivating disease resistance, local adaptations, fruit quality and productivity. *Botrytis cinerea*, *Colletotrichum* spp., *Phytophthora cactorum*, *Phytophthora Fragariae* and *Verticillium albo-atrum* are the major pathogens [4]. Strawberry (*Fragaria x ananassa*) is produced in marketable scale because of the use of chemicals to retain the quality of fruit during storage and transport is prohibited, high perishability and short postharvest life. Due to high content of essential nutrients and beneficial phytochemicals, which seem to have relevant biological activity in human health, Strawberry (*Fragaria x ananassa*) is called an important fruit in Mediterranean diet.

Phytochemicals, anthocyanin and ellagitannins are the major antioxidant compounds. An individual phytochemical constituents of strawberries have been studied for their biological activities, hu-

man intervention studies using whole fruits are still lacking [5]. In Italy, the history recording of Strawberry (*Fragaria x ananassa*) has been growing wild for over 2200 years as long ago as 234BC. Strawberry (*Fragaria x ananassa*) were first cultivated was not introduced until late 13 century. In early 1643, Native American growing strawberries were found by early settlers.

### Bioactive compound

The strawberry (*Fragaria x ananassa*) is a relevant source of bioactive compounds because of its high levels of vitamin C, phenolic constituents and folate [6]. Most of which express relevant antioxidant capacities. Strawberry (*Fragaria x ananassa*) is a foundation of healthy, essential fatty acids because its seed oil is rich in unsaturated fatty acids (w72% polyunsaturated fatty acids). Polyphenolic phytochemicals (flavonoids, phenolic acids, lignans, and tannins) is used as a variety of non-nutritive components. The bioactive compounds are specific focus on phytochemical compounds, primarily anthocyanins and ellagitannins. Phytochemicals are mainly represented by the extensive class of phenolic compounds that have many nonessential functions in huge biological potentialities in humans and in plants. Flavonoids (mainly anthocyanins, with flavonols and flavanols providing a minor contribution) is the major class of phenolic compound, which is followed by phenolic acids (hydroxybenzoic acids and hydroxycinnamic acids) and hydrolyzable tannins (ellagitannins and gallotannins) with the minor constituents as condensed tannins (proanthocyanidins) [7].

### Mineral profile

Type	Nutrient	Per 100g
Proximate	Water(g)	90.95
	Energy(kcal)	32
	Protein(g)	0.67
	Dietary fiber (g)	2.0
	Ash (g)	0.40
	Total lipid (g)	0.30
	Carbohydrates(g)	7.68
	Sucrose (g)	0.47
	Sugars (g)	4.89
	Glucose(g)	1.99
Minerals	Fructose (g)	2.44
	Calcium (mg)	16
	Iron (mg)	0.41

	Magnesium (mg)	13
	Phosphorus (mg)	24
	Potassium (mg)	153
	Sodium (mg)	1
	Zinc (mg)	0.14
	Copper (mg)	0.048
	Manganese (mg)	0.386
	Selenium (mg)	0.4
Vitamins	Vitamin C(mg)	58.8
	Thiamin (mg)	0.024
	Riboflavin (mg)	0.022
	Niacin (mg)	0.386
	Pantothenic acid (mg)	0.125
	Vitamin B6 (mg)	0.047
	Folate (mg)	24
	Choline (mg)	5.7
	Betaine (mg)	0.2
	Vitamin B12 (mg)	0
	Vitamin A, RAE (mg)	1
	Lutein β zeaxanthin (mg)	26
	Vitamin E, α-tocopherol (mg)	0.29
	b-tocopherol (mg)	0.01
g-tocopherol (mg)	0.08	
d-tocopherol (mg)	0.01	
Vitamin k phyloquinone (mg)	2.2	

**Table 1**

(US Department of Agriculture and Agriculture Research Service, 2010)

### Effect of strawberry (*Fragaria x ananassa*) on Hypertension

In, adults, the leading cause of cardiovascular disease is hypertension. It affects approximately 18% in Pakistan. As increase in blood pressure increases the threat for cardiovascular disease mortality. The clinical recommendations show the 2 stages of hypertension in person. Systolic blood pressure  $\geq 160$  mmHg and diastolic blood pressure  $\geq 100$  mmHg comprises a more extensive treatment.

The 1 stages of hypertension is SBP 140-159 mmHg/DBP 90-99 mmHg. While, the ethnic disparities have been well documented in the prevalence of hypertension. The awareness, treatment and control within blood pressure stages.

To examine ethnic disparities in awareness, treatment and control of high blood pressure by hypertension stages. Although the treatment with stage 2 hypertension did not differ by ethnicity among persons. The stage 2 hypertension were treated with medication is less than 60%. More efforts are needed to reduce barriers to accessing low-cost medication and health care, along with increasing adherence to clinical guidelines and clinicians' hypertension treatment knowledge. The marginal hypertension patients by recurrently have a hyperkinetic circulation that can be normalized with autonomic blockade of the heart and is neurogenic. The origin of central nervous system is aberration and due to decreased vagal inhibition of the heart and increased sympathetic stimulation. A patients categorized by norepinephrine and high plasma renin values clearly has a neurogenic hypertension. The blood pressure becomes normal after vascular alpha-adrenergic blockade and cardiac blockade. Since, many patients with marginal hypertension have a high cardiac output.

Most of the patients with more innovative hypertension have increased vascular resistance. The main source of ellagic acid derivatives in the diet is represented by Strawberry (*Fragaria x ananassa*) more than 50% of all phenolic compounds found in the fruit [8]. Because of possible chemopreventive benefits, there is a particular interest in the firmness of the ellagic acid content in fruits. The satisfying approach available for type 2 diabetic patients is by delaying the absorption of glucose through the reduction of starch hydrolysis through strongly inhibiting intestinal glucose absorption by  $\alpha$ -glucosidase enzymes and slightly inhibiting pancreatic  $\alpha$ -amylase. Natural  $\alpha$ -glucosidase and  $\alpha$ -amylase inhibitors from fruits and vegetables could offer a good strategy to control the postprandial hyperglycemia [9]. It provide benefits without the side effects present in most available drugs such as flatulence, possibly diarrhea and abdominal distention [10].

It has been reported that individuals affected by diabetes have associated risk factors, including obesity, hypertension and dyslipidemia [11]. An important enzyme involved in maintaining vascular tension by two different reactions is Angiotensin I-converting

enzyme Angiotensin I-converting enzyme (ACE). It catalyzes the conversion of the inactive angiotensin I into a powerful vasoconstrictor and inactivation of the vasodilator bradykinin, salt-retainer and angiotensin II which is conducive to lowering blood pressure [12]. The useful therapy in the control of blood pressure in hypertensive patients is considered as inhibition of enzyme, which is a macro vascular complication of type 2 diabetes. So, to evaluate the potential health benefits of the purified ellagitannins was the objective of this study from strawberries in relation to the in vitro inhibitory activity and antiproliferative activity of enzymes related to hypertension and type 2 diabetes like  $\alpha$ -glucosidase, ACE and  $\alpha$ -amylase. Many fruits, including strawberry (*Fragaria x ananassa*) is known to contain high levels of soluble tannins, and has  $\alpha$ -amylase inhibitory properties. Neither ellagic acid nor gallic acid inhibited  $\alpha$ -amylase, indicating that other phenolic compounds are related to this functionality. The high blood pressure/ hypertension is one of the long-term complications of type 2 diabetes [13].

Many studies have reported the beneficial effects in hypertension of polyphenol-rich extracts not only by normalizing the blood pressure but also by retarding the development of hypertension [14]. ACE inhibition is an important target for hypertension management. It was observed that the purified ellagitannins had higher ACE inhibitory activity than ellagic acid and strawberries [15]. Besides, these results suggested that probably there is no synergistic effect of these compounds when present in food. There is evidence that some peptides naturally present in foods that could be responsible for such inhibitory activity or some water-soluble compounds other than the phenolics [16].

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