Polyphenol Family in Cardiovascular disease (CVD): Versatile Therapeutic Outcome

Emili Manna1, 2, Smarajit Maiti3

1Vidyasagar University, Life Science, India; 2Sinha Institute of medical science & Technology, Garia, Calcutta, India; 3Oriental Institute of Science and technology, Cell and Molecular therapeutics laboratory, Midnapore, India

ABSTRACT

Epidemiological evidence support that diet rich in polyphenolic compound reduces the risk of cardiovascular disease (CVD). Polyphenols (500-4000 Da) are the main organic constituent presenting with 5-7 phenolic ring with >12 phenolic hydroxyl groups, water soluble plant derived compound. These compounds are also able to generate NO from vascular endothelium. The aim of the mini review was to investigate the role of the most commonly consumed polyphenols in the pathophisiology of the risk of ischemic stroke and CVD. Polyphenol can reduce endothelial dysfunction, in the development of atherosclerosis with the inhibition of the aggregation of platelet and lowering blood pressure. This paper reviews the current advances in polyphenols in food, with emphasising on health aspects on the basis of the published literature, which may provide some guidance for researchers in further investigations and for industries in developing practical health agents. (Int J Biomed Sci 2017; 13 (4): 154-157)

Keywords: CVD; Polyphenol; NO; platelet aggregation; ischemia; flavonoid

INTRODUCTION

Prevention and cure of diseases using phytochemicals are well known. The role of polyphenols in CVD, especially in ACS, AMI and strokes, remains obscure. The aim of this review is to find out the relation between the association of intake of flavonoids and occurrence of CVD. Previous study suggested that high intakes of flavonoids may be associated with decreased risk of ischemic stroke (1) and possibly with reduced CVD mortality (2).

In the acute phase, flavones can prevent platelet aggregation and thrombosis, inhibit oxidative stress, reduce citotoxicity and improve cerebral blood flow (3). Fruits and vegetables are the main dietary sources of polyphenols for humans, along with tea and wine. The activities of polyphenols structure dependent. The chemical nature of polyphenols depends on their structural class, degree of hydroxylation, other substitutions and conjugations, and degree of polymerization (4). Previous study demonstrated that both male and female subjects who consume large amounts of polyphenols had the 18% lower mortality risk of cardiovascular diseases (CVD) compared to those whose intake was in the lowest (5).
EFFECT ON PLATELET AGGREGATION

Flavonoids consumption is beneficial to CVD as it has anti-aggregating property on platelet (6). As platelet aggregation in directly associated with AMI and ACS that cause death of several people. Inhibition of platelet aggregation reduces the risk of CVD whereas platelet activation and aggregation play an integral role in haemostasis and thrombosis. Flavonoids, such as quercetin or rutin, have anti-aggregating properties, and thereby reduce the risk of clot formation near the damaged endothelium (7).

Cardiovascular disease is a major problem that is caused by the disorder by blood vessel, coronary heart disease and cerebrovascular disease etc. The major cause of CVD is unhealthy diet, physical inactivity, consumption of tobacco (8). Diets and nutrients play a potential role in modifying CVD progression, particularly in platelet function.

REDUCE ISCHEMIA

It has been reported that flavonoid intake can reduce the incidence of several myocardial infarction and cerebral ischemia (9). The cardiovascular diseases are comprised of acute ischemic heart disease that includes coronary artery disease / acute coronary syndrome (ACS) and acute myocardial infarction that are reported to be caused by the aggregation of platelets on the site of atherosclerotic plaque rupture or fissuring on the wall of the coronary artery, resulting the development of the formation of thrombus, (a micro-aggregate of platelet embedded in fibrin mass) as in case of acute coronary syndrome (ACS) (10). On the other hand in the development of thrombosis in the blood vessel of pericardium may also occur leading to acute myocardial infarction (AMI) (11).

Cerebral ischemia is caused by insufficient blood flow to the brain leads to poor oxygen supply called hypoxia (12). Previous experimental study resulted that moderate amount of apple juice, grape juice, red wine or isolated polyphenols like flavon, resveratrol and quercetin reduce the contractile dysfunctions of the heart and protect against cardiac ischemia (13). Oral intake of flavonoids is reported to able lowering blood pressure and reducing the lipid oxidation; prevent the initiation of atherosclerotic plaque development (14).

MAINTAIN THE LDL LEVEL

Previous study suggested that elevated LDL level is an established cause of cardiovascular disease (15). LDL level change from normal can cause several problems in our body. The flavonoids compound has beneficial role to control the level of the LDL. Because of their antioxidant and chelating properties, flavonoids inactivate reactive oxygen species (ROS) and this way counteract plasma LDL oxidation (30) and improve inflammation of the blood vessel endothelium. Ingestion of the grape and apple juice reduces the plasma lipid concentration (16). The consumption of polyphenol also reported to be reduce the cholesterol level of hypercholesterolic patient and reduce the oxidation of the LDL (17). However the effect of polyphenol on the reduction of the oxidation of the LDL depends on their structure, type and concentration.

PREVENTION OF HYPERTENSION

High blood pressure is a major risk of cardiovascular disease. Consumption of flavonoids improves the endothelial function through eNOS (18). Increment of NO improve vesodialition and blood circulation. It also affects protein kinases, ion channels and phosphodiesterases, counteracting vascular inflammation and LDL oxidative stress.

Polyphenols are able to induce nitric oxide (NO)-mediated endothelium-dependent relaxations in a large number of arteries including the coronary artery (19). Endogenous NO production is involved in the regulation of blood pressure. Inhibition of NO synthesis has been demonstrated to induce rise in blood pressure (20). Elevated blood pressure is well known risk factor for the development of cardiovascular disease such as myocardial infarction and stroke (21). Polyphenols from red wine, grape skin or an isolated polyphenol (quercetin) possess an antihypertensive effect (22).

CLASSIFICATION OF POLYPHENOL FAMILY

Polyphenols are mainly four types: flavonoids, stilbenes, phenolic acids and lignans (23). Flavonoids are subdivided into major six groups: Flavon, Isoflavon, flavanols, anthrocyanidin, flavanones, flavones. Phenolic acids are mainly two types: Hydroxyecinamic acid and hydroxyl benzoic acid. The total polyphenolic family is distributed in the nature majorly in plant.

CONCLUSION

There has been increasing interest about polyphenolic research due to their several health benefits. Polyphenols are bioactive, non-caloric, non-nutrient compounds (24),
which are ubiquitous in fruits, vegetables and other vascular plants and cannot be synthesized by humans. CVDs are now a current major problem in causing mortality in both Western and developing countries (25). Polyphenols have several pharmacological and therapeutic activities including cancer (26). Current research also suggested that polyphenol and metal – ion complex has novel therapeutic activity (27). In CVD polyphenol mainly flavonoids have several beneficial outcomes to prevent ACS, AMI and Stroke through the inhibition of cardiovascular risk factors. Recently it was reported that the red wine from grape juice and green tea are worldwide popular drink for heart to protect CVD (22, 28). Polyphenol-rich grape products and green tea reduce obesity-mediated chronic inflammation by multiple mechanisms, thereby preventing cardiac risk factor (29-31).

Toxicity of flavonoids consumed in large doses remains unknown. The question arises that when to use these substances to enable their most effective action, and which polyphenol is the most beneficial to human health. Therefore more research is needed about polyphenol. In conclusion; this study suggests that a moderate amount of intake of flavonoids decreases the risk of ischemic stroke and possibly CVD mortality.

CONFLICT OF INTEREST

Author declare that they have no financial or other relationships with commercial entities whose products or services are related to the subject matter in the manuscript, or socio-political issues that can cause conflict.

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