Procyanidin

Procyanidins are members of the proanthocyanidin (or condensed tannins) class of flavonoids. They are oligomeric compounds, formed from catechin and epicatechin molecules. They yield cyanidin when depolymerized under oxidative conditions.

Apple polyphenol contains abundant procyanidins, which have been associated with an anti-atherosclerosis and cholesterol-lowering effect.

Although procyanidins (PCs) have a powerful free radical scavenging capability and have been widely studied in the traumatic brain injury treatment, conventional systemic drug therapy cannot make the drug reach the targeted area in the early stage of TBI and will cause systemic side effects because of the presence of the blood-brain barrier (BBB). To address this issue, they designed and fabricated a ROS-scavenging functional hydrogel-loaded PC (GelMA-PPS/PC) to deliver the drug by responding to the traumatic microenvironment. In situ injection of the GelMA-PPS/PC hydrogel effectively avoided the BBB and was directly applied to the surface of brain tissue to target the traumatic area. Hydrophobic poly(propylene sulfide)60 (PPS60), a ROS quencher and H2O2-responsive substance, was covalently bound to GelMA and exposed in response to the trauma microenvironment. At the same time, the H2O2 response of PPS60 further caused the structure of the hydrogel to degrade and release the encapsulated PC. Then PC could regulate the oxidative stress response in the cells and synergistically deplete ROS to play a neurotrophic protective role. This work suggests a novel method for secondary brain injury treatment by inhibiting the oxidative stress response after TBI [1)].

The aim of this study was to investigate whether apple procyanidins (APCs) feature therapeutic efficacy in terms of regressing atherosclerosis and whether this efficacy is due to mechanisms other than a cholesterol-lowering effect.

After eight weeks on an atherogenic diet, rabbits were given a normal diet for another eight weeks to normalize the increased serum lipids level. The rabbits in the baseline group were sacrificed at this stage. The control group was subsequently fed a normal diet for eight weeks, while the APCs group was administrated 50 mg/kg/day of APCs in addition to the normal diet. Serum lipids and aortic intimal-medial thickness (IMT) were serially examined, and the resected aorta was examined histologically and through molecular biology.

Aortic IMT on ultrasonography and the lipid accumulation area examined using Sudan IV staining were significantly reduced in the APCs group as compared to the control group. Serum lipid profiles were not different between the groups. Immunohistochemistry showed significantly decreased staining of an oxidative stress marker and significantly increased staining of ATP-binding cassette subfamily A member 1 (ABCA1) in the APCs group. Western blotting and RT-PCR also showed increased expression of ABCA1 mRNA and its protein in the APCs group.

This study revealed that APCs administration causes a regression of atherosclerosis. APCs might hold promise as an anti-atherosclerotic agent [2)].

1)
Huang X, Ye Y, Zhang J, Zhang X, Ma H, Zhang Y, Fu X, Tang J, Jiang N, Han Y, Liu H, Chen H. Reactive Oxygen Species Scavenging Functional Hydrogel Delivers Procyanidins for the Treatment of Traumatic Brain Injury in Mice. ACS Appl Mater Interfaces. 2022 Jul 14. doi: 10.1021/acsami.2c04930. Epub ahead of print. PMID: 35833273.
2)
Wang L, Fumoto T, Masumoto S, Shoji T, Miura T, Naraoka M, Matsuda N, Imaizumi T, Ohkuma H. Regression of atherosclerosis with apple procyanidins by activating the ATP-binding cassette subfamily A member 1 in a rabbit model. Atherosclerosis. 2017 Jan 27;258:56-64. doi: 10.1016/j.atherosclerosis.2017.01.032. [Epub ahead of print] PubMed PMID: 28196336.