

Summary of scientific research indicating health benefits for apples.

Health Issue	Summary of Findings	Reference & Comment
Coronary heart disease (CHD)	Significant inverse association between consumption of flavonoids and apple and mortality by CHD. Relative risk between lower and upper quartiles for apple consumption was 0.81	(Knekt et al. 1996). Cohort study
Coronary heart disease (CHD)	Flavonoid intake was significantly and inversely associated with mortality by CHD. Adjusted relative risk between lower and upper tertile was 0.51	(Hertog et al. 1993) Cohort. Major sources of flavonoids intake are tea, onions and apple.
Coronary heart disease (CHD)	Significant inverse effect between flavonoid (apple) consumption and mortality by CHD. Adjusted relative risk between lower and upper quartiles for apple consumption was 0.75	(Knekt et al. 2002). Cohort study. Apples were the major sources of flavonoids in this population
Cholesterol lowering	Plasma cholesterol concentrations were significantly lowered when cholesterol-fed rats were also fed with freeze dried apple.	(Aprikian et al. 2001), (Aprikian et al. 2002)
Asthma	There was a significant inverse relationship between flavonoid consumption and asthma. The relative risk for asthma between lower and upper quartiles was 0.55	(Knekt et al. 2002). Cohort study. Apples were the major sources of flavonoids in this population
Asthma and chronic obstructive pulmonary disease	Asthma was not associated with the classes of polyphenols present in apple.	(Garcia et al. 2005). Case control study with population drawn from the previous study (Shaheen et al. 2001).
Lung function	In a prospective study, good lung function in elderly men was associated with a number of dietary patterns including the consumption of apple.	(Butland et al. 2000)
Diabetes/glucose metabolism	Consumption of apple juice appeared to reduce the absorption of glucose	(Johnston et al. 2002)
Diabetes/glucose metabolism	Glycosylated flavonoids inhibited the uptake of glucose into Caco-2 cells under Na condition, but under NA-free conditions catechin and phenolics acids inhibited glucose uptake.	(Johnston et al. 2005)
Asthma	In a cross-section study of young adults, apples and pears appeared to protect against current asthma (odds ratio: 0.83	(woods et al. 2003)

Cognitive performance	Apple juice concentrate protected from oxidative stress a	(Rogers et al. 2004)
	and cognitive decline in ApoE deficient mice fed a pro-oxidant diet	
Cognitive performance	Apple juice prevented oxidative damage to SHSY-5Y cells exposed to amyloid-beta.	(Ortiz & Shea 2004)
Cognitive performance	Apple juice concentrate prevented oxidative damage and neurodegeneration (Y-maze) in old aged mice consuming a pro-oxidant diet	(Tchantchou et al. 2005)
Antioxidant capacity (in vitro)	In vitro antioxidant and radical scavenging appeared to be due to the polyphenolic composition of apple.	(Lu & Foo 2000; Wolfe et al. 2003)
Antioxidant/Oxidative stress	Apple had a substantial antioxidant activity that could be related to a number of beneficial effects on the risk and progression of degenerative disease. Apples contain relatively small amounts of vitamin C and the antioxidant activity is associated with the polyphenolic content.	(Eberhardt et al. 2000). Measured antioxidant activity using the TOSC This study also found anti-tumour effects and has been widely quoted. It is now generally believed, however, that these facts are due to artifactual production of hydrogen peroxide generated from the reaction between media components and polyphenols (Lapidot et al. 2002).
Antioxidant/Oxidative stress	Apple extracts and polyphenolic components protect against LDL oxidation ex vivo	(Pearson et al. 1999)
Antioxidant/Oxidative stress	A rise in plasma FRAP was observed when human subjects consumed 6 apples. This rise in plasma antioxidant capacity was due to a rise in uric acid which was due to the fructose in apples not the polyphenols. In vitro and in vivo antioxidant measures are therefore not necessarily related.	(Lotito & Frei 2004)
Antioxidant/Oxidative stress	Apples function as a in vivo antioxidant. Adding apples to the diet of pigs fed linseed oil to increase oxidative stress showed reduced levels of lipid and DNA oxidation.	(Pajk et al. 2006)
Cancer	Compelling evidence that extracts of whole apple prevented mammary cancer in a rodent.	(Lui et al. 2005)
Cancer (lung)	In a case-controlled study, apples protected against lung cancer (odds ratio: 0.6). Protection was associated with good dietary sources of flavonoids such as quercetin.	(Le Marchand et al. 2000)
Cancer (colon)	In an animal model of colon cancer, the number of hyperproliferative crypts and of aberrant crypt foci was reduced by 50% in rats receiving 0.01% apple	(Gosse et al. 2005)

	procyanidins in their drinking water after being subjected to chemical induction with azoxymethane.	
Cancer (colon)	Apple polyphenols may reduce the risk of colon cancer as apple extract inhibited the growth of HT29 cells and modulated the activation of genes associated with detoxification of xenobiotics.	(Veeriah et al. 2006)
Hair growing	Topical application of the procyanidin B2 extract from apple promoted hair growth and increased mean hair diameter and the hair number per unit area. This property appears to be associated with protein kinase C inhibitory activity.	(Kamimura et al. 2000;Takahashi et al. 2001; Kamimura & Takahashi 2002)
Oral health	Apple polyphenols inhibited glucosyltransferases in streptococci suggesting anti-cariogenic properties.	(Yanangida et al. 2000)
Weight loss	Weight loss was significantly greater when apples were added to the diet. The difference was significant when compared with both the control and a diet substituted with oatmeal.	(Conceicao De Oliveira et al. 2003)
Antimicrobial	Significant inhibitory activity against cholera toxin and a reduction in accumulation of gastrointestinal fluid. The activity was associated with the procyanidin fraction.	(Saito et al. 2002)