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REVIEW

Potential of Fruits to Improve Dyslipidemias: A Pilot Review

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Abstract: Dyslipidemia is a condition characterized by excessive lipids in the blood plasma, including triglycerides (TG), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C) and decreased levels of high-density lipoprotein cholesterol (HDL-C), which is generated mostly due to obesity. This study aims to summarize research conducted on rats and humans regarding the potential of eight fruits in reducing dyslipidemia and their associated health benefits (eg, reduction of free radicals, hypoglycemic effects, weight reduction, lowering of blood pressure, and anti-inflammatory properties). The studied fruits include pomegranate, star fruit, Rosa roxburghii, pineapple, tree tomato, coffee, apple, and passion fruit. Various parts of these fruits, such as the root, leaves, stem, peel, and pulp, were analyzed for their effects. These fruits are edible, widely available, and cost-effective when purchased during the harvest season (Graphical abstract).

Keywords: fruits, dyslipidemias, humans, rats, benefits

Introduction

Overweight and obesity result from an imbalance between excessive energy intake (primarily from foods rich in fat and refined sugars) and insufficient energy expenditure. This leads to excess adipose and visceral tissue accumulation, which can contribute to non-communicable diseases and dyslipidemia.[1] Dyslipidemia is characterized by elevated cholesterol and triglyceride levels, resulting in abnormal lipoprotein levels such as LDL (low-density lipoprotein) and HDL (high-density lipoprotein). The most common consequences associated with dyslipidemia include an increased risk of atherosclerotic cardiovascular disease (ASCVD) and pancreatitis, particularly when triglyceride levels are high.[2] The treatment of dyslipidemia can be pharmacological or involve natural products, which have gained increasing scientific attention. These natural products include nutritional supplements, fresh fruits, and fruit juices that help inhibit lipid oxidation due to the powerful antioxidant effects of phenolic compounds, oils, and dietary fiber.

This study aims to highlight the bioactive properties of eight fruits (Figure 1) that help prevent dyslipidemia. Their primary nutrients, functional health effects, and mechanisms of action will be discussed. The findings aim to encourage the consumption of fresh fruits as a preventive measure against dyslipidemia and related health issues.

Methods

The information presented in this review was obtained from reputable scientific databases, including ScienceDirect, PubMed, Scopus, and Google Scholar. The keywords used for the literature search included "Apple" or "Malus domestica", "Pineapple" or "Ananas comosus", "Tree tomato", "Solanum betaceum" or "Cyphomandra betacea", "Coffee", "Pomegranate" or "Punica granatum", "Starfruit" or "Averrhoa carambola L.", "Rosa roxburghii" and "Passion fruit" or "Passiflora edulis" in combination

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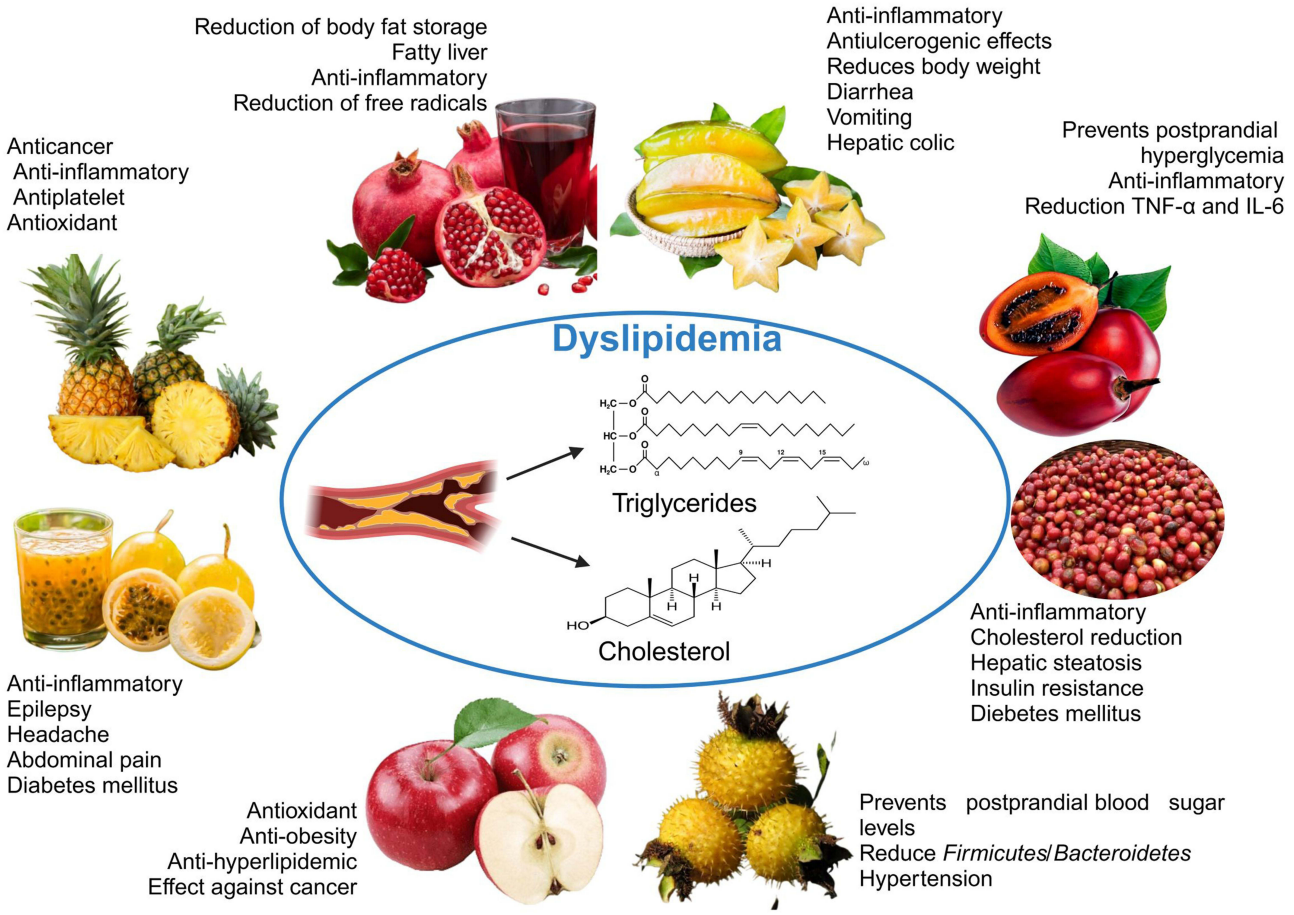
Graphical Abstract



with the words "Dyslipidemia", "Hyperlipidemia", "rats" and "Human". In short, all the information to present in the following review.

Fruits That Prevent the Development of Dyslipidemia in Experimental Models

Pomegranate (Punica granatum L.)

Pomegranate is an ancient fruit from the *Punicaceae* family, often referred to as a "superfruit or miracle fruit" due to its high nutritional value, including carbohydrates, vitamins, and minerals.[3] It has been cultivated worldwide (since the northern hemisphere to the middle east)[4] and is particularly known for its cardiovascular benefits, especially in reducing excess cholesterol in the blood.[3]

Research in rats indicates that ad libitum consumption of fermented pomegranate juice for a period of 6 weeks reduces at least 48% of blood TG.[4] In another study, they found that the consumption of 250 mg/kg of weight per day for 35 days of pomegranate peel and pulp reduced TC, TG, and LDL levels and increased HDL levels.[5] On the other hand, consumption of 1 mL of fresh juice significantly reduced plasma CT and TG values, and 100 mg of seed powder consumption raised HDL, all of this was analyzed for 22 days.[6]

Studies in humans with 66 obese women who supplemented with 500 mg of pomegranate peel extract for 8 weeks found a reduction in TC and TG.[7] Likewise, in another study with 14 volunteers who consumed 300 mL/day of fresh pomegranate juice for 2 weeks, lower LDL levels were evident.[8] The use of 1 g/day for 2 weeks of pomegranate extract pill (POMx) in 12

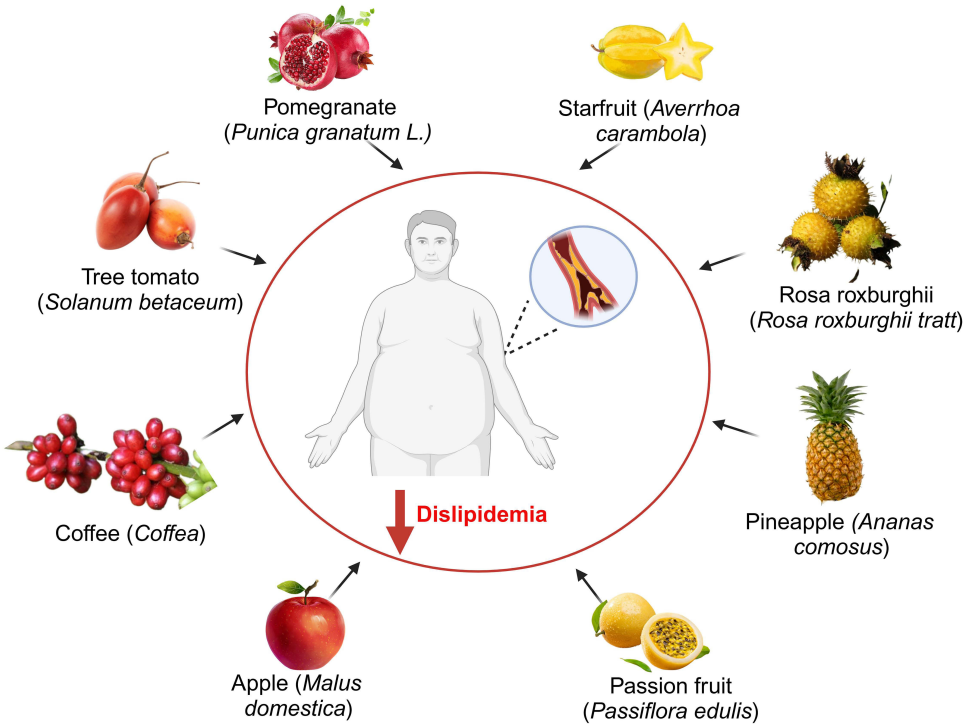


Figure 1 Fruits that prevent dyslipidemia. Created in BioRender. Flores Flores, M. (2025) https://BioRender.com/i31f701.

volunteers decreased LDL by 26%, reactive oxygen species (ROS) by up to 30%, triglycerides by up to 48%, and cholesterol by up to 44%.[9] Eleven volunteers with acute coronary syndrome used 20 g/day of microencapsulated pomegranate dissolved in 250 mL of water for 30 days, decreased triglycerides, cholesterol and LDL-c by 42%, 15% and 35% after 8 hours, respectively.[10] Twenty-two women with polycystic ovary syndrome received 45 mL/day combined with 180 mL of water, decreased triglycerides and LDL-c.[11] Sixty-six patients on hemodialysis received 100 mL of pomegranate juice 3 times a week for 1 year, and the results showed significantly higher levels of HDL and lower levels of triglycerides.[12] Thirty patients with Type 2 diabetes mellitus (T2DM) received capsules containing 250 mg twice daily per 8 weeks of potential of pomegranate peel extract (PoPEx) twice daily, the results were significant decrease in the levels of TC, LDL-C and TG and significant increase of HDL-C.[13] 51 hyperlipidemia subjects received 400 mg pomegranate seed oil (PSO) twice daily per 4 weeks, the result was non-significant increase in HDL-C concentration.[14] Twenty-two type II diabetic patients with hyperlipidemia consumed 40 g/day of concentrated pomegranate juice (CPJ) for 8 weeks, the results showed significant reductions of total cholesterol and low-density lipoprotein (LDL)-cholesterol (Figure 2).[15,16]

This reduction in dyslipidemia is thanks to the bioactive compounds contained in different parts of the pomegranate, such as[3] pomegranate juice is rich in polyphenols such as ellagitannins, anthocyanins, flavonoids, and helps modulate the intestinal microbiota with the increased probiotics,[4] and the seeds rich in conjugated fatty acids and the peel rich in ellagitannins[17,18] and the peel extract are rich in anthocyanins and tannins,[7] and the fresh juice is rich in malic acid, polyphenol and tryptophan.[6,8]

These investigations also indicated that the consumption of pomegranate in its different presentations indicated above also has effects on the reduction of body fat storage, weight reduction,[4] fatty liver, visceral and subcutaneous,[5] anti-inflammatory;[6] reduction of free radicals,[7] levels of docosahexaenoic acid (22:6n-3, DHA) in erythrocytes, slowed the development of atherosclerotic plaque in the carotid arteries and optimized stress-induced myocardial ischemia in patients with coronary artery disease.[9]

Starfruit (Averrhoa carambola)

Star fruit, family of *Oxalidaceae*, is believed to be native to Malaysia and is usually called "sweet belimbing or star fruit" being a natural source of antioxidants and vitamin C that help strengthen immunity and eliminate toxins that affect the body.[19]

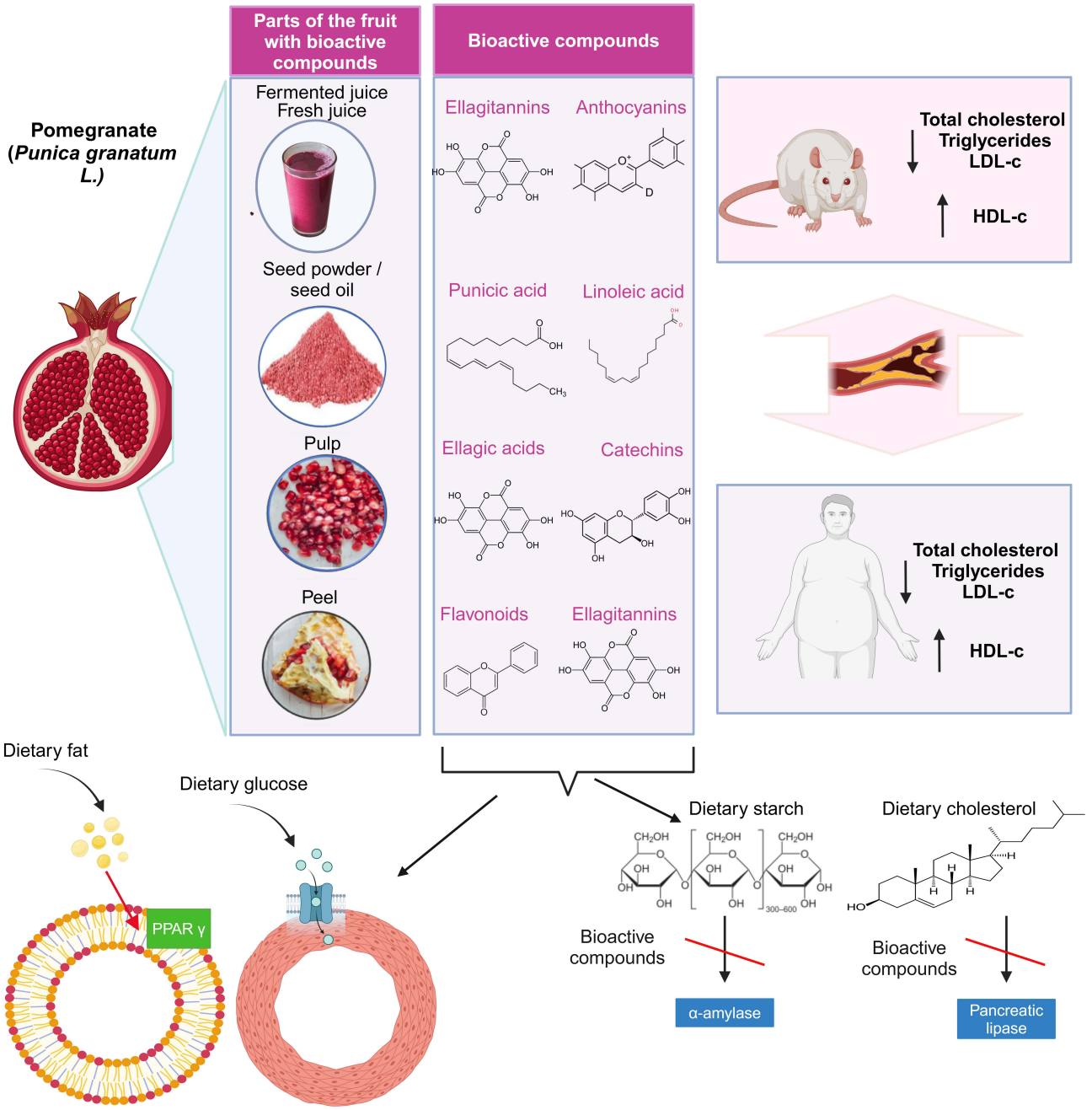


Figure 2 Bioactive compounds present in Pomegranate (*Punica granatum L.*) and their effect in vivo. Created in BioRender. Flores Flores, M. (2025) https://BioRender.com/e75a587.
Notes: Polyphenolic compounds in pomegranate juice increase the sensitivity of insulin receptors, activate γ-PPAR receptors, modulate GLUT-4 expression and thus improve glucose uptake by tissues. Pomegranate extracts can reduce glucose absorption by inhibiting enzymes such as α-amylase and pancreatic lipase.[4]

Aladeileh and Saghir[19,20] investigated the use of Star fruit leaf extract in rats, reaching the conclusion that regardless of the doses and for a period of 5 weeks, the values of TC, TG, LDL and increase of HDL. 500 mg/kg for 48 hours of ethyl acetate fractions in Star fruit leaves had a greater effect regarding CT and TG.[21] 300 mg/kg of aqueous methanol extract of the leaves for a period of 4 weeks reduced TC, TG and LDL.[22] The use of 120 mg/kg for 21 days of benzoquinone extracted from Star fruit roots reduced CT and TG levels.[23] The ad libitum use of star fruit bagasse for 30 days reduced the concentrations of TG, cholesterol and LDL in mice.[24] Also, the polyphenols from the fruit that was applied intragastrically for 14 weeks reduced the levels of CT and TG (Figure 3).[25]

The extract of Star fruit leaves is rich in ascorbic acid and phenolic compounds such as gallic acid and epicatechin,[26] while stem extracts have antioxidant effects thanks to their flavonoid content.[13,20] Star fruit bagasse is rich in insoluble fiber.[24]

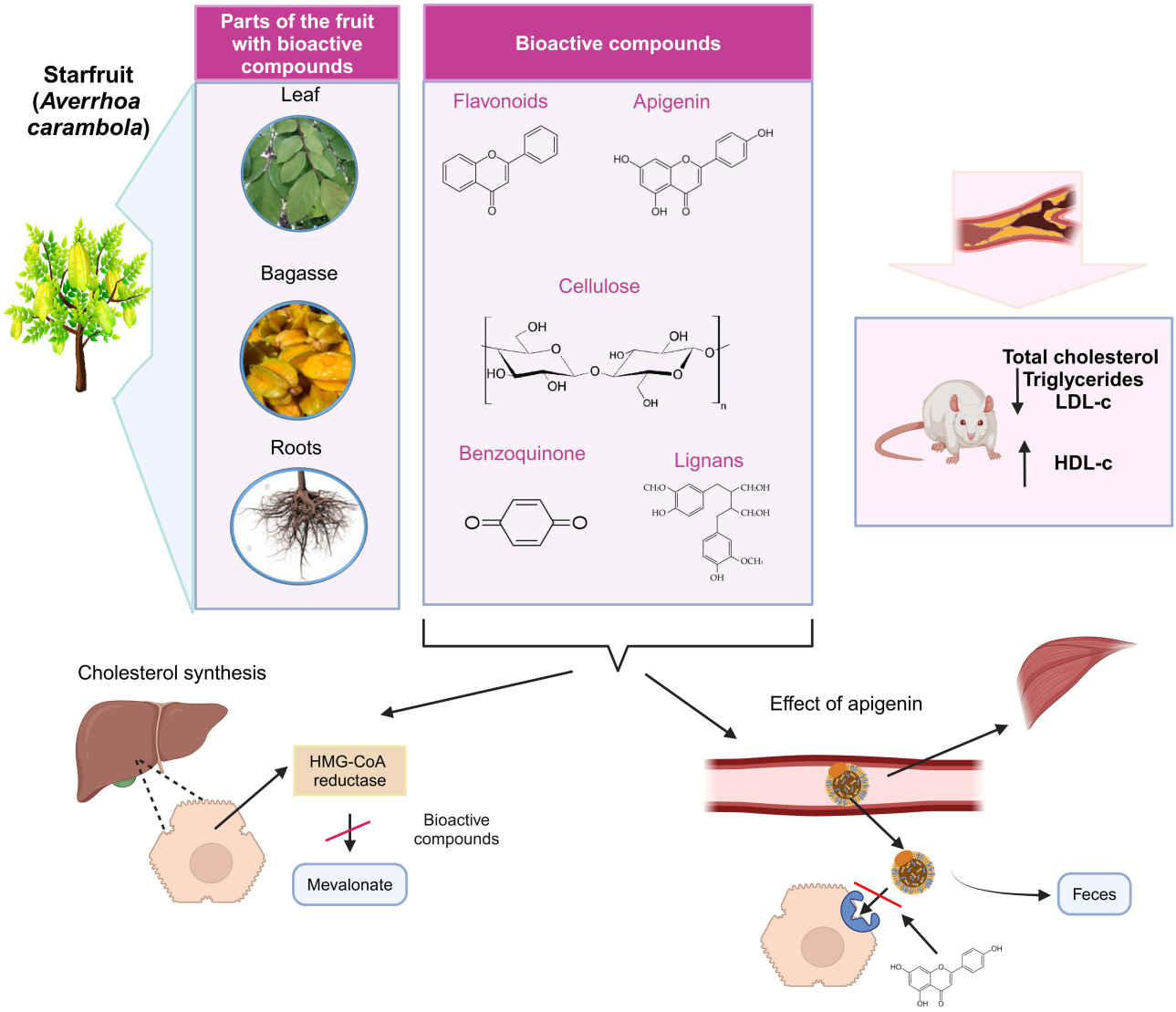


Figure 3 Bioactive compounds present in Starfruit (*Averrhoa carambola*) and their effect in vivo.BioRender. Flores Flores, M. (2025) https://BioRender.com/e75a587.
Notes: In cholesterol synthesis, HMG-CoA reductase reduces HMG-CoA to mevalonate, which is a step in cholesterol synthesis. This is where the bioactive compounds in carambola leaves inhibit the action. Apigenin stimulates the immune system, reducing plasma levels of LDL-C (which were not used) by inhibiting LDL receptors in hepatocytes and expelling cholesterol through the feces.[21]
Abbreviation: HMG-CoA, 3-hydroxy-3-methylglutaryl-coenzyme A.

This reduction in dyslipidemia is associated with the inhibitory effect of HMG-CoA (3-hydroxy-3-methylglutaryl-coenzyme A) reductase in the blood, the activation of pancreatic lipase and the antioxidant effect of GSH (L-g-glutamyl-L-cysteinyl-glycine), the enzyme superoxide dismutase (SOD) and catalase.[19,21,22]

Research affirms that the consumption of star fruit juice also has anti-inflammatory and antiulcerogenic effects, reduces body weight[19] and helps with diarrhea, vomiting, and hepatic colic.[27] While the leaves may have anti-obesity effect[22] and fruit stem have antioxidant effect.[20] On the other hand, roots are associated with the reduction of inflammatory factors because it has against tumor necrosis factor-α (TNF-α) and interleukin-6 (IL-6).[23] The insoluble fiber found in bagasse is also associated with lowering blood glucose.[22,24]

Rosa roxburghii (*Rosa roxburghii Tratt*)

The fruit of the Rosa roxburghii, family Rosaceae, grows mostly in mountains between 200 and 2500 meters above sea level and is cultivated in southwest China. Fruit rich in vitamin C, which is why it is known as the "king of vitamin C".[28]

Studies with 48 rats with dyslipidemia indicate that the use of 10%, 30% and 50% (0.1 mL/10 g of weight) of rose roxburghii fruit vinegar for 30 days decreases the levels of TC, TG and LDL and increases the HDL.[28] Likewise, the use of 125, 250 and 500 mg/kg of seed oil for 8 weeks has effects on the inhibition of the accumulation of lipids such as CT and TG.[29] 900 mg/kg/day for 8 weeks of polysaccharides isolated from fruit showed a significant decrease in TC, TG, LDL and an increase in HDL.[30] Consumption of 10 mL/kg/day for 12 weeks of fermented juice decreases the levels of TC, TG, LDL and increases HDL which are associated with beneficial intestinal bacteria.[31] 120 mg/kg of hydroalcoholic extract of the fruit for 8 weeks helped to decrease TC, TG, LDL and increase HDL.[32]

Jin et al[33] studied 100 patients with psychiatric disorders and antipsychotic-induced metabolic syndrome (MetS), of which, 50 received daily dose of 32 mg of Chiglitazar combined with *Rosa roxburghii Tratt* per 12 weeks; the results were significant decreases in triglyceride (TG) and total cholesterol (TC) levels (Figure 4).

The fermented juice and fresh juice are rich in flavonoids, polyphenols, and polysaccharides in general and rich in vitamin C.[31] Fruit vinegar is rich in acetic acid, flavonoids and total phenolics,[28] while seed oil is rich in unsaturated fatty acids, including linoleic acid, α-linolenic acid and oleic acid.[29] Likewise, the hydroalcoholic extract is rich in phenolic acid[32] and the fruit itself is rich in polysaccharides such as organic acid, triterpenes and superoxide dismutase.[30]

In vivo research indicates that the polysaccharide of rose roxburghii fruit has an antioxidant effect, which acts by reducing lipid peroxidation (LPO) and malondialdehyde (MDA), which is used as a biomarker of oxidative stress,[34] inhibiting the activity of α-D-glucosidase, decreasing the formation of glucose, which prevents postprandial blood sugar levels from rising in patients with diabetes.[35] Polysaccharides and fermented juice reduce colon bacteria such as *Firmicutes/Bacteroidetes* responsible for the risk of diabetes and dyslipidemia.[30,31] The vinegar from the rose roxburghii fruit influences weight reduction, helps improve hypertension and diabetes, and regulates intestinal flora by increasing *Akkermansia* and *Bacteroides* bacteria.[28] The seed oil also helps in increasing gene expression of fatty acid oxidation, biogenesis and mitochondrial function for the prevention of non-alcoholic fatty liver.[29] The hydroalcoholic extract also helps inhibit lipoprotein lipase and the activity of antioxidant enzymes.[32] Polyphenols of fresh juice exhibit protective effects against lung injury by decreasing inflammatory cytokine levels and affecting key metabolic pathways, highlighting their potential therapeutic role in mitigating inflammation-related complications.[33]

Pineapple (Ananas comosus)

Pineapple is a fruit that belongs to the *Bromeliaceae* family and is mostly cultivated in equatorial areas due to its medicinal properties on the health of people suffering from tumors, helps wound healing[36] and aids in digestion.[37]

Studies in rats indicate that consuming 200 mg/kg/day for 8 weeks of dehydrated pineapple pulp and fresh fruit reduced TC, TG and LDL levels.[38,39] A 15% dose of pineapple juice for 8 weeks significantly reduced TG, TC, LDL and VLDL levels and increased HDL.[40] 0.40 mg/kg of ethanolic extract of pineapple leaves for 15 days inhibits the increase in postprandial TG, TC and LDL.[41] Treatment with 20 mg/kg day of bromelain from fruit, leaves, and fruit peel for 4 weeks reduced lipid accumulation and therefore the reduction of CT and TG (Figure 5).[42]

The pineapple stem is rich in bromelain and has anticancer, anti-inflammatory, antiplatelet, antioxidant and significant weight reduction effects.[36,42] The pulp is rich in phenols, flavonoids, gallic acid, catechin, epicatechin and ferulic acid, so its contribution to health is also as an antioxidant and helps in weight reduction;[38] pineapple juice, rich in phenolic compounds such as: gallic acid, gentisic acid, isoferulic acid, vanillin, ferulic acid, sinapic acid, syringic acid and o-coumaric acid that help reduce visceral fat.[40] Phenols in pineapple leaves have effects on reducing abdominal fat, hypoglycemic and reducing fatty liver.[37]

Tree Tomato (Solanum betaceum / Cyphomandra betacea)

The tree tomato, also known as "tomatillo", "tamarillo" "Chilto", belonging to the *Solanaceae* family, is produced worldwide, as well as in Latin America. It is a highly valued fruit due to its high vitamin content and among them the phytochemicals that include anthocyanins, flavonoids, phenolic acids, ascorbic acid[43] and fiber.[44]

Studies on rats with a dose of 150, 200 and 300 mg/kg of tree tomato powder extract for 7 weeks significantly reduced the level of TG, LDL and increased HDL.[43] In another study, they used 100, 200 and 400 mg/kg/day of dried

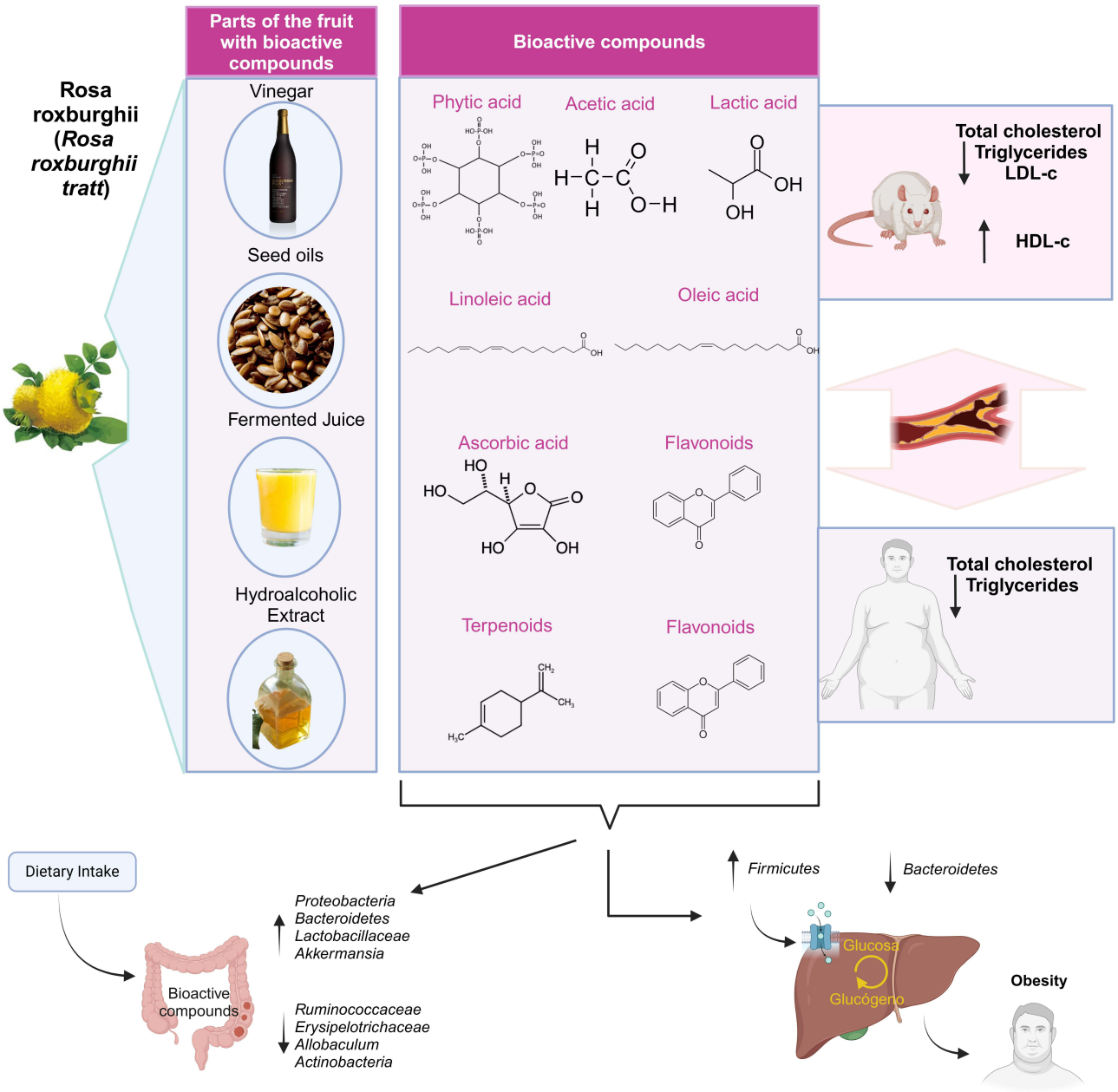


Figure 4 Bioactive compounds present in *Rosa roxburghii* (*Rosa roxburghii* tratt) and their effect in vivo. Created in BioRender. Flores Flores, M. (2025) https://BioRender.com/l71g160.

Notes: Dyslipidemia can change the intestinal microbiota and affect the reproduction of metabolites and short-chain fatty acids, leading to imbalance of the intestinal microbiota. Therefore, bioactive components decrease the bacteria that cause imbalances and increase beneficial bacteria. *Firmicutes* is more efficient with sugar metabolism than beneficial bacteria, which favors energy absorption and storage, promoting obesity.[29]

ethanol extract of the pulp for 28 days in mice exposed to cigarette smoke, resulting in the ethanol extract of tree tomato being able to prevent development of atherosclerosis due to oxidative stress.[45]

Salazar-Lugo et al[46] they studied 54 volunteers with hypercholesterolemia and hypertriglyceridemia and consumed tree tomato juice (100 g of fruit in 150 mL of water) daily for 6 weeks, the result was a significant decrease in total cholesterol and LDL (Figure 6).

The beneficial effects on health include weight reduction, increase in antioxidant enzymes, prevents postprandial hyperglycemia and has anti-inflammatory effects with the reduction of cytokines such as TNF-α and IL-6.[43] Likewise, the seed and skin of the fruit showed antioxidant activity by suppressing the generation of free radicals.[44,49] The crude

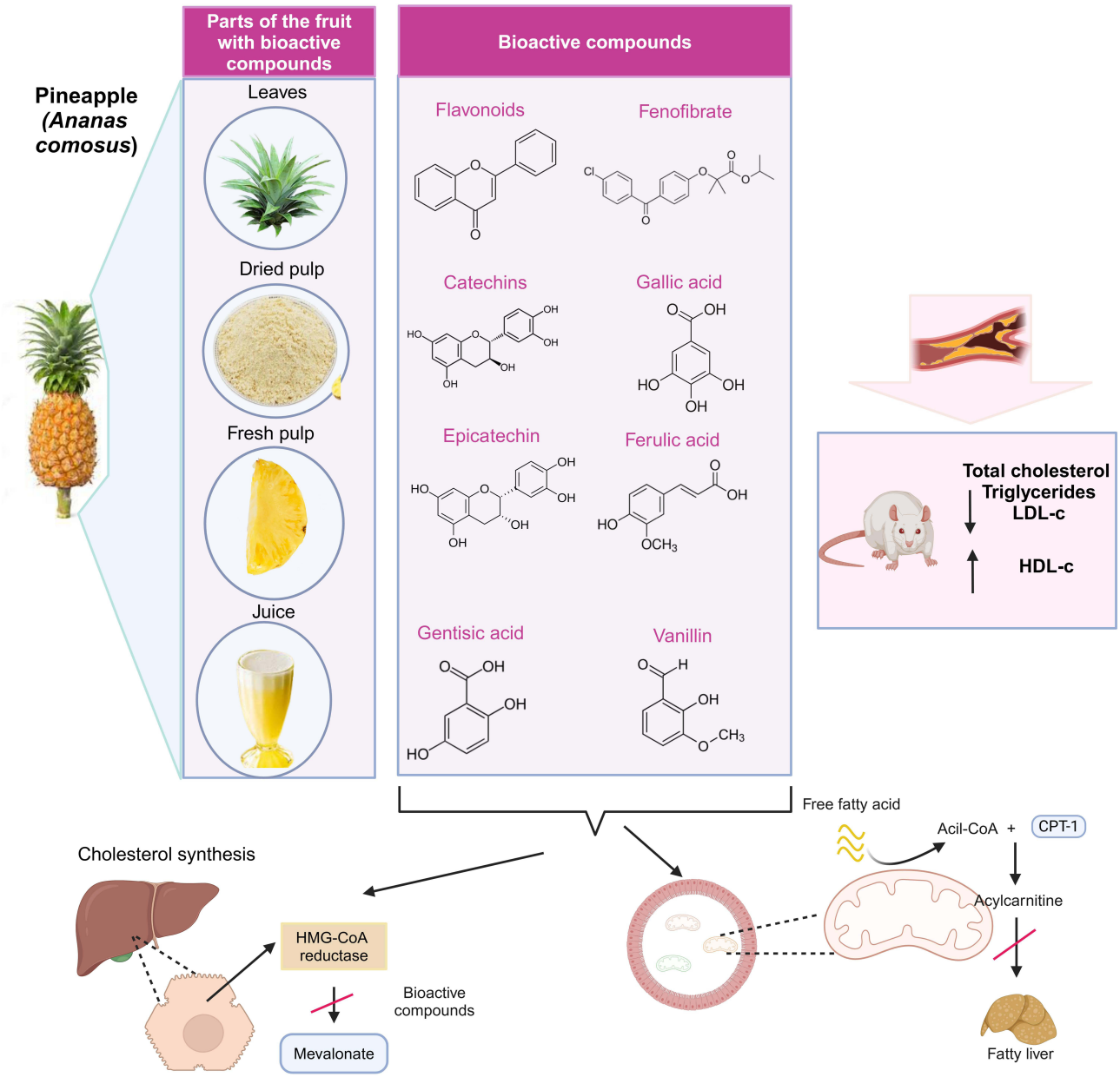


Figure 5 Bioactive compounds present in Pineapple (*Ananas comosus*) and their effect in vivo. Created in BioRender. Flores Flores, M. (2025) https://BioRender.com/r70d826.

Notes: By inhibiting HMG CoA reductase, statins reduce cholesterol synthesis in the liver. Carnitine palmitoyl transferase I (CPT-1) converts long-chain fatty acyl-CoA molecules into their corresponding acylcarnitine molecules, which is associated with the inhibition of fatty liver formation.[37]

extract of tree tomato inhibits the activity of the enzyme α-glucosidase,[47] α-amylase and lipase, and enzymes that are related to metabolic syndrome.[48]

The skin, pulp and seeds of the fruit are rich in fiber, total phenolics, anthocyanins, carotenoids, ascorbic acid,[44,47,49] condensed and hydrolyzable tannins,[50] rosmarinic acid and caffeic acid.[51]

Coffee (Coffea)

Coffee is one of the most consumed beverages worldwide due to its unique flavour and the role it plays in social gatherings; it belongs to the family *Rubiaceae*, subfamily *Cinchonoideae* and tribe *Coffeae* and to the genus *Coffea*.[52] The pulp and skin of coffee stands out for its content of polyphenols and flavonoids such as chlorogenic acid (CGA),

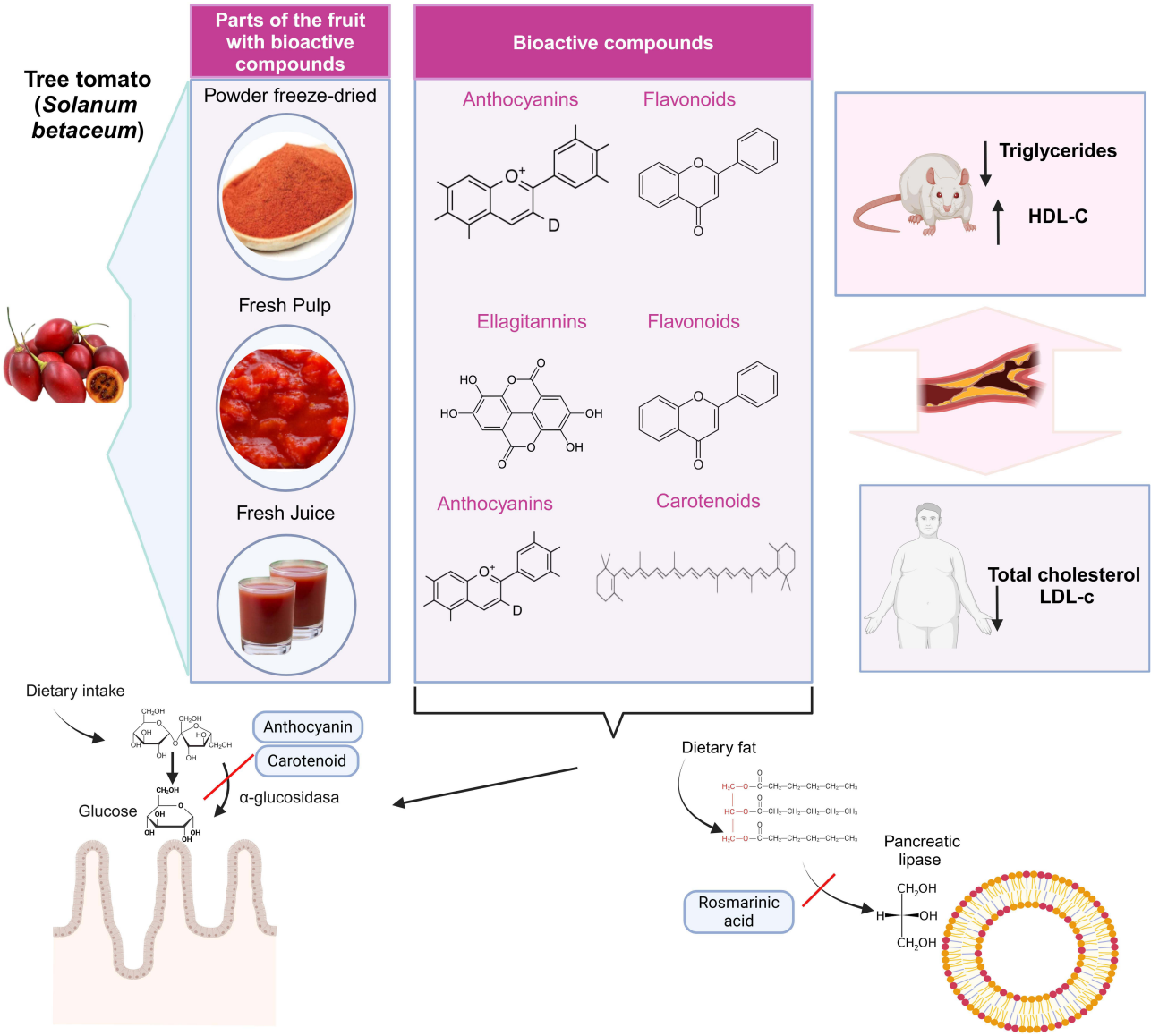


Figure 6 Bioactive compounds present in Tree tomato (*Solanum betaceum*) and their effect in vivo. Created in BioRender. Flores Flores, M. (2025) https://BioRender.com/t90c849.

Notes: Anthocyanin and carotenoid compounds have an antidiabetic effect by inhibiting α-glucosidase, which lowers blood sugar and increases insulin secretion.[47] On the other hand, the inhibition of pancreatic lipase reduces the absorption of fatty acids by cells, reducing the increase in triglycerides.[48]

caffeine, catechin, epicatechin, chlorogenic acid, rutin and some β-carotenes.[53,54] In addition, it is widely used in the food industry in the preparation of juices, jellies, jams and some alcoholic beverages.[53]

Studies with rats used 1000 mg/kg for 12 weeks, after which time it was shown that coffee pulp reduced cholesterol transport by inhibiting intestinal absorption of cholesterol and reducing weight gain.[55] The combined extract (comprising cocoa, coffee, green tea and garcinia; CCGG) in 40 male hamsters for 6 weeks in doses of 311 mg/kg/d, 622 mg/kg/d, 1555 mg/kg/d decreased significantly LDL-C, total cholesterol and triglycerides.[56]

In a study where 112 participants drank 3 to 5 cups of coffee for 8 weeks, they found that after days 36 and 92, patients decreased cholesterol and LDL levels.[57] In another study, 30 volunteers received 28 g/day of coffee pulp juice for 8 weeks, where it was found to decrease cholesterol and LDL levels.[53] Twenty-seven hypercholesterolemia men and women consumed three times a day a 2 g serving of the coffee blend dissolved in 200 mL of hot water, the result was a significant reduction of triglyceride levels was observed (Figure 7).[58]

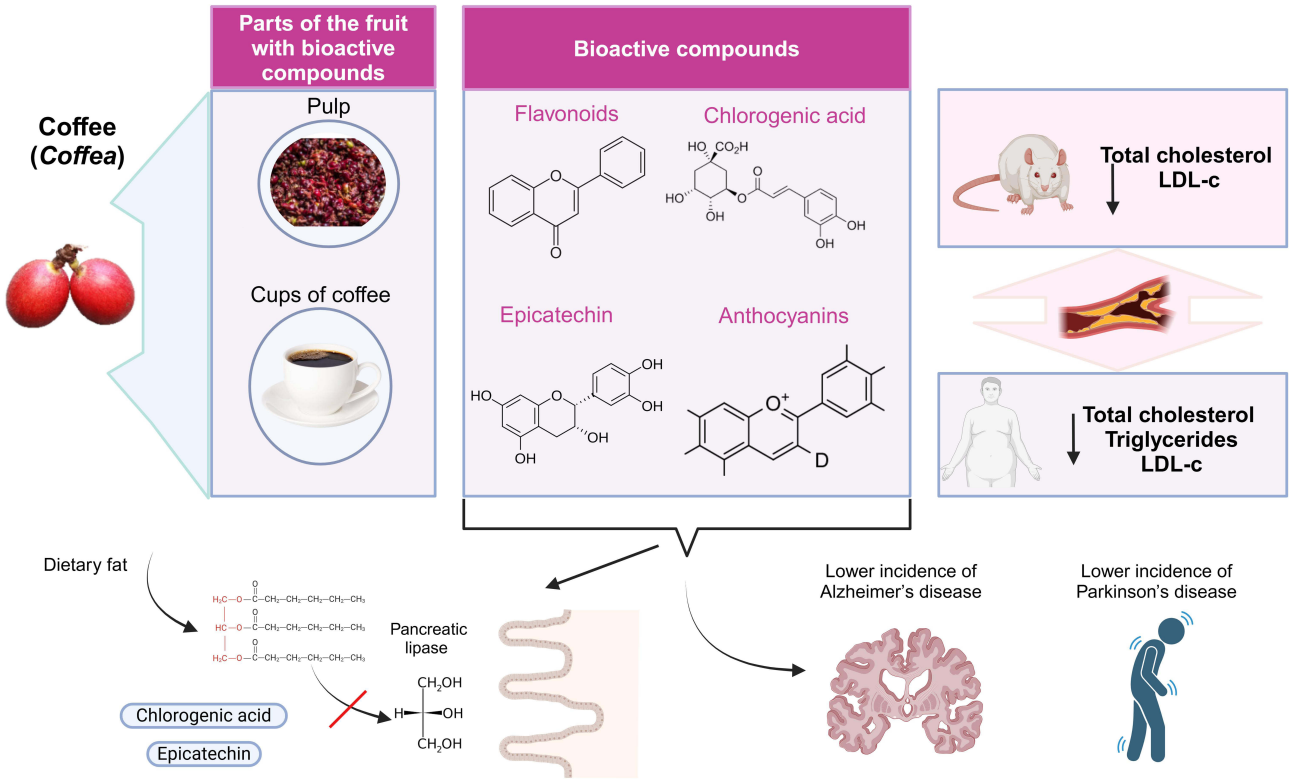


Figure 7 Bioactive compounds present in Coffee (*Coffea*) and their effect in vivo. Created in BioRender. Flores Flores, M. (2025) https://BioRender.com/o96y523.
Notes: The mechanisms of lipid control are probably through the inhibition of intestinal cholesterol absorption and the antioxidant effects of polyphenols such as chlorogenic acid (CGA), epicatechin (EC).[53] Additionally, there is evidence linking coffee to a decreased risk of Parkinson's and Alzheimer's diseases.[57]

Among the health benefits, it is found to be the greatest source with antioxidant capacity, cholesterol reduction, anti-inflammatory, diseases that reduce cognitive function,[53] and prevention of hepatic steatosis, insulin resistance,[59] protects against reactive oxygen radicals, reduces the levels of glycosylated hemoglobin (HbA1c),[57] prevents cancer and degenerative diseases, aging[60] and reduces the risk of suffering from diabetes mellitus.[61] In other research, it is highlighted that coffee pulp reduces blood glucose, lipid peroxidation, and increases hepatic, renal and cardiac glutathione values. Likewise, it promotes the activity of catalase, glutathione peroxidase and superoxide dismutase in rats induced to diabetes.[55]

Apple (Malus domestica)

The apple is the most consumed fruit worldwide, it belongs to the *Rosaceae* family. They are rich in anthocyanins and low in calories.[51,62] Likewise, the peel is rich in flavonoids (quercetin), polyphenols[63] and pectin, a bioactive component of the cell wall that has an effect against cholesterol.[64]

Studies with rats showed that ingesting 114 mg/kg of apple peel extract for 30 days reduces LDL levels and increases HDL.[63] The use of 20% of the feed weight with sun-dried apple peels for 43 days significantly reduced triglyceridemia levels[65] and where 600–900 mg/kg of polyphenolic apple peel extract was used for 8 weeks, increased HDL levels and decreased TC, TG and LDL.[66] Using 15 mL/kg of apple juice for 21 days decreased levels of TC, TG, LDL and increased HDL.[67] Forty male Wistar rats received Apple cider vinegar (6 g vinegar/100 g animal food) for 4 weeks, the result was 47% reduction in LDL-c levels and 34% increase in HDL-c levels.

Study in 23 healthy human patients, it was confirmed that consuming 550 g/day of whole apples and 22 g/day of apple pulp for 4–5 weeks reduces TC and LDL levels.[64] Seventy participants with hyperlipidemia and type 2 diabetes received 20 mL apple vinegar per day using an 8-week, the result showed decreased the dyslipidemia (Figure 8).[68]

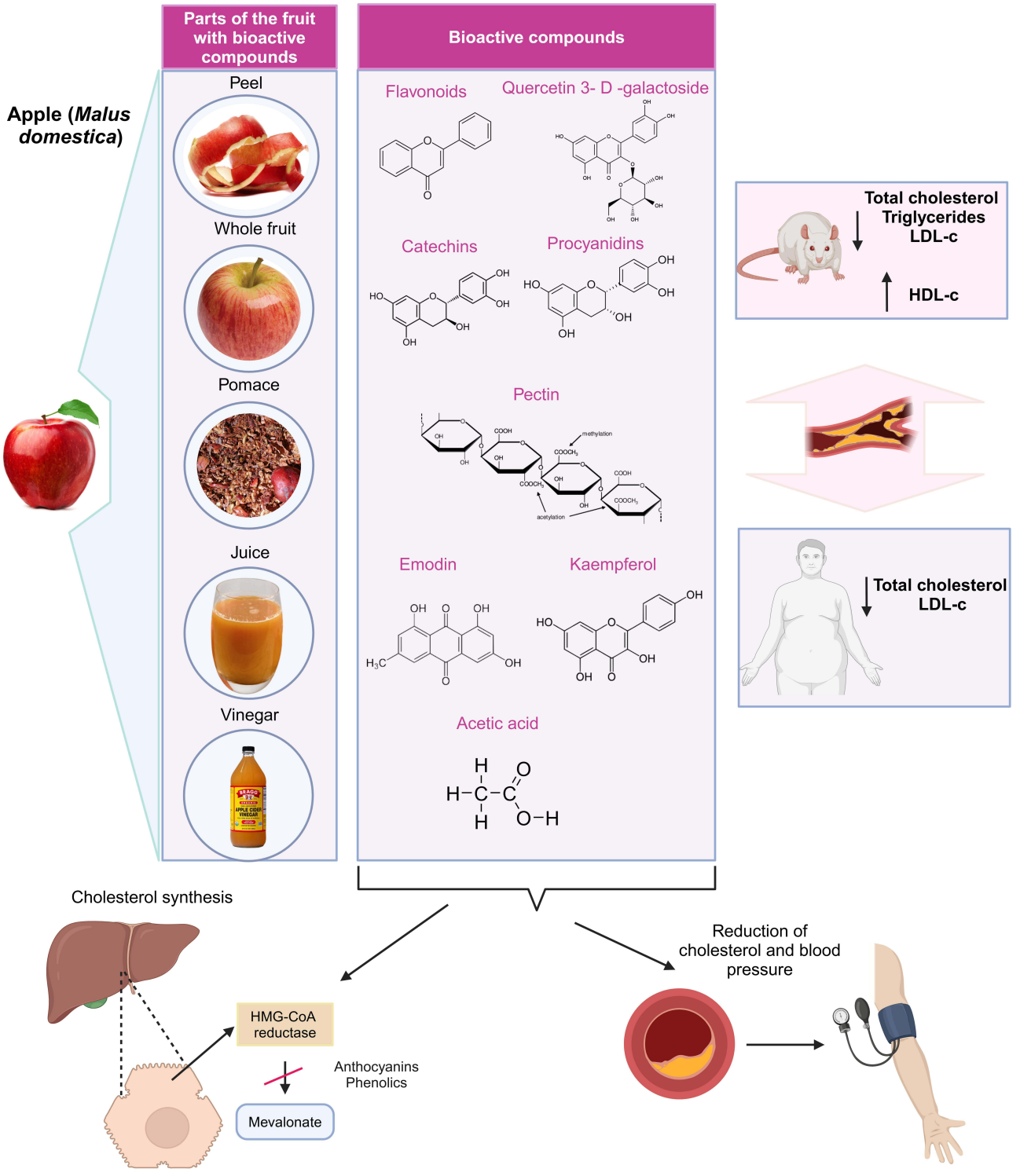


Figure 8 Bioactive compounds present in Apple (*Malus domestica*) and their effect in vivo. Created in BioRender. Flores Flores, M. (2025) https://BioRender.com/t54q725.
Notes: HMG-CoA reductase (HMG) inhibits cholesterol biosynthesis in the liver before the synthesis of mevalonate.[63] It also has an impact on reducing high blood pressure caused by increased cholesterol or triglycerides.[62]

Its health effects are antioxidant, anti-obesity, anti-hyperlipidemic activity, prevention of metabolic syndrome,[62,63] lower risk of death from cerebrovascular disease[69] and changes in the intestinal microbiota of rats that consumed whole apples.[70] In addition, apple peels have an effect against high blood glucose and insulin levels[65] and a decrease

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in serum biomarkers of inflammation such as IL-6, IL-8 and TNF-α, an effect against cancer and gastrointestinal protection,[67] the source of acetic acid and phytochemicals (apple vinegar), can improve glycemic indices and reduce starch digestion.[68]

Passion Fruit (Passiflora edulis)

Passiflora edulis, commonly referred to as passion fruit or egg fruit, is indigenous to Brazil and a member of the *Passifloraceae* family of passion flowers. Grown in tropical and subtropical climates, it is a perennial herbaceous vine.[71]

Passion fruit oils reduce triglyceride, total cholesterol, and low-density lipoprotein cholesterol content in cells (Pancreatic lipase and Cholesterol esterase).[71] Seven obese male *db/db* mice received 7 g of bark of Passiflora edulis (BPe) kg of chow corresponding to 1.5 g/kg of body weight for 8 weeks, the result showed reduction of triglycerides and total cholesterol.[72] Fifteen offspring from treated nondiabetic dams rats and 15 offspring from treated diabetic dams rats consumed at a dose of 0.58 g/kg once a day (early morning) for 30 consecutive days of passion fruit juice (oral gavage), the result showed significantly reduced low-density lipoprotein cholesterol levels, total cholesterol triglyceride and increased high-density lipoprotein cholesterol level.[73] Groups of 6 to 13 Male Wistar rats was induced diabetes and treated with pectin daily for 5 days (0.5–25 mg/kg orally), and the result was pectin decreased triglyceride levels in diabetic rats.[74] Eight rats induced hyperlipidemic consumed 4.2 mL/200gBB/day of purple passion juice for 14 days, the result was a significant decrease in triglyceride levels.[75]

In other study, 43 adults with dyslipidemia consumed 300 mL jelly drink containing polyphenol-rich roselle calyces extract and passion fruit juice with pulp concentrate (RP jelly drink) for 8 weeks of intervention; results showed a significant decrease in LDL-C and TG, respectively.[76] Twenty participants with dyslipidemia received 250 mL/day of yellow passion fruit peel juice for 15 days, the result show that HDL level was increased and LDL level decreased.[77] Eighteen patients with HIV lipodystrophy consumed 30 g of passion fruit peel flour daily for 90 days and diet therapy counseling, and the result was effective in reducing total cholesterol, triacylglycerides, LDL-C and HDL-C increased (Figure 9).[78]

Another diseases that passion fruit can help are anxiolytic, antioxidant, antibacterial, antitumor, anti-inflammatory, hypolipidemic properties,[71] epilepsy, headache, abdominal pain, diabetes mellitus,[73] fruit peel in cases of asthma,[75] reduction of malondialdehyde (MDA) and tumor necrosis factor- (TNF-).[76] Also, can be helping to reduce the obesity and complications in target organs such as liver, heart and kidney.[72]

Passion fruit seed oils are rich in unsaturated fatty acids (linoleic acid, C18:2), lipid-soluble acids, vitamin E, β-carotene, proteins, minerals, polyphenols, flavonoids, lipids[71] and vitamin C. On the other hand, passionflower bark flour (Passiflora edulis) is rich in pectin, a soluble fiber, able to form a gel.[72] The pulp is composed of polyphenols, alkaloids, flavonoids, tocopherols, carotenoids and ascorbic acid.[76]

Conclusion

This review gives an overview of the benefit of fresh fruits and their various parts as an alternative for reducing dyslipidemia, as well as for the benefit of other types of diseases related to diet, such as the case of some tumors, types of cancer, diarrhea, cardiovascular diseases, diabetes, etc. It should be noted that among the components that are mostly related to the reduction of free radicals, which prevents lipid peroxidation, are phenolic compounds such as anthocyanins, flavonoids and tannins, which fulfill a powerful antioxidant function. On the other hand, this benefit of reducing dyslipidemia is not only provided by soluble fiber (which we usually find in the edible and inedible parts of fruits) but also by polyphenols such as anthocyanins, thiamine and oils found in the seeds of fruits. The various parts of fruits such as leaves, stems, peels, pulp and seeds are used as prebiotics, which can increase beneficial bacteria, which by producing short-chain fatty acids also fulfill the function of preventing dyslipidemia, among other benefits.

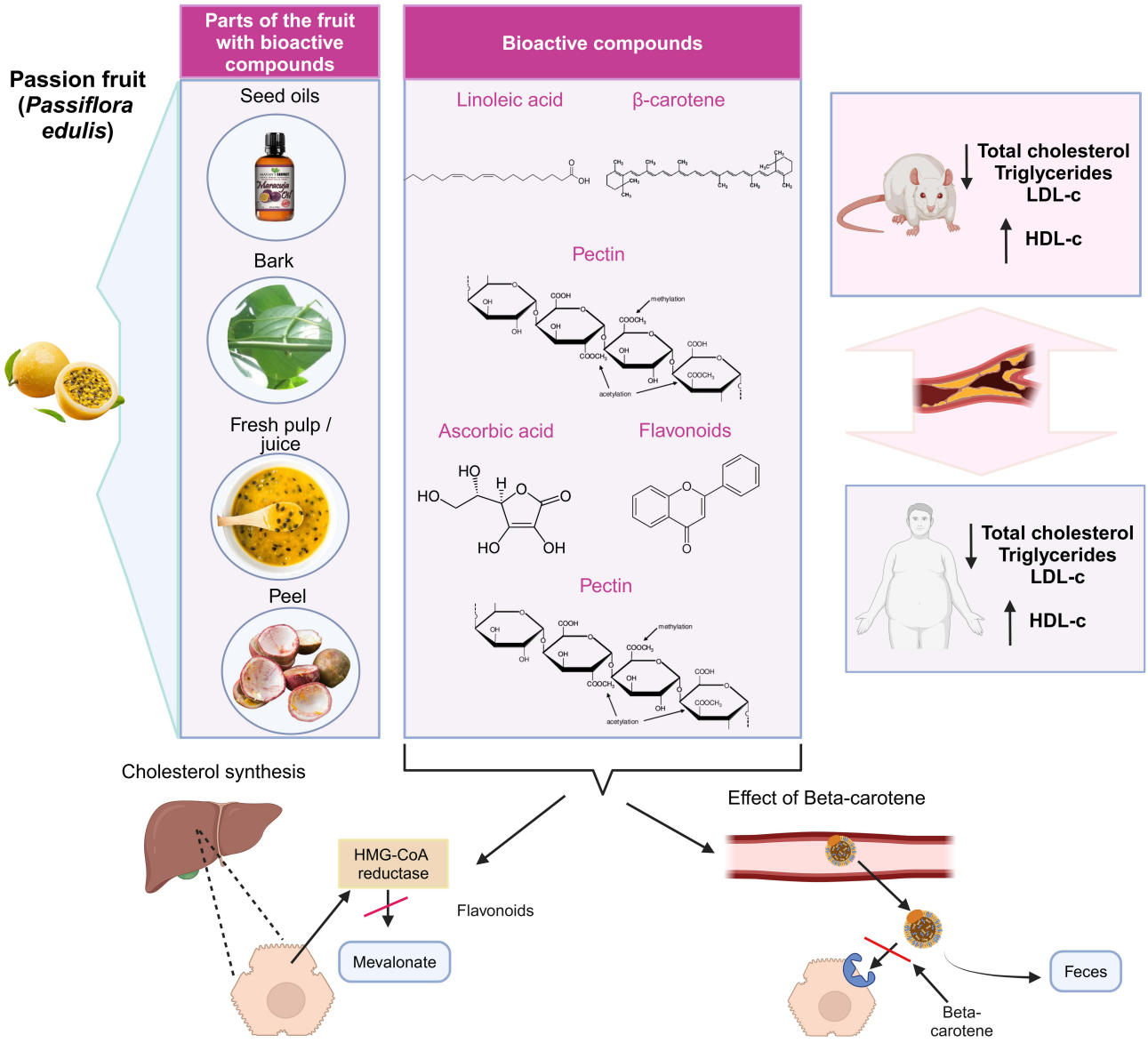

Figure 9 Bioactive compounds present in Passion fruit (*Passiflora edulis*) and their effect in vivo. Created in BioRender. Flores flores, M. (2025) https://BioRender.com/u41t501.

Notes: Flavonoids can enhance the conversion of cholesterol into bile acids and restrict its absorption, lowering blood cholesterol levels. Beta-carotene can enhance the elimination of cholesterol through feces and decrease its absorption in the intestines. In the colon, this fiber will ferment and transform into short-chain fatty acids. It can make the intestinal contents more viscous, which will cause the cholesterol from the bile salts to be expelled in the feces.[71]

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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