

Review

Red Color Foods in Heart Health

Nabia Ijaz¹, Sania Saeed², Sidra Khalid^{3*}, Syeda Mahnoor Sajjad⁴, Umme-Qadar⁵, Iqra Zubair⁶, Naiha Tariq⁷, Rafia Ayub⁸, Rimsha Shabbir⁹, Fatima Naveed¹⁰, Ayesha Wahid¹¹, Tehreem Shahzadi¹², Syeda Zahra Aftab¹²

Abstract

^{1,2,4-12}Student Of Doctor Of Dietetics And Nutritional Sciences, at University Institute of diet and nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore, (Lahore, Pakistan)

³Senior Lecturer at University Institute of diet and nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore, (Lahore, Pakistan)

^{1,2,3,4,5,6,7,8,9,10,11,12}University Institute of Diet and Nutrition Sciences, Faculty of Allied Health Sciences, The University of Lahore

*Corresponding Author's E-mail:
sidrakhalid.uaf@gmail.com

Red color foods and their impact on human health are always positive and beneficial. Lycopene is a carotenoid fight against cancer and cardiovascular diseases (CVD) while citrulline lowers the hypertension. Strawberries have a photochemical fight against hyperglycemia and dyslipidemia. The outcomes of sweet fruits as wellbeing promoters, especially their antimicrobial, cell reinforcement, anti diabetic, anticancer, hostile to neuro-degeneration, mitigating and cardiovascular effects is described in this study. Cherries as an antioxidant have blood cancer prevention agent capacity. Cherry-advanced weight control plans additionally diminished “greasy liver” or triglyceride and cholesterol gathering inside the liver. This organic product shows antibacterial, mitigating, antiviral, and against cancer-causing activities. Pomegranate counteracts diabetes, dental conditions, male erection, brokenness, bacterial contaminations, anti-infection obstruction, and skin harm brought about by bright. Aftereffects of a creature study demonstrated that both lycopene and tomato powder supplementation given independently were similarly successful and advantageous in lessening provocative and metabolic issues that happen with a high-fat eating routine. Strawberries are a rich wellspring of anthocyanin. An investigation on humans show drink of strawberry diminished feast evoked postprandial irritation as estimated by high-affectability C-receptive protein (hs-CRP) and IL-6, notwithstanding lessening postprandial insulin reaction. Solidified strawberries refreshment seems to have a calming reaction. Beet root contains contingents, a rich compound in decreasing irritation, oxidative pressure and dyslipidemia. Various constituents in red-hued nourishments may help in lessening foundational irritation and fortifying safe status by diminishing diseases.

Key words: CVD, Diet, Education, Intervention, Knowledge

INTRODUCTION

CVD is led to by disarrangement of the center and veins and incorporates coronary malady (CHD), vessel upset, fringe course upset, rheumatic coronary malady, and inherent coronary malady. Atherosclerosis is an interminable provocative ailment brought about by plaque burst or disintegration, which prompts intense development of platelet-rich thrombi that block or halfway impede the blood vessel lumen and causes CVD clinical

occasions, for example, myocardial localized necrosis, insecure angina, or cerebrovascular mishap. Conduct hazard factors, for example, smoking, absence of physical inertia, and an undesirable eating routine record for the reason for CVD. Conduct hazard variables may speedily prompt middle hazard components of creating CVD, including stoutness, just as raised circulatory strain, glucose, and lipid levels (Wallace et al., 2011).

Table 1. Cardio-protective effects of red color fruits

Red colored foods	Food sources	Phytonutrients	Heart-health benefits
	Tomato, Strawberries, Oranges, Raspberries, Cherries, Red apples, Beets, Pomegranate, Cranberries and Red peppers	Anthocyanins, Carotenoids, Lycopene and Flavones	Reduces inflammation, Improves lipid markers, Lowers blood pressure and Protects from oxidative damage

Anthocyanin are water-dissolvable colors having a place with the phenolic gathering. The shades are in glycosylated structures. Anthocyanin liable for the hues, red, purple, and blue, is in products of the soil. Berries, currants, grapes, and some tropical natural products have high anthocyanin content (Khoo et al., 2017). Carotenoids (explicitly lycopene), anthocyanin, and betacyanins are traditional red shades found in foods grown from the bottom. They need cell reinforcement properties helpful within the anticipation of malignant growth and vas diseases. medical specialty examines propose that swollen utilization of anthocyanin brings down the danger of vas illness, the foremost widely known reason for mortality among men and girls enhancing the assimilation of anthocyanin and describing their metabolic and to boot breakdown things are necessary to eventually assess their utilization for insurance/counteraction against the advancement of CVD (Leong et al., 2018). It a strong cell reinforcement limit and offers a range of medical blessings, for instance, transportation down the danger of heart sicknesses and specific types of tumors, rising the resistant framework, and security from age-related macular degeneration—the main supply of irreversible visual disorder among grown-ups (Gul et al., 2015).

Benefits of red color foods in heart health

Pomegranate

Pomegranate cell reinforcements aren't free, however are connected to the pomegranate sugars, and thus were demonstrated to be gainful even in diabetic patients (Aviram et al., 2013). Pomegranate centers around malignancy treatment and counteraction, issue, diabetes, dental conditions, male erection brokenness, bacterial contaminations, anti-infection obstruction, and skin harm brought about by bright. Baby cerebral ischemia, male fruitlessness, Alzheimer's malady, diabetes, and weight are other conceivable conditions (Mohammad et al., 2012).

In examinations have incontestable that puniic

destructive, a type of conjugated radical destructive and on these lines the fundamental constituent of pomegranate seed oil (PSO), has against atherogenic effects (Mirmiran et al., 2010). Pomegranate is to disturbed your heart (Ledyard et al., 2012).

The pomegranate advertises enthusiastically red natural products with significant levels of cancer prevention agents. Thus, concentrates on the results of worldwide environmental change and water quality on pomegranate anthocyanin and phenolic fixation is amazingly meaningful (Borochoy et al., 2013). Table 1

Pomegranate fruit exhibits therapeutic properties and helps to fight against certain diseases such as cancer, cardiovascular, diabetes and infertility. The pomegranate juice contains antioxidant potential which is more than green tea and red wine which stimulate over hydrosable tannins. The pomegranate juice may be a wealthy supply of aldohexose fruit sugar and saccharides. It conjointly contains very little quantity of amino acids (Lansky et al., 2007).

The peel of pomegranate is also very effective for us. Peel is rich in polyphenols that shows pharmacological potential of pomegranate caused by ant oxidative and preservative activities (Newman et al., 2007).

By drinking pomegranate juice can help to boost your immunity so it is very beneficial to remove toxins from your body. The juice of pomegranate is made of antioxidants and consists of high quality vitamins A and C that is beneficial for your bones and eyesight. It can reduce inflammation through our body and kills oxidative stress and damage (Adhami et al., 2009).

The products of pomegranate are among the most hopeful dietary supplements. Whereas all pomegranate-derived materials offer a bigger or lesser variety to the malignant neoplasm results of pomegranate (Seeram et al., 2005) Figure 1.

Tomatoes

Tomatoes are utilized in many took care of things like tomato and pasta sauce, tomato soup, ketchup, and ingredient (Nasir et al., 2015). Lycopene is a basic

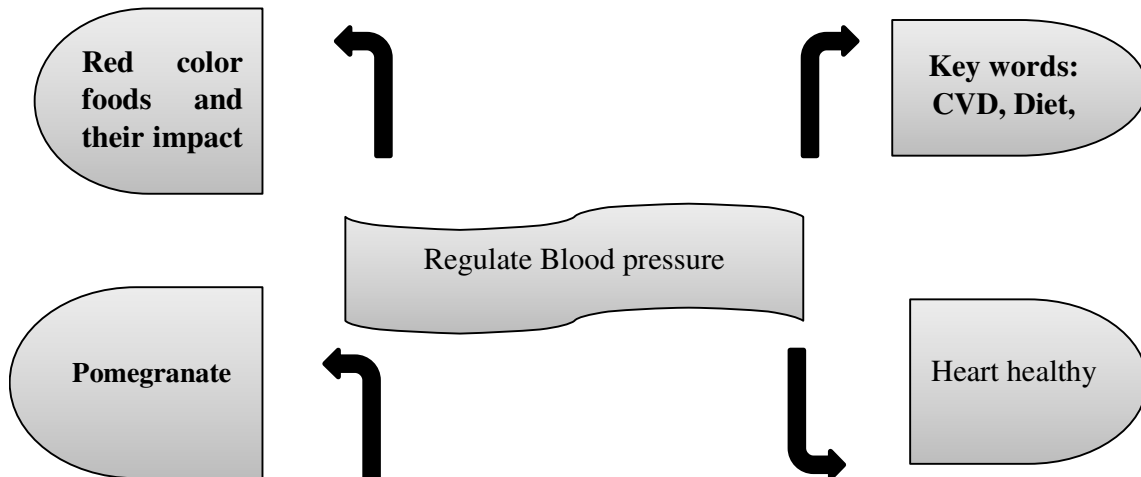


Figure 1. Cardio-protective effects of pomegranate

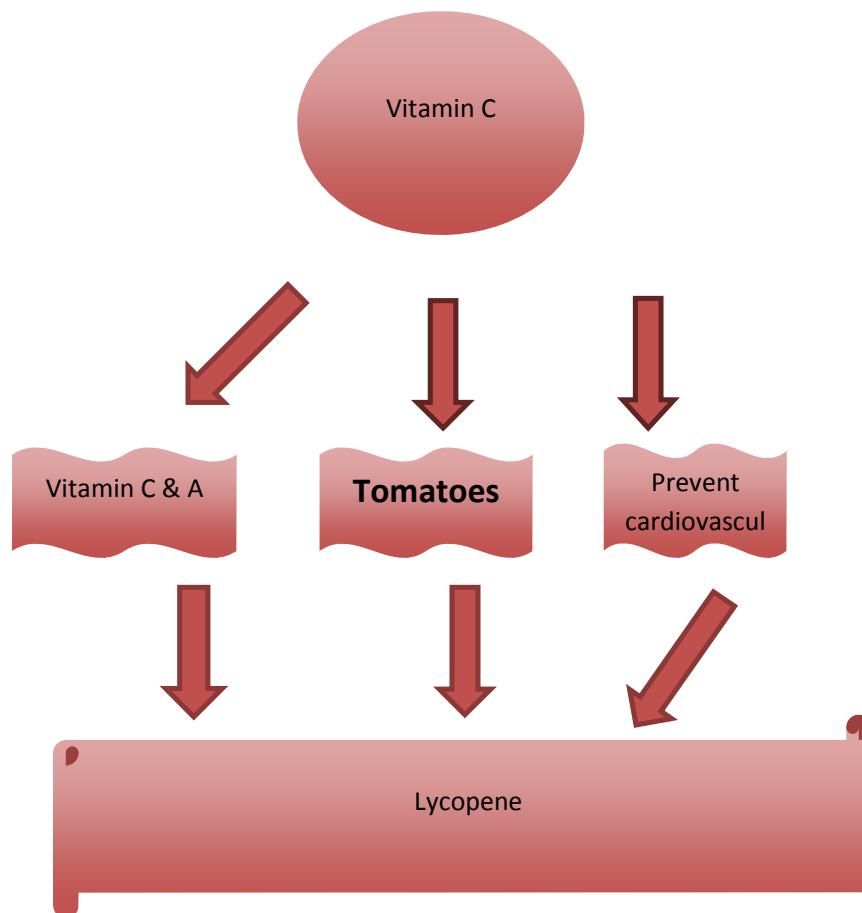


Figure 2. Cardio-protective effects of tomato

carotenoid found in tomatoes that has started late and got thought for its latent capacity work in thwarting distinctive degenerative ailments in individuals.

Tomatoes and their form focuses on their bioavailability, bioactivity, and frameworks of action

against dangerous development cells and option gainful bioactivities just as against microbial, alleviating, antagonistic to aerophilic, vas, and secure recharging impacts in cells, animals, and humans (Friedman et al., 2013). The relationship between carotenoid affirmation

and thus the speed of CVD is backwards (Jacques et al., 2013).

Dietary confirmation of tomatoes and tomato things containing carotenoid has been incontestable to be associated with decreased peril of endless infections like tumors and vas diseases (Ray et al., 2011). Whereby, carotenoid or its metabolites zone unit is incontestable to have natural development in humans (Story et al., 2010).

Tomato reactions contain a sublime kind of naturally powerful substances, principally carotenoid, that region unit showed by in vitro and in vivo assessments to have malignant growth obstruction operator, hypolipidemic, and pismire disease exercises (Viuda-Martos et al., 2014) Figure 2.

Red Bell Peppers

Red bell peppers consist of so many antioxidants that one red bell pepper has three times the vitamin C as an orange. Besides, it includes heart-healthy fiber, which can help keep a check on cholesterol (Nadeem et al., 2011).

Red Delicious Apples

The Red apple is a characteristic vitality promoter that comprises nutrient C just as potassium, it's a mineral which assists control with blood pressure and decreases the danger of stroke (Budak et al., 2011). The apple is likewise a high wellspring of gelatin, which forestalls cholesterol to develop and furthermore diminishes the danger of coronary illness. Apple is accessible all year, making it the ideal regular nibble food (Barbosa et al., 2010; Ezra et al., 2015).

Watermelon

Watermelon is an incredible wellspring of lycopene. Lycopene may diminish the danger of coronary illness by diminishing LDL cholesterol which is the awful cholesterol (Hong et al., 2015). And it diminishes the hazard for specific tumors, mostly prostate, just as the danger of macular degeneration. It additionally improves capacity of vein and brings down danger of stroke (Hong et al., 2018). We get it in season around May through September, however accessible year-round (Abu-Hiamed et al., 2018).

Cherries

Cherry – expanded utilization regimens essentially cut down plasma lipid and complete cholesterol, forbearance aldohexose and hormone, and a plasma marker of

oxygen consuming hurt, while a tiny bit at a time expanding high-thickness lipoproteins (HDL-the "solid" cholesterol) and incredibly expanding blood disease block specialist capacity. The cherry-propelled weight the board intends to boot reduced "greasy liver" or lipid and cholesterol assembling inside the liver (Reiter) of these prepared organic products have potential clinical endowments to help fight vigorous weight, decline provocative response, change glucose and improve abstract performance. Unpleasant natural products supplementation outstandingly, has been represented to take in mending from compute induced muscle hurt (Blando et al., 2019).

Tart cherries are likewise one of the chief copious regular wellsprings of melatonin, and devouring them has been found to fortify rest. A portion of these mixes can balance vascular cells in vitro – which have made researchers wonder if adding natural product like tart fruits to the eating regimen could bring down imperative sign through its consequences for our veins. As we've talked about high crucial sign might be an inescapable medical problem, influencing upwards of 1 of every 3 grown-ups inside the US. So there's a lot of premium discovery approaches to influence it by means of lifestyle (Grigoras et al., 2012).

Cherry organic products are plentiful in nutrients and minerals, and it's one among the common sources which will flex the body with bounteous measures of potassium and energy (Alshawwa et al., 2020). The usage of pomegranate natural products dates from past and reports of its remedial characteristics have resounded all through the ages. Both in vitro and in vivo examinations have exhibited how this organic product goes about as cell reinforcement, ant diabetic, and hypolipidemic and shows antibacterial, mitigating, antiviral, and against cancer-causing activities (Viuda-Martos et al., 2010).

Strawberries

They are a legitimate wellspring of characteristic cancer prevention agents and cell reinforcement catalysts which give assurance against unsafe free radicals and assume a significant job in ensuring human wellbeing. Eating more foods grown from the ground including strawberries has been related with lower frequency and death paces of malignancy, heart condition and assortment of other human diseases (Wang et al., 2012). Strawberries are another compost wealthy in bioactive phytochemical (Giampieri et al., 2012), especially flavonoids, that there's expanding proof of points of interest on cardio metabolic hazard that are connected to their intense cell reinforcement power (Ros et al., 2010).

The berry type and their one of a kind metabolite profiles may mean explicit medical advantages remembering enhancements for blood lipid profiles, sign, insulin affectability, memory and portability in more

seasoned grown-ups, disease assurance, and joint pain based illnesses. Similarly, the job of berries in gut wellbeing is quickly developing demonstrating changes in gut microbial organization and performance (Seeram et al., 2018). Strawberries are accounted for to downsize cardiovascular hazard factors, similar to raised sign, hyperglycemia, dyslipidemia, and irritation in restricted studies (Basu et al., 2010). The constituent enhancements and bioactive food fragments support the potential preventive health advantages of cherry confirmation on threatening development, diabetes, provocative sicknesses, and Alzheimer's (McCune et al., 2010). The results of sweet organic products are also being advertised, especially their antimicrobial, cell fortification, pismire diabetic, anticancer, antagonistic to neurodegeneration, moderating and vessel impacts (Gonçalves et al., 2019).

Raspberry

Raspberry confirmation, at some that might be practiced by human use, may ensure against diabetes-incited aerophilous weight and heart wellbeing (Noratto et al., 2017). It offers confirmation against polygenic turmoil, vas disease and distinctive symptoms (Lin et al., 2019).

Raspberries are high in fiber, that assists with bringing down degrees of beta-lipoprotein (LDL) or called 'bad' steroid liquor. We will in general catch on in season around August through mid-October, anyway available all year. These are sweet berries that are made in heart solid fiber; basically a cup conveys four grams. Thirty one Raspberries are low in fat and have elevated levels of polyphenols, which encourage reducing danger of cardiopathy (Burton-Freeman et al., 2016).

Cranberry

Cranberry has huge impacts along with assurance from lipoprotein oxidation, restriction of thrombocyte grouping, and a diminishing circulatory strain. There's furthermore improvement in dysglycemia and a reduction in inflammation (Agarwal et al., 2013). Cranberries, high in polyphenols, are associated with certain clinical favors, but unnatural clinical primers are represented to support these findings (Basu et al., 2011). Cranberries square measure another synthetic stacked in bioactive phytochemicals, especially flavonoids, that there's expanding evidence of advantages on cardiometabolic likelihood that square measure associated with their serious malignant growth impedence operator power (Estruch et al., 2013).

Clinical examination for cranberry and heart eudaemonia has started as beta yet new exhaustive controlled clinical fundamentals have up inside the past not a couple of years to help the creating confirmation of

cranberry polyphenols control vas risk factors like cardiovascular infection, dyslipidemia and C-responsive super molecule, and oxygen consuming weight markers, for instance, low-thickness compound protein (LDL) oxidization. As cranberry could be a trademark food thing and not a medication, the effect seen is regularly mellow in any case that's dependable with the proposal for a food with eudemonia sections that's depleted as a piece of a strong balanced way of life (Khoo et al., 2014).

Phenolic blends in organic product smash square measure bioavailable and apply malignancy impedence specialist exercises in sound extra prepared grown-ups (McKay et al., 2015). Flavonoids, blessing in indispensable levels in cranberries, square measure exceptional bio actives renowned for their eudemonia progressing advantages (Duffey et al., 2013). Figure 3

A contemporary audit of connection between red meat utilization and cardiovascular hazard

Use of moderate lean red meat plays as a major role of a fair eating regimen is probably not going to expand hazard for CVD or colon malignant growth, yet may decidedly impact supplement admissions and unsaturated fat profiles, in this manner affecting emphatically on long haul health (McAfee et al., 2010). Utilization of red meat including handled items is exposed to expanding examination because of the wellbeing dangers related with cytotoxins that conceivably could be created during meat preparation (Jiang et al., 2016).

Higher red meat utilization is related with an essentially higher predominance and rate of focal heftiness in people at high danger of cardiovascular disease (Babio et al., 2012). Handled meat utilization could build the danger of mortality from any reason and CVD, while red meat utilization is decidedly yet pitifully connected with CVD mortality (Abete et al., 2014).

Red meat has been related for quite a while to an expanded danger of CVDs. In any case, ongoing discoveries exhibited that notwithstanding the nearness of heme-iron and carnitine, red meat doesn't essentially increment cardiovascular hazard when it is accepted in suggested portions. Noticeable fat and additives are the significant issues in the connection between red meat and expanded cardiovascular hazard, accordingly prompting a critical casual job for safeguarded red meats, particularly on the off chance that they are devoured day by day. It has been recommended to increment cardiovascular hazard basically by causing dyslipidemia (Bronzato et al., 2017).

Processed and natural red meat utilization was identified with an expansion within the sight of atherosclerotic plaques in male and female hypertensive people. In male hypertensive members, prepared meat admission was additionally seen to be related with an expansion in intima-media thickness, atrial width

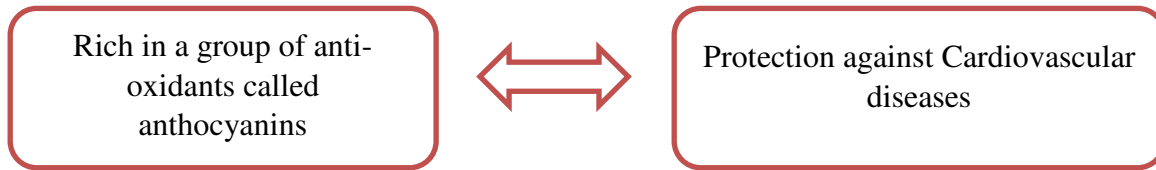


Figure 3. Cardio-protective effects of cranberry

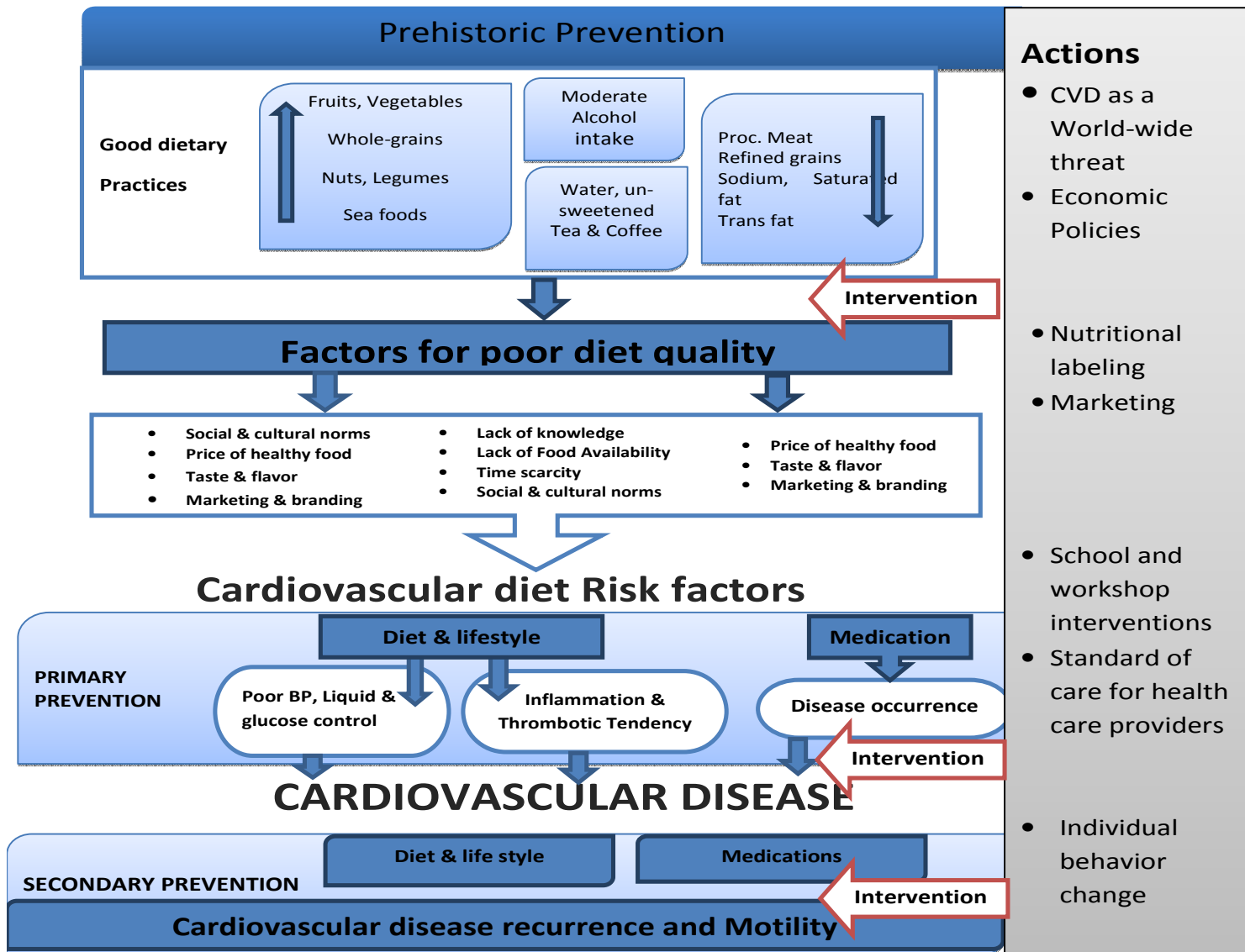


Figure 4. Progression and possible dietary prevention of CVD

however not LVM. In non-hypertensive members, neither natural nor handled red meat admission was related with changes in heart boundaries or carotid atherosclerosis (Haring et al., 2017).

Impacts of red meat on cardiovascular affliction chance factors are inferable, somewhat, to the association of the connection diet. Subbing red meat with extraordinary plant protein sources, yet not with fish or

low-quality sugars, prompts progressively great changes in blood lipids and lipoproteins (Guasch-Ferré et al., 2019). Figure 4, Figure 5

Red foods and its inflammation

Red-colored foods are high in various phyto-nutrients that

may help in anti-inflammatory, antioxidant and immune-modulating activities such as ascorbic acid, astaxanthin, lycopene, fisetin and the large class of anthocyanin. Chronic inflammation has a link with dysregulated immune responses, or dysfunctional which results in different conditions like neurological abnormalities, cancers or heart diseases, diabetes, obesity, pulmonary diseases, immunological diseases and other life-threatening conditions harmful to health (H. C. et al., 2016).

Red-colored foods like cherries and tomatoes have high levels of vitamin-c. vitamin-c (ascorbic acid) is very well known for its certain effects on the immune system and in the condition of increased inflammation, vitamin c levels then tend to increase in the body. Several studies in cell, animals and humans have come to results the red-colored foods and their constituents (Liugan et al., 2019) may help in reducing systemic inflammation and strengthen immune status by reducing infections by increasing the intake of watermelon (A. Basu et al., 2018), apples (Hong et al., 2015), cherries (Sharma et al., 2019), (Showiheen et al., 2019), (Minich et al., 2019), cranberries, raspberries or pomegranate. (Nie et al., 2019), (Denis et al., 2016)

Tomatoes

Tomatoes have been studied all across the world in a variety of formats, from raw tomatoes to tomato juice and even further into isolated tomato-derived phytonutrients like lycopene (Ogura et al., 2016). They have high amounts of vitamin c, flavonoids (e.g. fisetin) and carotenoids (e.g. lycopene). There is also a commentary by various consumer-directed websites and different organizations that tomatoes alkaloid content is inflammatory to individuals who are sensitive to those compounds.

Even results of an animal study (Bibi et al., 2018) showed that both lycopene and tomato powder supplementation, when given separately, were very effective and beneficial in reducing inflammatory and metabolic issues that take place with a high-fat diet. Apart from this, these both supplemental formats helped to reduce and lessen inflammatory and lipid markers, through a reduction in the phosphorylation levels at the Tehran university of medical sciences, a group of 106 overweight or obese students were randomly assigned either 330ml of tomato juice or water per day for about twenty days. Comparing with the control group and the baseline serum concentrations decreased in overweight and obese female objects. Some other studies in which tomato juice or tomato-based drinks were used showed beneficial effects on inflammation. In another study, concerned with tomato juice, individuals with the condition of metabolic syndrome had a significant improvement in inflammation status and endothelial

dysfunction after having tomato juice four times a week over a duration of two months in comparison with the control group. Especially when products of tomato, if consumed with a high-fat meals were effective at attenuating postprandial lipemia-induced oxidative stress and associated inflammatory response (Fuhrman et al., 2000; Fenni et al., 2017; Ghavipour et al., 2013; Jacob et al., 2008).

If we consume tomato in any form like raw tomatoes, tomato sauce or tomato sauce with refined olive oil, it decreases plasma total cholesterol, triglycerides level and several cellular and plasma inflammatory biomarkers, besides it increased plasma HDL cholesterol (Riso et al., 2006). Adding oil to the tomato sauce caused greater changes of plasma and vascular cell adhesion molecules.

Overall, studies concluded that tomatoes when included in a meal may offset inflammatory markers related to cardio muscle and oxidative stress.

Strawberries

Strawberries are a rich source of anti-inflammatory polyphenols such as anthocyanin which have been shown to reduce postprandial meal-induced increases in inflammation and oxidative stress in fourteen overweight healthy adults. Specifically, the intake of strawberry drinks before the meal (Tsitsimpikou et al., 2014), (Burton-Freeman et al., 2012).

A study showed that obese adults who were suffering from knee arthritis, drank a freeze-dried strawberry beverage (approximately 50gm on daily basis) for at least twelve weeks, and it was more helpful at reducing serum biomarkers of inflammation and also cartilage degeneration, comparing with the control beverage.

Strawberry supplementation reduced constant intermittent and even total pain, which led to researches concluding that strawberries have analgesic and anti-inflammatory effects in obese adults with the condition known as knee osteoarthritis adults who were overweight consumed a high-carbohydrate, moderate fat meal and then included strawberry or any beverage related it in diet beverage of strawberry lessened inflammation as measured by high sensitivity (Valderas-Martinez et al., 2016).

In type 2 diabetes, thirty six subjects were divided into two groups. The group that was under treatment consumed two cups of freeze-dried strawberry beverage, (50g) of freeze-dried strawberry is approx. equal to 500 g of fresh strawberries or macronutrient-matched placebo powder with strawberry flavor daily for at least six weeks in a controlled trial. Supplementation of freeze-dried strawberry decreased CRP level in comparison to the baseline.

There was a design which was crossover, in which fourteen women and ten men were guided to consume a

six-week strawberry or placebo beverage followed by a carbohydrate/fat meal with assessments for six hours (Huang et al., 2016). The response of a high-carbohydrate / fat meal after six weeks of the strawberry beverages intake showed reduced inflammatory markers in comparison with placebo. Intake of beverage strawberry showed results in lowering postprandial concentrations at about six hours.

Summarizing the strawberries, specifically as freeze-dried beverages, appears to reduce the inflammatory response within the passage of time.

Beets

Beets provide various nutrients and are rich in a class of compounds especially in betalains (Schell et al., 2017).

In chronic diseases, betalains are considered very important involving inflammation, oxidative stress and dyslipidemia (Ellis et al., 2011).

Those individuals who were hypertensive, took either raw beet juice or cooked beet in a design that was cross over, came to results that both forms of beetroot were effective in reducing systemic inflammation as assessed but intracellular adhesion molecules (Rahimi et al., 2019).

CONCLUSION

Red fruits and vegetables have various health effects on the body. These improve body functioning besides helping to fight inflammation too. There are a wide range of fruits like different berries, apples, watermelons or tomatoes which are linked with improving heart health. Besides, intake of red meat contributes to adverse effects towards heart health.

REFERENCES

- A. Basu, J. Schell, and R. H. Scofield, et al. (2018). "Dietary fruits and arthritis," *Food & Function*, vol. 9, no. 1, pp. 70–77
- Abete I, Romaguera D, Vieira AR, de Munain AL, Norat T, et al. (2014). Association between total, processed, red and white meat consumption and all-cause, CVD and IHD mortality: a meta-analysis of cohort studies. *Brit. J. Nutr.*;112(5):762-75.
- Abu-Hiamed H, et al. (2018). Hypocholesterolemic effects of watermelon fruit rind on rats. *Nutrition and Food Science*.
- Adhami VM, Khan N, Mukhtar H, et al. (2009). Cancer chemoprevention by pomegranate: laboratory and clinical evidence. *Nutrition and cancer*. 16;61(6):811-5.
- Agarwal SK, et al. (2013). Blueberries, cranberries, and strawberries: Heart healthy fruits. *Med. Sci.*;1:4-6.
- Alshawwa IA, El-Mashharawi HQ, Elkahout M, Al-Shawwa MO, Abu-Naser SS, et al. (2020). Analyzing Types of Cherry Using Deep Learning.
- Aviram M, Rosenblat M, et al. (2013). Pomegranate for your cardiovascular health. *Rambam Maimonides medical journal*.;4(2).
- Babio N, Sorlí M, Bulló M, Basora J, Ibarrola-Jurado N, Fernández-Ballart J, Martínez-González MA, Serra-Majem L, González-Pérez R, Salas-Salvadó J, et al. (2012). Association between red meat consumption and metabolic syndrome in a Mediterranean population at high cardiovascular risk: cross-sectional and 1-year follow-up assessment. *Nutrition, Metabolism and Cardiovascular Diseases*. 1;22(3):200-7.
- Barbosa AC, Pinto MD, Sarkar D, Ankolekar C, Greene D, Shetty K, et al. (2010). Varietal influences on antihyperglycemia properties of freshly harvested apples using in vitro assay models. *J. Med. Food*. 1;13(6):1313-23.
- Basu A, Betts NM, Ortiz J, Simmons B, Wu M, Lyons TJ, et al. (2011). Low-energy cranberry juice decreases lipid oxidation and increases plasma antioxidant capacity in women with metabolic syndrome. *Nutrition Research*.1;31(3):190-6.
- Basu A, Fu DX, Wilkinson M, Simmons B, Wu M, Betts NM, Du M, Lyons TJ, et al. (2010). Strawberries decrease atherosclerotic markers in subjects with metabolic syndrome. *Nutrition research*. 1;30(7):462-9.
- Bibi S, Kang Y, Du M, Zhu MJ, et al. (2018). Dietary red raspberries attenuate dextran sulfate sodium-induced acute colitis. *J Nutr. Biochem*. 1;51:40-6.
- Blando F, Oomah BD, et al. (2019). Sweet and sour cherries: Origin, distribution, nutritional composition and health benefits. *Trends in food science & technology*.
- Borochoy-Neori H, Lazarovitch N, Judeinstein S, Patil BS, Holland D, et al. (2013). Climate and salinity effects on color and health promoting properties in the pomegranate (*Punicagranatum L.*) fruit arils. In *Tropical and Subtropical Fruits: Flavors, Color, and Health Benefits* (pp. 43-61). American Chemical Society.
- Bronzato S, Durante A, et al. (2017). A contemporary review of the relationship between red meat consumption and cardiovascular risk. *Int. J. Prevent. Med.*;8.
- Budak NH, Kumbul Doguc D, Savas CM, Seydim AC, Koktas T, Ciris MI, Guzel-Seydim ZB, et al. (2011). Effects of apple cider vinegars produced with different techniques on blood lipids in high-cholesterol-fed rats. *J. Agric. Food Chem*. 22;59(12):6638-44.
- Burton-Freeman B, Talbot J, Park E, Krishnankutty S, Edirisinghe I, et al. (2012). Protective activity of processed tomato products on postprandial oxidation and inflammation: a clinical trial in healthy weight men and women. *Molecular nutrition & food research*.; 56(4):622-31.
- Burton-Freeman BM, Sandhu AK, Edirisinghe I, et al. (2016). Red raspberries and their bioactive polyphenols: cardiometabolic and neuronal health links. *Advances in Nutrition*.;7(1):44-65.
- Denis MC, Roy D, Yeganeh PR, Desjardins Y, Varin T, Haddad N, Amre D, Sané AT, Garofalo C, Furtos A, Patey N, et al. (2016). Apple peel polyphenols: a key player in the prevention and treatment of experimental inflammatory bowel disease. *Clinical Science*.1;130(23):2217-37.
- Duffey KJ, Sutherland LA, et al. (2013). Adult cranberry beverage consumers have healthier macronutrient intakes and measures of body composition compared to non-consumers: National Health and Nutrition Examination Survey (NHANES) 2005–2008. 5(12):4938-49.
- Ellis CL, Edirisinghe I, Kappagoda T, Burton-Freeman B, et al. (2011). Attenuation of meal-induced inflammatory and thrombotic responses in overweight men and women after 6-week daily strawberry (*Fragaria*) intake: a randomized placebo-controlled trial. *Journal of atherosclerosis and thrombosis*. :1101120336.
- Estruch R, Ros E, Salas-Salvadó J, Covas MI, Corella D, Arós F, Gómez-Gracia E, Ruiz-Gutiérrez V, Fiol M, Lapetra J, Lamuela-Raventós RM, et al. (2013). Primary prevention of cardiovascular

- disease with a Mediterranean diet. *New Eng. J. Med.* 368(14):1279-90.
- Ezra D, Kirshner B, Hershovich M, Shtienberg D, Kostol,et al. (2015). Heart rot of pomegranate: disease etiology and the events leading to development of symptoms. *Plant Disease.*13;99(4):496-501.
- Fenni S, Hammou H, Astier J, Bonnet L, Karkeni E, Couturier C, Tourniaire F, LandrierJF,et al. (2017). Lycopene and tomato powder supplementation similarly inhibit high-fat diet induced obesity, inflammatory response, and associated metabolic disorders. *Molecular nutrition & food research.*:61(9):1601083.
- Friedman M,et al. (2013).Anticarcinogenic, cardioprotective, and other health benefits of tomato compounds lycopene, α -tomatine, and tomatidine in pure form and in fresh and processed tomatoes. *Journal of agricultural and food chemistry.* 9; 61(40): 9534-50.
- Fuhrman B, Volkova N, Rosenblat M, AviramM,et al. (2000). Lycopene synergistically inhibits LDL oxidation in combination with vitamin E, glabridin, rosmarinic acid, carnolic acid, or garlic. *Antioxidants and Redox Signaling.*1;2(3):491-506.
- Ghavipour M, Saedisomeolia A, Djalali M, Sotoudeh G, Eshraghyan MR, Moghadam AM, Wood LG, et al. (2013). Tomato juice consumption reduces systemic inflammation in overweight and obese females. *British Journal of Nutrition.*:109(11):2031-5.
- Giampieri F, Tulipani S, Alvarez-Suarez JM, Quiles JL, Mezzetti B, BattinoM,et al. (2012). The strawberry: composition, nutritional quality, and impact on human health. *Nutrition.*1;28(1):9-19.
- Gonçalves AC, Bento C, Silva B, Simões M, Silva LR,et al. (2019). Nutrients, bioactive compounds and bioactivity: The health benefits of sweet cherries (*Prunusavium L.*). *Current Nutrition & Food Science.* 1;15(3):208-27.
- Grigoras CG, Destandau E, Zubrzycki S, ElfakirC,et al. (2012). Sweet cherries anthocyanins: An environmental friendly extraction and purification method. *Separation and Purification Technology.* 24;100:51-8.
- Guasch-Ferré M, Satija A, Blondin SA, Janiszewski M, Emlen E, O'Connor LE, Campbell WW, Hu FB, Willett WC, StampferMJ,et al. (2019). Meta-analysis of randomized controlled trials of red meat consumption in comparison with various comparison diets on cardiovascular risk factors. *Circulation.*9;139(15):1828-45.
- Gul K, Tak A, Singh AK, Singh P, Yousuf B, WaniAA,et al. (2015). Chemistry, encapsulation, and health benefits of β -carotene-A review. *Cogent Food & Agriculture.*:1(1):1018696.
- H. C. Pal, R. L. Pearlman, and F. Afaq,et al. (2016). "Fisetin and its role in chronic diseases," *Advances in Experimental Medicine and Biology*, vol. 928, pp. 213–244,
- Haring B, Wang W, Fretts A, Shimbo D, Lee ET, Howard BV, Roman MJ, Devereux RB,et al. (2017). Red meat consumption and cardiovascular target organ damage (from the Strong Heart Study). *Journal of hypertension.*:35(9):1794.
- Hong MY, Beidler J, Hooshmand S, Figueroa A, Kern M,et al. (2018). Watermelon and L-arginine consumption improve serum lipid profile and reduce inflammation and oxidative stress by altering gene expression in rats fed an atherogenic diet. *Nutrition Research.*1;58:46-54.
- Hong MY, Hartig N, Kaufman K, Hooshmand S, Figueroa A, Kern M,et al. (2015). Watermelon consumption improves inflammation and antioxidant capacity in rats fed an atherogenic diet. *Nutrition Research.*1;35(3):251-8.
- Hong MY, Hartig N, Kaufman K, Hooshmand S, Figueroa A, Kern M,et al. (2015). Watermelon consumption improves inflammation and antioxidant capacity in rats fed an atherogenic diet. *Nutrition Research.*1;35(3):251-8.
- Huang Y, Park E, Edirisinghe I, Burton-Freeman BM,et al. (2016). Maximizing the health effects of strawberry anthocyanins: understanding the influence of the consumption timing variable. *Food & function*;7(12):4745-52.
- Jacob K, Periago MJ, Böhm V, BerruetoGR,et al. (2008). Influence of lycopene and vitamin C from tomato juice on biomarkers of oxidative stress and inflammation. *British Journal of Nutrition.*:99(1):137-46.
- Jacques PF, Lyass A, Massaro JM, Vasan RS, D'AgostinoSr RB, et al. (2013). Relationship of lycopene intake and consumption of tomato products to incident CVD. *British Journal of Nutrition.*:110(3):545-51.
- Jiang J, XiongYL,et al. (2016). Natural antioxidants as food and feed additives to promote health benefits and quality of meat products: A review. *Meat science.*1;120:107-17.
- Khoo C, Falk M,et al. (2014). Cranberry polyphenols: Effects on cardiovascular risk factors. In *Polyphenols in human health and disease* (pp. 1049-1065). Academic Press.
- Khoo HE, Azlan A, Tang ST, Lim SM,et al. (2017). Anthocyanidins and anthocyanins: colored pigments as food, pharmaceutical ingredients, and the potential health benefits. *Food & nutrition research.* 1;61(1):1361779.
- Lansky EP, Newman RA,et al. (2007).Punicagranatum (pomegranate) and its potential for prevention and treatment of inflammation and cancer. *Journal of ethnopharma-cology.*19;109(2):177-206.
- Ledyard A,et al. (2012). Snake Oil in Your Pomegranate Juice: Food Health Claims and the FTC. *USFL Rev.*:47:783.
- Leong HY, Show PL, Lim MH, Ooi CW, Ling TC,et al. (2018). Natural red pigments from plants and their health benefits: A review. *Food reviews international.* 4;34(5):463-82.
- Lin CL, Lin SC, Liu YT, Lin HL, Huang YC, Huang PH,et al. (2019). Design of a Healthy Diet Control System for the Elderly Group by Using Raspberry Pi. In *International Conference on e-Business Engineering* (pp. 330-341). Springer, Cham.
- Liugan M, CarrAC,et al. (2019). Vitamin C and neutrophil function: findings from randomized controlled trials. *Nutrients.*:11(9):2102.
- McAfee AJ, McSorley EM, Cuskelly GJ, Moss BW, Wallace JM, Bonham MP, FearonAM,et al. (2010). Red meat consumption: An overview of the risks and benefits. *Meat science.*1;84(1):1-3.
- McCune LM, Kubota C, Stendell-Hollis NR, Thomson CA,et al. (2010). Cherries and health: a review. *Critical reviews in food science and nutrition.*30;51(1):1-2.
- McKay DL, Chen CY, Zampariello CA, Blumberg JB,et al. (2015). Flavonoids and phenolic acids from cranberry juice are bioavailable and bioactive in healthy older adults. *Food chemistry.*1;168:233-40.
- MinichDM,et al. (2019). A Review of the Science of Colorful, Plant-Based Food and Practical Strategies for "Eating the Rainbow". *Journal of Nutrition and Metabolism.*
- Mirmiran P, Fazeli MR, Asghari G, Shafiee A, AziziF,et al. (2010). Effect of pomegranate seed oil on hyperlipidaemic subjects: a double-blind placebo-controlled clinical trial. *British journal of nutrition.*:104(3):402-6.
- Mohammad SM, Kashani HH, et al. (2012). Chemical composition of the plant *PunicagranatumL.*(Pomegranate) and its effect on heart and cancer. *Journal of Medicinal Plants Research.*17;6(40):5306-10.
- Nadeem M, Anjum FM, Khan MR, Saeed M, RiazA,et al. (2011). Antioxidant potential of bell pepper (*Capsicum annum L.*)-A review. *Pakistan Journal of Food Science.*:21(1-4):45-51.
- Nasir MU, Hussain S, JabbarS,et al. (2015). Tomato processing, lycopene and health benefits: A review. *Science Letters.*:3(1):1-5.
- Newman RA, Lansky EP, Block ML, et al. (2007). *Pomegranate: the most medicinal fruit.* Basic Health Publications, Inc.

- Nie Q, Hu J, Gao H, Fan L, Chen H, Nie S, et al. (2019). Polysaccharide from *Plantago asiatica* L. attenuates hyperglycemia, hyperlipidemia and affects colon microbiota in type 2 diabetic rats. *Food Hydrocolloids*.1;86:34-42.
- Noratto GD, Chew BP, Atienza LM, et al. (2017). Red raspberry (*Rubus idaeus* L.) intake decreases oxidative stress in obese diabetic (db/db) mice. *Food chemistry*.15;227:305-14.
- Ogura K, Ogura M, Shoji T, Sato Y, Tahara Y, Yamano G, Sato H, Sugizaki K, Fujita N, Tatsuoka H, Usui R, et al. (2016). Oral administration of apple procyanidins ameliorates insulin resistance via suppression of pro-inflammatory cytokine expression in liver of diabetic ob/ob mice. *Journal of agricultural and food chemistry*. 23;64(46):8857-65.
- Rahimi P, Abedimanesh S, Mesbah-Namin SA, Ostadrahimi A, et al. (2019). Betalains, the nature-inspired pigments, in health and diseases. *Critical reviews in food science and nutrition*.; 59(18): 2949-78.
- Ray RC, ElSheikha AF, Panda SH, Montet D, et al. (2011). Antioxidant properties and other functional attributes of tomato: An overview. *International Journal of Food and Fermentation Technology*.;1(2):139-48.
- Reiter R. The Cherry Nutrition Report is a summary of the scientific literature on the health benefits of tart cherries and their compounds. The report was commissioned by the Cherry Marketing Institute (CMI), an organization funded by North American tart cherry processors and growers. The intent of the report is to provide an overview of the scientific evidence, not to provide individual recommendations. The information is not intended to substitute for the advice of a physician or another healthcare professional.
- Riso P, Visioli F, Grande S, Guarnieri S, Gardana C, Simonetti P, Porrini M, et al. (2006). Effect of a tomato-based drink on markers of inflammation, immunomodulation, and oxidative stress. *J. Agric. Food Chem*. 5;54(7):2563-6.
- Ros E, Tapsell LC, Sabaté J, et al. (2010). Nuts and berries for heart health. *Current atherosclerosis reports*.1;12(6):397-406.
- Schell J, Scofield RH, Barrett JR, Kurien BT, Betts N, Lyons TJ, Zhao YD, Basu A, et al. (2017). Strawberries improve pain and inflammation in obese adults with radiographic evidence of knee osteoarthritis. *Nutrients*. ;9(9):949.
- Seeram NP, Adams LS, Henning SM, Niu Y, Zhang Y, Nair MG, Heber D, et al. (2005). In vitro antiproliferative, apoptotic and antioxidant activities of punicalagin, ellagic acid and a total pomegranate tannin extract are enhanced in combination with other polyphenols as found in pomegranate juice. *The Journal of nutritional biochemistry*. 1;16(6):360-7.
- Seeram NP, Burton-Freeman B, et al. (2018). The seventh biennial berry health benefits symposium. *Food & function*.;9(1):20-1.
- Sharma A, Ghani A, Sak K, Tuli HS, Sharma AK, Setzer WN, Sharma S, Das AK, et al. (2019). Probing into Therapeutic Anti-cancer Potential of Apigenin: Recent Trends and Future Directions. *Recent Patents on Inflammation & Allergy Drug Discovery*.1;13(2):124-33.
- Showiheen SA, Sun AR, Wu X, Crawford R, Xiao Y, Wellard RM, Prasadam I, et al. (2019). Application of metabolomics to osteoarthritis: from basic science to the clinical approach. *Current Rheumatology Reports*.1;21(6):26.
- Story EN, Kopec RE, Schwartz SJ, Harris GK, et al. (2010). An update on the health effects of tomato lycopene. *Annual review of food science and technology*.;1:189-210.
- Tsitsimpikou C, Tsarouhas K, Kioukia-Fougia N, Skondra C, Fragkiadaki P, Papalexis P, Stamatopoulos P, Kaplanis I, Hayes AW, Tsatsakis A, Rentoukas E, et al. (2014). Dietary supplementation with tomato-juice in patients with metabolic syndrome: a suggestion to alleviate detrimental clinical factors. *Food and chemical toxicology*.1;74:9-13.
- Valderas-Martinez P, Chiva-Blanch G, Casas R, Arranz S, Martínez-Huéllamo M, Urpi-Sarda M, Torrado X, Corella D, Lamuela-Raventós RM, Estruch R, et al. (2016). Tomato sauce enriched with olive oil exerts greater effects on cardiovascular disease risk factors than raw tomato and tomato sauce: A randomized trial. *Nutrients*.;8(3):170.
- Viuda-Martos M, Fernández-López J, Pérez-Álvarez JA, et al. (2010). Pomegranate and its many functional components as related to human health: a review. *Comprehensive Reviews in Food Science and Food Safety*.;9(6):635-54.
- Viuda-Martos M, Sanchez-Zapata E, Sayas-Barberá E, Sendra E, Pérez-Álvarez JA, Fernández-López J, et al. (2014). Tomato and tomato byproducts. Human health benefits of lycopene and its application to meat products: a review. *Critical reviews in food science and nutrition*. 1;54(8):1032-49.
- Wallace TC, et al. (2011). Anthocyanins in cardiovascular disease. *Advances in Nutrition*. 1;2(1):1-7.
- Wang SY, et al. (2012). Antioxidants and health benefits of Strawberries. In VII International Strawberry Symposium 1049 18 (pp. 49-62).
- Yu E, Malik VS, Hu FB, et al. (2018). Cardiovascular disease prevention by diet modification: JACC health promotion series. *J. Ame. College of Cardiol*. 13;72(8):914-26.