

3.3 The role of nutrition in the development and prevention of atherosclerosis

An estimated 31% of the total deaths worldwide are caused due to cardiovascular diseases (CVD's) and stroke. The most contributing factor for their development is the condition called atherosclerosis.

Atherosclerosis is a specific and most common form of arteriosclerosis, affecting primarily the intima of large and medium-sized muscular arteries and is characterized by fibro-fatty plaques deposition or atheromas in these vessels. This deposition causes obstruction to arterial blood flow, decreasing the amount of blood supply and resulting in ischaemic conditions in aorta, heart, brain and lower extremities. The progression of atherosclerosis paves way for deteriorating clinical effects in the arterial systems such as: ischemia and atrophy, infarction necrosis, plaque propagation by formation of thromboembolism and aneurysmal dilatation causing eventual rupture.

Around 17.9 million people die each year from cardiovascular diseases and strokes and from this, more than 65% of deaths are due to atherosclerotic cases. One-third of the deaths happens in people around 70 years of age. Ischaemic heart diseases (IHD's) of such origin are found to be three times higher in men in the late 40's than in women. More than 75% of such diseases occur in low and middle income countries, with the highest cases reported in Eastern Europe. In United States, more than 1.5 million people suffers from myocardial infarction each year with the death of half million among them.

Extensive epidemiological investigations were conducted on living populations with risk of developing clinical atherosclerosis, summarizing the main causative factors into major and minor risk factors. Major risk factors are again divided into modifiable and non-modifiable ones based on the ability in which they can be controlled in the lifestyle of an individual. Modifiable factors includes hyperlipidaemia, hypertension, smoking and diabetes mellitus. Hyperlipidaemia has direct proportionality with atherosclerosis and IHD's. The evidences of cholesterol accumulations in the vessels leading to fibro-fatty plaques and increased mortality of IHD patients due to hypercholesterolemia underlines the fact. Nowadays, a constant

dilemma appears in the dietary system globally, as concentrations of bad cholesterol called as low-density lipoproteins (LDL) rises in contrast to good cholesterol called as high density lipoproteins (HDL) in the body. This poses the great threat of lipid build-up in vessels. The next major culprit in the case turns out to be hypertension. A systolic blood pressure of over 160mmhg over a diastolic of 95mmhg is associated with five times higher risk of developing IHD's, causing mechanical injury to arterial walls and starting the initiation of atherosclerosis progression. Man who smokes a pack of cigarettes a day are 3-5 times more likely to die of IHD's than non-smokers. Smoking reduces the level of HDL and raises the carbon monoxide in blood, producing carboxy-haemoglobin and eventually hypoxia in the arterial wall, favouring atherosclerosis. The harmful effects of Diabetes mellitus extends in increasing the aggregation of platelets in the lesions, increasing LDL and decreasing HDL. Thus the risk of developing IHD is doubled, tendency to develop CVDs is high and frequency to form gangrene of foot is elevated. The non-modifiable risk factors comprises age, sex, genetic factors, familial and racial factors. Atherosclerosis is an age related condition and significant lesions appear with increasing age. The lower incidence of atherosclerosis in women, especially in pre-menopausal age. The lower incidence of atherosclerosis in women, especially in pre-menopausal age is probably due to the increased level of estrogen and HDL in them, both of which having anti-atherogenic influence. Hereditary genetic derangements of lipoprotein metabolism predispose the individual to high lipid and familial hypercholesterolemia. Familial predisposition to atherosclerosis may be related to other risk factors such as diabetes, hypertension and hyperlipidaemia. Racial differences too exists in such that, blacks have generally less incidence of the disease than in whites. The minor risk factors includes: obesity, environmental influences, hormones (estrogen deficiency, oral contraceptives), physical inactivity, stressful life, infections (C. pneumoniae, Herpes virus, CMV), Homocystinuria and alcohol usage.

If you compare the artery function of those who don't eat meat to those who do, the healthy ability of arteries to dilate and let more blood flow is significantly better among those eating vegetarian—and not just by a little; we're talking four times better. Well duh, vegetarians tend to be younger, smoke less, be slimmer, and have lower rates

of diabetes, high cholesterol, high blood pressure, and heart disease. But, the researchers controlled for all that. They only let healthy nonsmokers into the study, and recruited a group of meat-eaters who were about just as slim, on average, about the same blood pressures, even practically the same cholesterol – a really healthy cohort on omnivores. Yet they still got their arteries handed to them by the vegetarians, and the longer someone was meat-free, the better. The degree of superior artery function correlated with the number of years eating meat-free. Instead of their artery function worsening over time as they aged, it got better the longer they ate that way. This suggests that vegetarian diets, by themselves, have a direct beneficial effect on artery function, and may help to account for the lower incidence of atherosclerosis and cardiovascular mortality.

Since researchers were able to control for other known risk factors, they figured it must be the food. But what aspect of the food? Is it simply the lack of the deleterious effect of meat? Or could it also be because the vegetarians may simply be eating more whole healthy plant foods—for example, up to a serving a day more vegetables?

The heart of a traditional Mediterranean diet is mainly vegetarian, much lower in meat and dairy, and uses fruit for dessert. So, no surprise those eating that way had very low heart disease rates compared to those eating standard Western diets. This landmark study, though, has been cited to suggest that all types of fat, animal or vegetable, are associated with the appearance of new atherosclerotic lesions in our coronary arteries, feeding our hearts.

About a hundred men were given angiograms at baseline and then two years later, looking for the development of lesions like this, before and after, all the while monitoring their diets every year. Only about 1 in 20 eating lower fat diets had new lesions, compared to about 8 in 20 on more typical American diets around 33% or more fat. But when they drilled down, though, only three types of fat appeared to significantly increase the likelihood of the appearance of new, lesions: lauric, oleic, and linoleic. Lauric acid is a saturated fat, found in coconut oil, and palm kernel oil, which is found in junk food—whipped cream and candy bars. Oleic from the Latin word *oleum* for olive oil, but that's not where these men were getting their oleic acid

from. The top sources for Americans are basically cake, chicken, and pork, and linoleic comes mostly from chicken. So, the study really just showed that people eating lots of junk, chicken, and pork tended to close off their coronary arteries. To see if major sources of plant fats, like olive oil or nuts, help or hurt, ideally, we'd do multi-year randomized study where you take thousands of people and have a third eat more nuts, a third eat more olive oil, and a third do essentially nothing to see who does better.

And that's exactly what they did. The PREDIMED study took thousands of people at high risk for heart disease in Spain, who were already eating a Mediterranean-ish diet, and randomized them into three groups for a couple years, one with added extra virgin olive oil, one with added nuts, and a third group that was told to cut down on fat, but they didn't; so, basically ended up as a no dietary changes control group. What happened to the amount of plaque in their arteries over time?

Whereas there was significant worsening of carotid artery thickening and plaque in the no dietary change control group, those in the added nuts group showed a significant reversal in thickening, an arrest in plaque progression. There were no significant changes in the added olive oil group.

The richness of the plant-based Mediterranean diet in potentially beneficial foods, such as fruit, vegetables, beans, nuts, whole grains, and olive oil, is believed to explain its cardioprotective effects. However, these results suggest nuts are a preferable source of fat compared to olive oil, and may delay the progression of atherosclerosis, the harbinger of future cardiovascular events such as stroke. Adding nuts appeared to cut the risk of stroke in half.

Note, though, they were still having strokes. Half as many strokes; so, the nuts appeared to be helping, but they were still eating a diet conducive to strokes and heart attacks. All three groups had basically the same heart attack rates, the same overall death rates. That's what Dr. Ornish noted when he wrote in: there was no significant reduction in the rates of heart attack, death from cardiovascular causes, or death from any cause, just that stroke benefit. But hey, that's something. A Mediterranean diet is certainly better than what most people are consuming, but even better may be a diet based on whole plant foods, shown to reverse heart disease, not contribute to it. The

authors of the study replied that they didn't wish to detract from Ornish's work, noting that Mediterranean and plant-based diets actually share a great number of foods in common.

The Ornish Diet involves avoiding meat and animal products. In this case, the basis of nutrition becomes plant foods, which are very rich in vitamins, complex carbohydrates, nutrients, and minerals. According to Dean Ornish, the only way to lose weight and improve the body at the same time is by eliminating the consumption of animal fats. The scientist claims that these components stimulate weight gain, resulting in a strain on the heart. This leads to poor health and various diseases.

Yes, Ornish's diet can reverse heart disease— but, the Mediterranean diet proponents argue, the major problem with Ornish's diet is that it doesn't taste good; so, hardly anyone sticks to it.

A study in the journal *Atherosclerosis* found that eating just 3 eggs or more a week was associated with a significant increase in artery-clogging plaque buildup in people's carotid arteries going to their brain, a strong predictor of stroke, heart attack, and death. They found an exponential increase in arterial plaque buildup for smokers and egg-eaters. Those that ate the most eggs had as much as two-thirds the risk of those that smoked the most, the equivalent of a pack-a-day habit for 40 years or more.

In reaction to the study that found a similar exponential increase in artery-clogging plaque in smokers and egg-eaters, one critic countered that eggs have “beneficial...effects;...on vascular endothelium”—the inner lining of our arteries)—citing this study on “Egg consumption and endothelial function,” funded by the American Egg Board.

It was done on a group of men and women eating the Standard American Diet—overweight, normal cholesterol (which is to say extremely high cholesterol), LDL levels twice as high as could be considered optimal. See, it's often “not appreciated that the average blood cholesterol level in the United States, the so-called normal level, [has] actually [been] abnormal,...accelerating [heart disease] and putting a large fraction of the so-called normal population at a higher risk” for coronary heart disease, our #1 killer.

If you threw a lit match into a flaming pool of gasoline, and saw no real difference in the height of the flames, you can't conclude that throwing lit matches into gasoline is not a fire hazard, but that's what the Egg Board study concluded. When the addition of eggs didn't make the arterial function worse than it already was, they concluded that "short-term egg consumption does not adversely affect endothelial function in healthy adults."

The Council conducted additional research. They report that "egg consumption had no effects on endothelial function as compared to sausage and cheese." Compared to the "ingestion of a sausage-and-cheese [breakfast] sandwich." Yet, instead of sounding the alarm that eating eggs is as bad for arterial function as a "McDonald's Sausage McMuffin," they conclude "Egg consumption was found to be non-detrimental to endothelial function." And cholesterol as well. They started out with a life-threatening cholesterol, and ended up with a life-threatening cholesterol.

Why didn't it get even worse? Because there's a plateau effect; you can basically max out on cholesterol absorption. After a certain level of intake, it's just another match to the fire. If you're already consuming the Standard American Diet, averaging 400 milligrams of cholesterol daily, even add, you know, two jumbo eggs to one's diet, and it may already be a lost cause. But, in people trying to eat healthy, those same two eggs could shoot their cholesterol up 20 points, whereas a fat-free, cholesterol-free egg substitute "was beneficial."

So, not eating eggs lowered cholesterol levels. Not eating eggs "improved endothelial function"—and that's what these people needed. Their arteries were already hurting; they needed something to bring the fire down, not throw more matches at it. Eating oatmeal instead of eggs made things better, helping to quench the fire.

When researchers compared two crappy meals, Sausage and Egg McMuffins to Frosted Flakes, and found the fatty meal impaired artery function within hours, but the sugary meal didn't, they blamed the fat. But it may just be the animal fat, since high-fat whole plant foods like nuts don't have the same effect. In fact, if you look at a systematic review of all the randomized controlled trials on the effect of nut

consumption on artery function, you find that nuts actually make things better over time.

Enough to counter the artery-crippling effects of a salami sandwich? Let's find out. And the answer is yes for walnuts, but no for almonds. Just like there are some fruits that are better than others—like blueberries over bananas—there are some nuts that are better than others. And walnuts appear to be the blueberries of nuts.

Would berry juice be able to stop artery dysfunction caused by a high-fat meal this unhealthy, squeezing down artery function within hours? Researchers created a cocktail of grapes, lingonberry, blueberry, strawberry, and black Aronia berry, and were able to turn this, into this. No significant change after the high-fat meal. Of course, if you had just drunk those berries alone, you'd probably get an improvement, but it's better than nothing.

Well, what about something a little less exotic than black Aronia berries? What about orange juice? Participants were provided a high-fat meal of ham and cheese croissants, along with a cup of either water, orange juice, green tea, or red wine. The arteries didn't much like the croissants, and orange juice was useless, as was a cup of green tea and red wine. So, it's probably best to not eat ham and cheese croissants in the first place.

The preventive measures in atherosclerosis are crucial because it can progress without the manifestation of probable symptoms. Prevention implies primary and secondary measures. Primary prevention aims at the possibilities for protection against any serious complications. It applies for control of blood pressure, blood glucose and cholesterol levels and their regular monitoring. Maintaining a proper diet is pivotal so that it controls the plasma cholesterol levels. Several studies have found that polyunsaturated fats can reduce the LDL build up. Adequate weight management, stress control, regular exercises and cessation of smoking and alcohols are also recommended. Secondary prevention is intended to prevent the recurrence of events such as myocardial infarction and stroke in symptomatic patients. Strict administration of proper treatment and surgical procedures are advised in this case. A new hope in the field of atherosclerosis prevention is the introduction of herbal therapy. Herbal

compounds such as flavonoid extracts from plants are now being used to defend the disease. Studies suggest that their anti-oxidant properties inhibits LDL oxidation inside the arteries and reduce the LDL build up. They also possesses less toxicity and side-effects compared to other anti-oxidants. Some of the many such plant groups includes Cornelian cherry, Verjuice, *Allium hirtifolium*.

CONCLUSIONS

Despite advancements in the medical field, atherosclerosis remains as an underlying cause of deaths all over the world. Tackling the disease is of utmost importance and implementations such as herbal therapy must be encouraged in order to restrict the disease from being a 'world's killer'. Following a healthy lifestyle with controlled diet and health regimens will help us to move forward, without falling into the hands of atherosclerosis.