

Dietary Cholesterol Restriction is Not Good for Health

Contrary to the popular belief prevailing in the last three to six decades in our healthcircle, cholesterol is actually an organic molecule essential for sustaining all animal lives. Chemically, it is a sterol which is found in the cell membrane. It acts as precursor of several vital molecules such as steroids, Vitamin D, and bile acids. In fact, it is so vital for cellular function that nature has made it available to us by endogenous synthesis mechanism in each cell in an organism.^[1] Although we can acquire cholesterol from our diet, especially animal food product (such as egg and meat.), body has the capacity to produce it to meet our daily requirement. This is the scientific basis why severe restriction of daily intake of cholesterol is not effective in reducing cholesterol in blood, and hence, daily intake does not correlate with blood level of cholesterol.^[1] On the other hand, severe dietary restriction can promote the endogenous production of cholesterol.

When we order for investigation of lipid profile, it takes into consideration the total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), and triglyceride levels circulating in blood. Low-density lipoprotein cholesterol (LDL-C) is derived from a calculation using previous three values (TC, HDL cholesterol, and triglyceride levels). It is the TC and especially LDL cholesterol that has been suggested to be bad for our health. These claims are based on several observational studies which found high TC, LDL cholesterol, or low HDL cholesterol associated with various cardiovascular diseases (CVD).^[2] However, it is interesting to note that LDL cholesterol level is a derived value (for triglyceride level below 400 mg/dL) from Friedewald equation, i.e., $TC = LDL-C + HDL-C + Triglycerides/5$. Therefore, for a person when all other factors are in normal range, bad cholesterol (LDL cholesterol) will increase if TC rises, HDL cholesterol decreases, or triglyceride level comes down. Therefore, if HDL cholesterol remains in range, decrease in triglyceride will be considered good but it will increase LDL cholesterol. On the other hand, with normal HDL cholesterol level, if we want LDL cholesterol value to go down, triglyceride level will go high which is another risk factor for CVD. This mathematical paradox (when we want all values in normal range) shows that our good health does not depend on mathematical dilemma when every factor is more or less near the normal range.

In fact, there are several lipid-related risk factors such as lipoprotein-a, oxidized LDL, several ratios of lipid fractions such as TC/HDL-C and LDL-C/HDL-C, which are better indicators of CV risk than lipid profile alone. There are several other nonlipid-related risk factors such as high-sensitivity C-reactive protein and homocysteine, which are equally potent

risk factors for CVD.^[3] However, all these parameters are not routinely checked by general physicians.

In fact, the ill effects of cholesterol were highlighted due to its association with atherosclerosis and CVD. Thus, the public became aware of TC and bad cholesterol. The much publicized Framingham risk study began in 1948. More than 5000 individuals were followed up for over half a century and the association of several biochemical parameters with the diseases encountered in this population was published. However, it is important to remind the public that all statistical correlations are not actual indications of its causation. Moreover, diseases such as CVD and metabolic syndrome do not depend on any one factor alone. These are called multifactorial diseases. Hence, while deciding the health impact of only one factor such as circulating cholesterol, one should also take into account every other confounding factors such as smoking, family history, level of stress, and inflammation.

As said earlier, we cannot reduce cholesterol level by restricting diet alone. The most common drug to reduce cholesterol level targets endogenous synthesis mechanism. This is beneficial for those suffering from severe hypercholesterolemia or familial hypercholesterolemia.^[2] However, anyone else trying to reduce cholesterol (without physician's prescription) by use of drugs popularized by advertisement is targeting the normal cellular machinery which can lead to adverse health effects on a later stage. Drastic reduction of cholesterol in circulation would in turn reduce the cholesterol required for cellular membrane integrity and vital functions.

For example, Vitamin D, a very essential fat-soluble vitamin, is synthesized in our body from cholesterol present in cell. Vitamin D is important for healthy bone, calcium homeostasis, overall immunity, etc.^[4] Bile acids and bile salts are synthesized in liver from cholesterol as precursor molecule. These are necessary for digestion and absorption of fat and fat-soluble vitamins. Steroid hormones which have wide implication in health are also byproducts of cholesterol. Therefore, before panicking over minimal rise in lipid profile values, one should ponder about one's overall general health, family history, lifestyle-associated risks, etc., and also the daily requirement of cholesterol for maintenance of cellular functions. Moreover, recently, it has been reported that the cholesterol *per se* does not cause heart disease; rather the individual's susceptibility, sedentary life, and familial predisposition promote the coronary artery disease. Even there are reports of cholesterol in optimal quantity is beneficial for health.

Therefore, one should consider promoting good health by maintaining proper diet and lifestyle unless warranted otherwise by a good physician. There are foods that promote

good cholesterol and reduce bad cholesterol through natural ways.^[5] Intake of olive oil, beans, legumes, garlic, fish rich in omega-3 fatty acids, flax seeds, soy protein, avocado, etc., are helpful in raising HDL cholesterol level and decreasing LDL cholesterol.^[6] Opting for a healthy diet and lifestyle naturally promotes a healthy cholesterol balance in body promoting the good effects of cholesterol over its ill effects.

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DOI:

10.4103/ijcep.ijcep_48_17

How to cite this article: Pal GK, Nanda N. Dietary cholesterol restriction is not good for health. *Int J Clin Exp Physiol* 2017;4:109-10.