

Cardiovascular: Cholesterol – a silent threat with seasonal variation

Cholesterol is an essential molecule for the human body, used for the making of hormones and steroids and the maintenance of nerve cells. The majority of cholesterol circulating in our bloodstreams is made by our own livers (75% - 80%) with the remainder being ingested from animal sources of food.

Hypercholesterolemia refers to the situation where blood cholesterol levels are elevated above the norm. A normal or desirable cholesterol level is defined as less than 200 mg of cholesterol per deciliter of blood (mg/dL). Blood cholesterol is considered to be borderline when it is in the range of 200 to 239 mg/dL. An elevated cholesterol level is 240 mg/dL or above. Cholesterol levels are determined by blood analysis.

Not all cholesterol is bad for you. Cholesterol has been divided into two major categories – LDL (low density lipoprotein) the so called “bad” cholesterol and HDL (high density lipoprotein) often referred to as “good” cholesterol. The most common cause of elevated serum cholesterol levels is eating foods rich in saturated fats or containing high levels of cholesterol leading to an increase in LDL levels. Lack of exercise, smoking and alcohol also play their part in raising LDL levels.

Obesity, which may have been caused by eating a high fat diet in any event, can also lead to elevated blood cholesterol levels. This is because obesity itself causes the body to produce excessive amounts of cholesterol. Unfortunately, it can be a vicious circle because being obese will often stop someone from exercising which in turn results in them becoming even more obese and all the time their cholesterol levels are rising. Generally, by exercising and losing weight you can increase HDL and decrease LDL levels.

Unfortunately for some people, diet and exercise may not be of help because they suffer from an inherited disorder in which cholesterol is not metabolized properly by the body, thus causing cholesterol levels to rise. Elevated cholesterol also can be caused by a number of underlying diseases that raise blood cholesterol levels such as diabetes mellitus, kidney disease, liver disease, or hypothyroidism.

Hypercholesterolemia increases the risk of heart disease and stroke. Elevated levels of circulating cholesterol cause deposits of fats (plaques) to form inside blood vessels. When the deposits become sufficiently large, they block blood vessels and decrease the flow of blood. These deposits result in a disease process called atherosclerosis, which can cause blood clots to form that will ultimately stop blood flow. If this happens in the arteries supplying the heart, a heart attack will occur. If it happens in the brain, the result is a stroke where a portion

of brain tissue dies. Atherosclerosis causes more deaths from heart disease than any other single condition.

The problem is that hypercholesterolemia is silent and shows no visible symptoms. For many people, the first time they know that they are suffering from it is after they have had a heart attack or stroke. It is for this reason that health professionals recommend adults have their cholesterol levels tested every five years and more frequently if an individual's circumstances so dictate. It should be measured, as far as possible, when a person is healthy. Acute illness and stressful events such as trauma and surgery can cause temporarily low levels of cholesterol.

It is not necessary to fast before a cholesterol test as cholesterol levels do not change in response to a single meal. Long term alterations in patterns of eating can cause changes in blood cholesterol levels but it takes weeks rather than hours to see such changes in cholesterol levels.

Studies have also shown that cholesterol levels may vary with the seasons, being highest during the winter months. Set out below is some of the research in this regard beginning with the latest study carried out by Ira S. Ockene, M.D., of the University of Massachusetts Medical Center, USA.

Ockene IS et al. (2004): The researchers conducted a longitudinal study of seasonal variations in lipid levels in 517 healthy volunteers from a health maintenance organization serving central Massachusetts. Data were collected during a 12-month period for each individual including baseline demographics and quarterly anthropometric, blood lipid, dietary, physical activity, light exposure, and behavioural information. The average total cholesterol level was found to be 222 mg/dL (5.75 mmol/L) in men and 213 mg/dL (5.52 mmol/L) in women. Amplitude of seasonal variation was 3.9 mg/dL (0.10 mmol/L) in men, with a peak in December, and 5.4 mg/dL (0.14 mmol/L) in women, with a peak in January. Seasonal amplitude was greater in hypercholesterolemic participants. Although the mechanisms for such a phenomenon were not clear, seasonal changes in plasma volume explained a substantial proportion of the observed variation. Overall, 22% more participants had total cholesterol levels of 240 mg/dL or greater ($>$ or $=6.22$ mmol/L) in the winter than in the summer and therefore, larger numbers of people are likely to be diagnosed as having hypercholesterolemia during the winter than in the summer. The authors concluded that their study confirms a variety of other studies showing seasonal variations in blood lipid levels and suggests greater amplitude in seasonal variability in women and hypercholesterolemic individuals, with changes in plasma volume accounting for much of the

variation. A relative plasma hypervolemia during the summer seems to be linked to increases in temperature and/or physical activity.

Woodhouse PR et al. (1993): The researchers investigated seasonal variation in serum lipids in 96 volunteers aged 65-74 years who were studied at 2-monthly intervals for one year. Periodic regression analysis revealed highly significant seasonal variation in serum total cholesterol and high-density lipoprotein (HDL) cholesterol. Peak levels for both occurred in winter with corresponding summer troughs. The seasonal difference for total cholesterol was 0.32 mmol/l (95% CI 0.23-0.41, $p < 0.0001$) and that for HDL cholesterol 0.16 mmol/l (95% CI 0.12-0.19, $p < 0.0001$). Low-density lipoprotein (LDL) cholesterol was highest in winter in men only (seasonal difference 0.27 mmol/l, 95% CI 0.15-0.39, $p < 0.0001$), and triglycerides were significantly greater in late winter for women only (seasonal difference 0.22 mmol/l, 95% CI 0.09-0.35, $p = 0.002$). The timing of seasonal variation in total cholesterol and triglycerides would be consistent with a role in the seasonal variation in vascular deaths, but our finding of a relatively high HDL: total cholesterol ratio in winter makes this less likely.

Gordon DJ et al. (1988): Seasonal plasma lipid and lipoprotein cycles were studied in 1446 hypercholesterolemic 35-59 year-old men followed for 7 years as the placebo group of the Lipid Research Clinics (LRC) Coronary Primary Prevention Trial (CPPT). Separate periodic time series were calculated for each study participant; mean parameter estimates were obtained by vector algebra. Highly significant (p less than 0.001) synchronous sinusoidal seasonal cycles, peaking in the first month of winter, were demonstrated for plasma levels of total (TOT-C), low-density lipoprotein (LDL-C), and high-density lipoprotein (HDL-C) cholesterol. Their mean seasonal changes (nadir to zenith) were 7.4, 6.4, and 0.8 mg/dl, respectively. An irregular but statistically significant seasonal pattern was also observed for plasma triglyceride (TG) levels, with peak levels in the autumn. The variation of these seasonal effects among subgroups and geographic locales and their correlation with seasonal weight and dietary patterns yielded few clues as to their underlying etiologic mechanisms.

Rastam L et al. (1992): In this study the researchers found a significant cyclic time-trend in cholesterol levels, with maximum peak in January in 3377 men and 3900 women who were participants in a community-based plasma cholesterol screening program. The 95% confidence interval (CI) of the peak to trough distance was 5.8-13.8

mg/dL (0.15-0.36 mmol/L) in men, corresponding to 2.6%-6.3% of the average cholesterol level. Corresponding figures for women were 2.0-9.3 mg/dL (0.05-0.24 mmol/L) or 1.0%-4.6%. Applying the cutoff level for high cholesterol risk proposed by the National Cholesterol Education Program (≤ 240 mg/dL [6.21 mmol/L]) to sex-specific bimonthly distributions, the authors found a statistically significant variation in prevalence, attributable to seasonal trends, in men ($P < .01$), but not in women. In men, the age-adjusted prevalence in winter (25.4%) was double that in the summer (13.5%). The researchers therefore concluded that seasonal variation is an important determinant of the prevalence of hypercholesterolemia in men and should be considered in patient follow-up and screening.

In view of the above evidence, it would seem wise to recommend that with regard to cholesterol testing, more than one test should be carried out at different times of the year. As Dr. Ronald Krauss of the American Heart Association notes the research "underscore(s) recommendations that doctors measure patients' cholesterol levels more than once before prescribing medication."

References:-

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