



## **Flight Crews Should Monitor Cholesterol Levels Closely**

*Poor diet and life-style choices lead to cardiovascular disease, a major threat to aeromedical certification.*

by

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High cholesterol can lead to cardiovascular disease and other ailments that threaten aeromedical certification. A variety of prescription medicines and substances can help lower serum cholesterol to avoid the high-risk levels that can lead to cardiovascular disease. Many health authorities believe that a diet that limits the use of egg yolks, butter and fatty foods can also reduce the risk of cardiovascular disease.<sup>1</sup>

If an individual's serum cholesterol level exceeds 200 milligrams (mg)/deciliter, an active serum cholesterol reduction program should be considered. Such a program might include dietary changes, more regular exercise and weight control. Exercise and weight control are generally recommended for everyone, but they should be especially high priorities for people at higher risk for developing heart and blood vessel disease. If a low fat, low cholesterol diet, exercise and weight control are not effective, medication may be necessary.

Life-long serum cholesterol levels should be kept below 200 mg. Adult arteries generally operate in the 90-130 millimeters (mm) of mercury ranges (mean pressure). When at rest, the adult arterial "systolic" pressure (the peak pressure per heart contraction) generally is within the 110-130 mm range, with the accompanying "diastolic" (or lower) pressure before the next heart contraction

in the 70-82 mm range. [Systolic measurement refers to pressure when the heart is pumping; diastolic measurement refers to pressure when the heart is at rest.]

The upper ranges of mean pressure occur temporarily during exercise and are a healthy response to demands on the cardiovascular system. During vigorous exercise, the systolic pressure upper level can rise in a healthy person to 180 or higher depending on the level of exertion. The diastolic pressure can reach 120 or higher under these circumstances. Pulse rates (ideally in the high 50s to high 60s per minute while at rest) can rise to 150 or more, depending on the exercise and the fitness of the individual. These temporary, increased pulse rates and pressures are considered normal physiologic responses to exercise, and are part of the healthy conditioning process accompanying regular exercise.

Continuous high average resting blood pressures (in contrast to those occurring during exercise) produce a sustained loading on the arteries and heart over time, and promote blood fat particle deposits (of which cholesterol is a predominant component) in the flexible semiporous inner arterial wall. The fatty deposits are known as "atherosclerosis," a condition noted by the ancient Greeks and named after their word for "porridge," which the deposits resemble. The increasing build-up of fat (lipids)

## Typical Laboratory Serum Cholesterol and Lipid Listing

<i>Chemical Screen</i>	<i>Unit of Measure</i>	<i>Reference Range</i>
Cholesterol	milligrams/deciliter (mg/dl)	*
Cholesterol percentile	Percentile	
Triglycerides	mg/dl	50-250
High-density Lipoprotein (HDL) Cholesterol	mg/dl	*
Low-density Lipoprotein (LDL) Cholesterol	mg/dl	*

\*Cutoff Values Recommended by the U.S. National Cholesterol Education Program

	<i>Desirable</i>	<i>Borderline</i>	<i>Higher Risk</i>
Cholesterol	Less than 200	200-239	240 or greater
HDL Cholesterol	Greater than 35	35	Less than 35
LDL Cholesterol	Less than 130	130-159	160 or greater

Source: Dr. Stanley R. Mohler

**Figure 1**

will ultimately create a loss of artery wall flexibility and will narrow the cross-sectional area of the affected artery. Sustained increased at-rest blood pressures (hypertension) dramatically increase the build-up of these fats over a period of time. The deposited fats will gradually narrow the inner artery surface in contact with blood and will progressively close the arterial opening, inhibiting an adequate flow of blood. Tobacco smoking also damages the inner arterial wall lining, further promoting atherosclerosis.<sup>1</sup>

This process of arterial damage by atherosclerosis is a major factor in more than 60 percent of the deaths in the United States. These atherosclerotic changes are the major causes of heart attacks and strokes.<sup>2</sup> Thus, preventing and reducing atherosclerosis are priorities for anyone seeking a healthier, longer life, and for pilots seeking a career with continuing aeromedical certification. Fortunately, accomplishing atherosclerotic prevention and reduction measures can be achieved by adopting a healthy lifestyle and by taking specific cholesterol lowering substances and medications when necessary. These measures can be beneficial at all ages.

Figure 1 shows a general form for a laboratory report of blood lipid levels, along with typically given ranges for normal levels.

Substances that inhibit the assembling of excessive cholesterol in the liver by metabolism include:

**Lipoprotein Inhibitors.** Gemfibrozil is a prescription drug that is known to decrease serum cholesterol

levels, and to decrease very low-density lipoprotein levels in serum. These very low-density lipoproteins carry fat and cholesterol into the arterial walls, producing atherosclerosis. The drug may also decrease fatty acid levels. In addition, some reports have found that the drug may increase levels of high-density lipoprotein, a beneficial result. High-density lipoproteins carry deposited fats away from their arterial wall deposition sites.

**Anti Low-density Lipoprotein Medication.** The prescription drug Probucol enhances the removal of serum low-density lipoprotein from arterial walls. Thus, the adverse effect of low-density lipoprotein deposits is diminished to a significant degree.

**Niacin (nicotonic acid).** This substance has a cholesterol-lowering effect (the low-density lipoprotein cholesterol is lowered). It has been observed that high-density lipoproteins may increase in people taking the substance, a potential benefit noted above. Very low-density lipoprotein synthesis is also decreased.

**Cholesterol Lowering Resins.** Substances known as "bile acid binding chemicals," referred to as "resins," can lower the total cholesterol level, mainly through diminishing the low-density lipoproteins. These also increase the liver "receptors" that pull low-density lipoproteins from the circulating blood, lowering their circulating level.

**Ethyl Alcohol.** A recent study reported that one to two alcoholic drinks a day appeared to raise high-density lipoprotein levels in the serum.<sup>3</sup>

Despite the publicity this received, it is important to note that the above study was based on questionnaires of 680 persons, half of whom had previously had heart attacks.

Some laboratory data were collected on each participant. There was a suggestion that high-density lipoproteins increased somewhat in those who reported consuming one or two alcoholic drinks a day within the study group, and that there were fewer future heart attacks in those who reported this moderate alcohol consumption.

But the many adverse effects of a mind-altering, habituating and addicting toxic substance, such as ethyl alcohol, cannot be overlooked simply because a study, based fundamentally on self-reported alcohol intake, seems to have indicated that a change in one category of serum lipids might of itself be beneficial to the health of the heart and blood vessels.

This lipid-change finding must be viewed in perspective with the many other changes alcohol produces that are detrimental to heart muscle, arteries, liver and other organs, including changes in the brain that can affect behavior and coordination. These symptoms include diminished simulator performance and increased risk of hemorrhagic stroke in those who regularly consume alcohol.<sup>4</sup>

Air crews can take positive nutritional and life-style steps to minimize the risks of developing cardiovascular disease. Medications are available from physicians for those who may need additional help in lowering serum cholesterol to safe levels. The long-term benefit can be avoidance of cardiovascular disease, enhanced quality of life, and continued aeromedical certification.♦

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*Mohler, an airline transport pilot and certified flight instructor, was director of the U.S. Federal Aviation Agency's Civil Aviation Medicine Research Institute (now the Civil Aeromedical Institute) for five years and chief of the Aeromedical Applications Division for 13 years.*

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# ***Disaster Response Planning Workshop for Business Aviation***



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**Table 3**  
**Visual Acuity ( $M \pm m$  relative units) and Refraction Error ( $M \pm m$  diopters) Before and After Orthokeratotomy**

Indices	Values Before Operation	Values after Operation
Visual Acuity, Rel. Units	0.3±0.04	0.86±0.05
Refraction Error, Diopters	Myopia 2.0±0.2	Myopia 0.58±0.05

Source: Victor Alexandrovich Roslyakov, M.D.

Thirteen pilots, six of whom have flown supersonic fighters, were monitored longitudinally from one to 10 years. The observations have not revealed any negative dynamic changes of the main visual functions. According to reports of their flight instructors, the pilots have not committed errors in flying procedures and have successfully performed at 1.5 to 2 times the average flight duty time limit levels per year.

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The results of surgical treatment of myopia in flying personnel suggest the urgency and desirability of further scientific investigation. This conclusion is warranted by:

- The improvement of preoperative examination procedures, including ultrasonic biometry and computer-assisted evaluation of the anatomic and functional state of the eye, allowing reliable predictions of long-term RK outcomes;
- The development of new improved methods of surgical correction of corneal refraction anomalies;
- The ophthalmological selection of patients for surgical refractive correction of vision based on the best possible expected results; and,
- The positive results of the initial experience in professional rehabilitation of military flying personnel after RK surgical treatment of myopia.

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