

# The Role of Low Density Lipoproteins in the Body

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**Obesity has been an ever growing problem in today's western society. A large number of chronic diseases are directly correlated with nutrition and what we put into our bodies. Trans-fats have been a constant problem with today's society and there are many negative aspects that come with the consumption of this lipoprotein. Low-density lipoprotein (LDL) cholesterol has negative effects on our bodies and is most specifically correlated with Atherosclerosis. It plays a huge role in the pathophysiology of disease. High amounts of LDL lead to hardening of the blood vessels in the body along with a greater risk for obesity. Huge strides have been made in order to cut back on the consumption of trans-fats in our country, but it is still a problem we deal with every day.**

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## Introduction

Trans-fat used to be a part of everybody's diet in the Western world before the late 1990's. You could find trans-fat in restaurants, cooking material, and even children's formula. Another huge source of trans-fat was in partially hydrogenated oils. A great example of this was margarine and certain vegetable oils. Certain food companies also hydrogenated their goods so that the shelf life would improve and be able to last longer on the store shelf. It was soon found that trans-fats have a high level of Low-Density-Lipoprotein (LDL). These LDL's are responsible for the thickening of the arterial walls and is directly correlated to Coronary Heart Disease (CHD), along with many other chronic diseases. We will get into the micro physiology of this later in the review, but the understanding of how this proceeds in your body is very important. Beginning in the late 1990s, efforts to remove trans fatty acids from the public food supply were underway in the US. This has improved the nations consumption of LDL's, but has not solved our major health problem that is currently on the rise.

## Recent Progress

Many strides have been made to cut trans-fat from today's diet. In mid-2006, the American Heart Association (AHA) launched a national campaign to educate the public about the health hazards of trans fats, and in

December of 2006, the New York City Board of Health voted to remove artificial trans fats in public restaurants by 2007. This lowered the amount of LDL in today's society by lowering the amount of trans fat available for public consumption. According the NHANES (9), the total trans-fat consumption for the United States has dropped 21% in the past 5 years. They have also found that a way to counteract the role of trans fat in LDL distribution is to consume larger amounts of omega-3 fatty acids like stearic and oleic fatty acid. These lower your LDL count in your body and can be found in large amounts in cold water fish like salmon and tuna. The combination of lowering trans fats and increasing omega 3 intake through cold water fish has drastically improved the United States cholesterol when it comes to Low Density Lipoproteins.

## Discussion

Trans-fat is full of LDL cholesterol. These LDL molecules are directly responsible for the accumulation of plaque in our arterial walls. LDL's enter the artery wall through a process called transmigration. Monocytes are originally attracted to the arterial wall by adhesion molecules. L-selectin (an adhesion molecule) grabs the monocytes and pull them along the membrane. Soon after that PECAM (another adhesion molecule) grabs the monocyte and pulls it into the arterial wall. These

monocytes then differentiate into macrophages inside the cell wall or the artery. These macrophages then search the body for LDL's to consume. These LDL's get consumed by macrophages and eventually turn into foam cells. Foam cells are the precursors to calcification of the arteries. These foam cells are hard and rigid, like bone, and when they are created in the arteries stiffening and atherosclerosis can occur rather quickly. The more foam cells that accumulate, the thicker the plaque in the artery can get. This thickening of the artery wall (atherosclerosis) causes ischemia, or the narrowing of the lumen in the blood stream; this also causes hypertension and elevated heart rate. Plaque formations can also be an even greater danger in the lives of people. These plaques could break away from the artery wall and cause a myocardial infarction, or heart attack. This occurs when the plaque breaks away from the lumen and gets lodged in a narrow artery causing a loss of blood flow to a certain area. Also, once this plaque breaks off the body would launch an immune response and try to clot the artery. This could turn into a thrombus and block off the artery even more. These plaque formations could also get lodged into the brain and cause a stroke or other brain disorder. Possibly the worst part of this plaque is that once it is formed, it sends out signals through cytokines for more plaque to be formed. They send out pro-inflammatory markers like IL-6 and TNF-alpha. These markers up regulate the formation of LDL cholesterol and therefore increase the likelihood of plaque formation. To wrap up the physiology of this entire process, plaque is very bad for your health and is formed by large amounts of LDL cholesterol. LDL cholesterol is present in large numbers in foods high in trans-fat, therefore it is not recommended to have a diet high in trans-fat. Our government is doing a lot in order to minimize the intake of trans-fat, but ultimately people need to watch what they eat in order to prevent this serious chronic disease.

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