



CLINICAL EXERCISE SPECIALIST MANUAL

A Fitness Professional's Guide
to Training People with
CHRONIC DISEASE

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CLINICAL EXERCISE SPECIALIST MANUAL

**A FITNESS PROFESSIONAL'S GUIDE TO
EXERCISE AND CHRONIC DISEASE**

BY J. DANIEL MIKESKA, DHSC

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CHAPTER 11

HYPERLIPIDEMIA

By the end of this chapter you will understand:

- Cholesterol and triglycerides
- Recommended goals for blood lipids
- Treatments:
 - o Exercise
 - o Nutrition
 - o Pharmacological
- FITT guidelines for blood lipid disorders

Cholesterol and Triglycerides

Hyperlipidemia, or *dyslipidemia* is a term to describe abnormal blood fat and lipoproteins (American College of Sports Medicine [ACSM], 2018; LaFontaine, Roitman, & Sorace, 2018). Lipoproteins are protein and fats that bind together and travel through the blood, carrying cholesterol (a waxy fat) and triglycerides. Triglycerides are made of three molecules of fatty acid and a molecule of glycerin, and are the most common fat in the body. In normal amounts cholesterol is a source of energy for the body, and triglycerides, in addition to being a fuel source help build cells (Mayo Clinic, 2019; Sugerman, 2013). However, at elevated levels, cholesterol builds in artery walls and disrupts normal blood flow, while triglycerides are associated with elevated cholesterol, and cardiovascular disease (CVD) risk factors such as obesity and metabolic syndrome. In combination, elevated levels of cholesterol and triglycerides are risk factors for atherosclerotic cardiovascular disease (ASCVD), a comprehensive term to describe multiple cardiovascular events caused by atherosclerosis including coronary heart disease (CHD), angina,

stroke, and myocardial infarctions (Ference et al., 2017; La Forge, 2015). Comorbidities associated with dyslipidemia are:

- Chronic heart disease
- Angina
- Diabetes
- Hypertension
- Obesity
- Metabolic syndrome
- Insulin resistance
- Renal Disease
- Peripheral vascular disease
- Chronic obstructive pulmonary disease

There are a number of classes of plasma lipoproteins, based on size and lipid composition, however, we will only discuss the five in Table 11.1.

Table 11.1

Classes and composition of plasma lipoproteins

Lipoprotein	Density (g/ml)	Size (nm)	Major Lipids	Composition
Chylomicrons	<0.930	75-1200	Triglycerides	Large triglyceride rich particles made by the intestine. They transport dietary triglycerides and cholesterol from the intestines to peripheral tissues and the liver.
Very low-density lipoproteins (VLDL)	0.930-1.006	30-80	Triglycerides Serum Cholesterol	Produced by the liver and are triglyceride rich and carry up to 15% of the body's serum cholesterol.
Intermediate-density lipoprotein (IDL)	1.006-1.019	25-35	Triglycerides Cholesterol	Remnants formed when triglycerides are deposited in muscle cells and adipose tissue by VLDL. IDLs also contain significant amounts of cholesterol, and along with VLDL, contribute to ASCVD.
Low-density lipoproteins (LDL)	1.019-1.063	18-25	Cholesterol	Carry approximately 60-70% of blood cholesterol and are formed from the catabolism of VLDLs. Due to the contribution to atherosclerosis, LDLs are considered the bad cholesterol.
High-density lipoproteins (HDL)	1.063-1.210	5-12	Cholesterol Phospholipids	Carry cholesterol from the blood back to the liver. Because of this reverse transport process, HDLs are considered the good or healthy cholesterol.

Feingold & Grunfeld, 2018; LaFontaine et al., 2018; La Forge, 2015

Recently, rather than using LDL cholesterol as a marker for CVD, non-HDL cholesterol levels and total cholesterol to HDL ratios have been studied. Because non-HDL cholesterol levels include other potentially harmful lipoproteins, it is considered a more comprehensive measurement when considering CVD risk factors. Similarly, total cholesterol to HDL ratios may also be a more valid predictor of CVD than just total cholesterol as it considers the benefits of a higher HDL level (Lopez-Jimenez, 2019). Accordingly, higher ratios mean a higher risk of heart disease. Ideally, the ratio should be below 5.0, with the optimum ratio at 3.5 (Mosca, 2007). However, while the total cholesterol to HDL ratio can be used as a guideline, it is not generally used for treatment. Table 11.2 details lipid level guidelines.

Table 11.2

Lipid level guidelines

Lipid in mg/dl	Optimal	Near optimal	Borderline	High	Very High
Total Cholesterol	<150	<200	200-239	>240	
LDL	<100	100-129	130-159	160-189	>190
HDL	>60			<40	
Triglycerides	<100	<150	150-199	200-499	>500

ACSM, 2019; Harvard Medical School, 2015; La Fontaine et al., 2018

Exercise

Regardless of the dangers of high levels of lipoproteins, lipids are a primary source of energy for aerobic and endurance exercise, and a modest source of energy for resistance exercise. Fatty acids are mobilized from adipose tissue and transported to working muscles. Different forms of exercise will result in reductions in total cholesterol, triglycerides, and LDL cholesterol, and an increase in HDL cholesterol. Triglycerides are particularly responsive to exercise, and mostly decrease immediately after exercise. Consequently, moderate to vigorous exercise 1-12 hours prior to a meal rich in fats can lower postprandial triglycerides (Gordon, Chen, & Durstine, 2014; La Forge, 2015). Long-term resistance exercise programs (>12 weeks) can result in up to a 3% decrease in total cholesterol, a 4.5% decrease in LDL, a 6% decrease in non-HDL cholesterol, and a 6% decrease in triglycerides. Resistance training can increase HDL cholesterol by approximately 1%. Because aerobic exercise uses lipids as a primary energy source, it can lead to a decrease of 2% in total cholesterol, 2.5% in non-HDL cholesterol, and 11% in triglycerides. Aerobic exercise can also lead to a 4% increase in HDL cholesterol (Gordon et al., 2014). Exercise recommendations for clients suffering from blood lipid disorders are detailed in Table 11.3.

Table 11.3

FITT guidelines for clients with blood lipid disorders

Mode	Frequency	Intensity	Time	Type
Aerobic	5-7 days/week	40-75 HRR RPE 12-16	15-60 min/bout Can be performed in 10 min. bouts With a long-term goal of at least 300 min/week and a total caloric expenditure goal of 2000cal./week	Exercises that target large muscle groups: Walk, jog, cycle, swim
Resistance	2-3 non-consecutive days/week	60-80%1RM RPE 11-15	8-12 exercises 8-12 reps 1-4 sets	Major muscle groups 4-5 exercises each for upper and lower body
Flexibility	3-7 days/week	Stretch to ROM tightness	10-30 sec/stretch 2-3 reps/stretch	4-5 exercises each for upper and lower body

ACSM; 2018; LaFontaine, 2018; La Forge, 2015

Nutrition

Although this manual is not intended to replace an educated and experienced nutritionist or registered dietician, proper nutrition habits combined with exercise, and in many cases pharmacological therapy, help with the management of dyslipidemia. There are a number of diets that provide guidance including eating plans developed by the American Heart Association and also by the Office of Disease Prevention and Health Promotion (LaFontaine, 2018; La Forge, 2015; Lichtenstein, et al., 2006; U.S. Department of Health and Human Services, 2019). General guidelines are:

- Lose body fat if needed (8-10 pounds can reduce LDL by up to 8%).
- Consume no more than 7% of calories from saturated fat (can reduce LDL by up to 10%).
- Avoid trans-fat.
- Only consume 20-30% of calories from fat sources.
- Consume no more than 200mg of cholesterol daily (can reduce LDL by up to 5%).
- Consume 25gm of berries daily.
- Consume fish for 2-3 meals per week.
- Consume 25gm of soy protein daily.
- Consume 5-10 gm of soluble fiber daily (can reduce LDL by up to 5%).
- Limit sugars to less than 5% of daily calories.
- Limit processed foods.

- Limit alcohol to 2 or fewer drinks per day.
- Consume 2gm of plant stanols and sterols daily (can reduce LDL by up to 15%).

Medication

Clients with blood lipid disorders may be prescribed medication by a physician. Some medications have undesirable side effects and some may interfere with the benefits of exercise. Table 11.4 lists common medications, their purpose, and side effects.

Table 11.4

Common medications for dyslipidemia and their side effects

Drug Class	Purpose	Side Effects	Effects on Exercise
HMG-CoA reductase inhibitors (AKA Statins)	Disrupt cholesterol synthesis to lower LDL	GI issues, headaches, muscle aches, dizziness, myopathy	May reduce the effectiveness of aerobic exercise May increase myalgia (muscle pain and/or damage) with exercise
Niacin	Lowers LDL and triglycerides, but most beneficial for increasing HDL	Flushing, itching, hypotension	No known effects
Fibrates	Lower triglycerides and increase HDL	GI issues, muscle aches, rash	May increase myalgia (muscle pain and/or damage) with exercise
Bile acid sequestrants	Bind bile acids to lower total and LDL cholesterol	GI issues	No known effects
Cholesterol absorption blockers	Blocks cholesterol from being absorbed and lowers total plasma cholesterol	GI issues	No known effects
Omega-3	Lowers triglycerides	No known side effects	No known effects

La Forge, 2015; LaFontaine et al., 2018

Discussion and application

1. Define the types of lipoproteins. Discuss each role as well as the benefits or disadvantages.
2. Explain the benefits of exercise on cholesterol levels.

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