



CLINICAL EXERCISE SPECIALIST MANUAL

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

J. DANIEL MIKESKA DHSc

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

BY J. DANIEL MIKESKA, DHSC

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CHAPTER 13

METABOLIC SYNDROME

By the end of this chapter you will understand:

- Characteristics and diagnostic criteria
- Treatment strategies
 - Pharmacological
 - Nutrition
 - Activity
- Comorbidities and associations
- Risks and contraindications
- FITT

Characteristics

Originally introduced in the 1920s, Metabolic Syndrome (MetS) did not gain attention until 1998 when the World Health Organization provided a first definition. A final definition was agreed upon in 2005: Metabolic syndrome is a cluster of risk factors that, in concert, increase the threat for developing cardiovascular disease and Type II diabetes (T2DM) (Kaur, 2014). The consequences of MetS is increased insulin resistance, low grade systemic inflammation, elevated HTN, and a pro-thrombotic state. Risk factors are listed below, and for a diagnosis of MetS an individual must have three risk factors or more (Kaur, 2014; Sorace, Ronai, & Churilla, 2014):

- Abdominal obesity as indicated by a waist circumference of ≥ 40 " for men or ≥ 35 " for women.

- Triglyceride levels of ≥ 150 mg/dl.
- HDL levels of <40 mg/dl for men and <50 mg/dl for women.
- Blood pressure $\geq 130/85$ mm/Hg.
- Fasting glucose level of ≥ 100 mg/dl.

The incidence of MetS has increased in tandem with the incidences of obesity and T2DM; as of 2012, one-third of U.S. adults met the criteria for MetS (Moore, Chaudhary, & Akinyemiju, 2017; Saklayen, 2018). Consequently, an individual with MetS is twice as likely to develop cardiovascular disease (CVD) in the next 10 years, and 5-10 times as likely to develop type II diabetes (Franklin, Miller, & McCullough, 2015; Cornier et al., 2008). A client diagnosed with MetS, based on the CVD risk factors listed in Table 2.2, and the results from a physical activity risk stratification form, may meet the criteria for high risk, and should be treated accordingly.

The underlying cause of MetS is adipose tissue. Macrophages are large white blood cells in various tissues of the body. When stored in adipose tissue, the accumulation of macrophages cause, in part, metabolic dysregulation and a chronic state of low-grade inflammation (Moore, et al., 2017; Russo & Lumeng, 2018; Saklayen, 2018). Systemic inflammation can impair endothelial function, lead to blood clots, and CVD. Additionally, adipocytes, the cells that store fat and make up adipose tissue, secrete numerous hormones. The hormone leptin suppresses appetite and facilitates energy intake when energy stores are low. Conversely, the absence of leptin can result in extreme obesity. The hormone adiponectin regulates triglyceride and glucose metabolism by increasing insulin sensitivity, decreasing the size of adipocytes, and increasing mitochondrial density (Saklayen, 2018). Ghrelin, a hormone in the gut, is responsible for triggering satiety. Ghrelin increases during hunger and decreases after food intake. Weight loss also increases ghrelin that may cause individuals who are dieting trouble with continued weight loss (Franklin, et al., 2015).

Treatment Strategies

Nutrition

The most effective treatment for MetS is lifestyle change (Franklin et al., 2015; Kaur, 2014). Effective interventions are weight management via diet and exercise, and clinical intervention. Nutritional advice should be given only by a registered dietitian or a physician with education and experience in nutritional counseling. However, general guidelines are:

- A daily deficit of 500-750 calories.
- Restrict certain high glycemic foods.
- Increase daily fiber consumption.
- Reduce saturated fats.
- Reduce simple sugars.
- Increase legumes and whole grains.

Pharmacology and surgery

A realistic expectation is for a reduction of 7-10% of bodyweight in 6-12-months. Any intervention needs to account for individuality and adherence (Franklin et al., 2015). Clinical interventions include weight loss drugs, bariatric surgery, and when appropriate, pharmacological treatment for individual risk factors. Pharmacological treatments will usually address one or more of the underlying diseases rather than the cluster of diseases that make up MetS. Accordingly, a CXS should be aware of any side effects of a prescribed medication.

Activity

The chances of developing MetS is almost double for individuals who perform no moderate or vigorous activity compared to individuals who meet or exceed the recommended guideline of 150 minutes per week (Cornier et al., 2008). Physical activity and obesity are generally inversely related; however, chronic inflammation often associated with chronic pain can be reduced with physical activity without weight loss (Paley & Johnson, 2016). In addition to expending calories and increasing lean body mass and RMR, resistance training can alleviate risk factors associated with the components of MetS, including lower cholesterol and triglycerides, help with glycemic control and insulin sensitivity, lower blood pressure, and reduced central and total adiposity (Sorace et al., 2014). There is also evidence that participation in resistance exercise, even in small doses and independent of aerobic exercise, is associated with a lower risk of ever developing MetS (Bakker et al., 2017). Aerobic exercise has been demonstrated to reduce adipose tissue hypoxia and increase vascularization, partially via a reduction of arterial stiffness, allowing for better blood flow and increased tissue oxygenation (Donley et al., 2014; Paley & Johnson, 2016). Aerobic exercise is associated with a reduction of pain related to chronic low-grade inflammation, a decrease in mechanical loading, better sleep, and fewer depressive symptoms. Flexibility, balance, and neuromuscular control may be negatively affected in clients with MetS (Chang et al., 2015); therefore integrating flexibility and neuromuscular training into an exercise program may be beneficial.

Unfortunately, due to the cluster of diseases associated with MetS, it is difficult to develop one exercise plan to accommodate all risk factors. Therefore, it is often advised a client diagnosed with MetS to seek a medically supervised exercise program. However, if a client with MetS has a medical release to exercise, the best results are achieved through a combination of resistance and aerobic exercise. Furthermore, recent evidence suggests an increase in physical activity with an emphasis on high intensity interval training may produce the greatest results for fat reduction and an increase in lean tissue (Paley & Johnson, 2018).

Cardiovascular exercise can be performed 5 or more days per week, with an RPE of 11-13, gradually increasing to 60 minutes per day (Franklin et al., 2015). Resistance training can be performed 2x per week, starting with a single set for each major muscle group with an intensity of 40% 1RM, with a gradual increase to multiple sets with an intensity of 80% 1RM (Sorace et al., 2014). FITT guidelines for MetS are detailed in Table 13.1.

Keep in mind contraindications for each component of MetS should be considered independently.

Table 13.1

FITT guidelines for metabolic syndrome

Mode	Frequency	Intensity	Time	Type
Aerobic	≥ 5 days/week to maximize caloric expenditure	40-60% HRR with RPE 11-13	30 min/day with a goal of reaching 60 min/day limited capacity: 3-6 10 min bouts/day to accumulate 30-60min/ day	Rhythmic activities that target large mus- cle groups
Resistance—same as healthy adults	Each major muscle group 2-3 days/ week	60%–70% of the 1RM (moderate to hard intensity) for novice to intermediate exercisers ≥80% of the 1RM (hard to very high intensity) for experienced strength trainers <50% of the 1RM for mus- cular endurance	8-12 exercises 8–12 reps to improve strength 15–20 reps to improve muscular endurance 2-4 sets	Resistance exercises involving each major muscle group, target- ing larger groups first
Flexibility same as healthy adults	≥ 2-3 days/week	Stretch to the point of feeling tightness or slight discomfort	Static stretching hold for 10-30 sec. or up to 60 sec. for older individuals For PNF stretching, a 3- to 6-sec contrac- tion at 20%–75% maximum voluntary contraction followed by a 10-30 sec. assisted stretch	Static flexibility, Dynamic flexibility PNF
Neuromuscular exercise training same as healthy adults	≥2-3 days/week	N/A	≥20-30 min/bout	Exercise that chal- lenges motor skills, coordination, and proprioception such as Yoga or Tai Chi

Franklin et al., 2015; Sorace et al., 2014

Discussion and application

1. What is Metabolic Syndrome and what are its associated conditions?
2. Why is exercise an important component of treating MetS?

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