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## Literature Review

# An Overview of the Identification and Management of the Metabolic Syndrome in Chiropractic Practice



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Weight loss

### Abstract

**Objective:** This article presents an overview of metabolic syndrome (MetS), which is a collection of risk factors that can lead to diabetes, stroke, and heart disease. The purposes of this article are to describe the current literature on the etiology and pathophysiology of insulin resistance as it relates to MetS and to suggest strategies for dietary and supplemental management in chiropractic practice.

**Methods:** The literature was searched in PubMed, Google Scholar, and the Web site of the American Heart Association, from the earliest date possible to May 2014. Review articles were identified that outlined pathophysiology of MetS and type 2 diabetes mellitus (T2DM) and relationships among diet, supplements, and glycemic regulation, MetS, T2DM, and musculoskeletal pain.

**Results:** Metabolic syndrome has been linked to increased risk of developing T2DM and cardiovascular disease and increased risk of stroke and myocardial infarction. Insulin resistance is linked to musculoskeletal complaints both through chronic inflammation and the effects of advanced glycosylation end products. Although diabetes and cardiovascular disease are the most well-known diseases that can result from MetS, an emerging body of evidence demonstrates that common musculoskeletal pain syndromes can be caused by MetS.

**Conclusions:** This article provides an overview of lifestyle management of MetS that can be undertaken by doctors of chiropractic by means of dietary modification and nutritional support to promote blood sugar regulation.

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## Introduction

Metabolic syndrome (MetS) has been described as a cluster of physical examination and laboratory findings

that directly increases the risk of degenerative metabolic disease expression. Excess visceral adipose tissue, insulin resistance, dyslipidemia, and hypertension are conditions that significantly contribute to the syndrome. These conditions are united by a pathophysiological basis in low-grade chronic inflammation and increase an individual's risk of cardiovascular disease, type 2 diabetes mellitus (T2DM), and all-cause mortality.<sup>1</sup>

The National Health and Nutrition Examination Survey (NHANES) 2003-2006 estimated that approximately 34% of United States adults aged 20 years and more had MetS.<sup>2</sup> The same NHANES data found that 53% had abdominal adiposity, a condition that is closely linked to visceral adipose stores. Excess visceral adiposity generates increased systemic levels of proinflammatory mediator molecules. Chronic, low-grade inflammation has been well documented as an associated and potentially inciting factor for the development of insulin resistance and T2DM.<sup>1</sup>

NHANES 2003-2006 data showed that 39% of subjects met criteria for insulin resistance. Insulin resistance is a component of MetS that significantly contributes to the expression of chronic, low-grade inflammation and predicts T2DM expression. T2DM costs the United States in excess of \$174 billion in 2007.<sup>3</sup> It is estimated that 1 in 4 adults will have T2DM by the year 2050.<sup>3</sup> Currently, more than one third of US adults (34.9%) are obese,<sup>4</sup> and, in 2008, the annual medical cost of obesity was \$147 billion.<sup>4,5</sup> This clearly represents a health care concern.

The pervasiveness of MetS dictates that doctors of chiropractic will see a growing proportion of patients who fit the syndrome criteria.<sup>6</sup> Chiropractic is most commonly used for musculoskeletal complaints believed to be mechanical in nature;<sup>6</sup> however, an emerging body of evidence identifies MetS as a biochemical promoter of musculoskeletal complaints such as neck pain, shoulder pain, patella tendinopathy, and widespread musculoskeletal pain.<sup>7-13</sup> As an example, the cross-linking of collagen fibers can be caused by increased advanced glycation end-product (AGE) formation as seen in insulin resistance.<sup>14</sup> Increased collagen cross-linking is observed in both osteoarthritis and degenerative disc disease,<sup>15</sup> and reduced mobility in elderly patients with T2DM has also been attributed to AGE-induced collagen cross-linking.<sup>16,17</sup>

A diagnosis of MetS is made from a patient having 3 of the 5 findings presented in Table 1. Fasting hyperglycemia is termed impaired fasting glucose and indicates insulin resistance.<sup>18,19</sup> An elevated hemoglobin A1c (HbA1c) level measures long-term blood glucose

**Table 1** Diagnostic Predictors for MetS<sup>20</sup>

Predictor	Abnormal value
Impaired fasting glucose	>100 mg/dL
Triglycerides	>150 mg/dL
HDL cholesterol	<50 for women; <40 for men
Blood pressure	>130/85
Waist circumference	≥36" for women; ≥40" for men

*HDL*, high-density lipoprotein.

regulation and is diagnostic for T2DM when elevated in the presence of impaired fasting glucose.<sup>3,18</sup>

The emerging evidence demonstrates that we cannot view musculoskeletal pain as only coming from conditions that are purely mechanical in nature. Doctors of chiropractic must demonstrate prowess in identification and management of MetS and an understanding of insulin resistance as its main pathophysiological feature. The purposes of this article are to describe the current literature on the etiology and pathophysiology of insulin resistance as it relates to MetS and to suggest strategies for dietary and supplemental management in chiropractic practice.

## Methods

PubMed was searched from the earliest possible date to May 2014 to identify review articles that outlined the pathophysiology of MetS and T2DM. This led to further search refinements to identify inflammatory mechanisms that occur in the pancreas, adipose tissue, skeletal muscle, and hypothalamus. Searches were also refined to identify relationships among diet, supplements, and glycemic regulation. Both animal and human studies were reviewed. The selection of specific supplements was based on those that were most commonly used in the clinical setting, namely, gymnema sylvestre, vanadium, chromium and  $\alpha$ -lipoic acid.

## Discussion

### Insulin Resistance Overview

Under normal conditions, skeletal muscle, hepatic, and adipose tissues require the action of insulin for cellular glucose entry. Insulin resistance represents an inability of insulin to signal glucose passage into insulin-dependent cells. Although a genetic predisposition can exist, the

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