

## Diabetes and Physical Activity

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# Diabetes and Physical Activity

Volume Editors

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## Preface

Diabetes, a chronic metabolic disease characterized by high blood glucose, occurs when cells are resistant to the action of insulin and the pancreatic  $\beta$ -cells are unable to adequately compensate for the resistance (type 2 diabetes, T2D) or when the  $\beta$ -cells are not able to produce insulin (type 1 diabetes). In 2013, the worldwide prevalence of diabetes was estimated to be 8.3%, and was projected to increase dramatically, affecting over 380 million persons by 2025. There is, however, marked heterogeneity in the magnitude and geographic distribution of T2D. Although the prevalence of T2D is currently lower in most developing countries, it is estimated that it will be 69% higher in 2030, compared to 20% in developed countries. The disease is one of the world's leading causes of morbidity, mortality, disability, and economic loss. Global health expenditure to treat and prevent T2D and its complications was approximately USD 232 billion in 2007, a figure that is projected to exceed 302 billion by 2025. Approximately one half of patients with T2D die prematurely of a cardiovascular cause, and approximately 10% die of renal failure. Global excess mortality attributable to T2D in adults was estimated to be 3.8 million deaths.

More than half a century of evidence from epidemiological, experimental and clinical trials indicates that physical inactivity and some dietary practices (i.e. high-fat and/or high-sugar diets) are strongly linked to T2D. Indeed, in most nations of the world, physical activity and a healthy

diet are promoted as the primary therapy for the prevention and/or treatment of T2D. This book, containing 14 chapters by a broad range of leading scientists and clinicians in the fields of diabetes, nutrition and physical activity, examines various aspects of how physical activity impacts on T2D and its precursor, insulin resistance in different populations and age groups. In the first chapter, scientific evidence that physical activity and dietary modification can improve or, in some cases, reverse some features of T2D, is provided. The second chapter examines the role of sedentary behavior, in which the majority of people spend most of their waking day, as a risk factor for T2D, metabolic syndrome and cardiometabolic risk factors. Further, this chapter explores the relevance of low-intensity physical activity, as opposed to the often-studied moderate-to-vigorous activity, on T2D risk. Chapter 3 explores the association between physical activity and the prevalence of T2D in sub-Saharan Africa, where high levels of physical activity are typically reported, but where the prevalence of T2D is increasing with urbanization. The next 4 chapters address issues related to mechanisms underlying the effect of physical activity on T2D risk. In chapter 4, the physiological mechanisms that explain why physical activity interventions prevent and treat T2D are presented, while the recent findings in the fields of mitochondrial biogenesis and T2DM are discussed in chapter 5. Chapter 6 concerns the interplay between lipid availability and skeletal

muscle lipid metabolism as key regulators of insulin sensitivity in obesity, and how exercise modulates this relationship. Current knowledge of the mechanisms through which exercise increases glucose disposal in skeletal muscle, with emphasis on how the various signaling pathways converge to translocate GLUT4-containing vesicles to the plasma membrane, are reviewed in chapter 7. An examination of how exercise, obesity and body fat distribution interact and alter the risk of T2D is presented in chapter 8. In chapter 9, recent advances in the genetics of T2D are introduced and the current evidence for gene-physical activity interactions in T2D risk is presented. The following 3 chapters address the interplay between physical activity and T2D through the life course, including discussions on gestational diabetes (chapter 10), children (chapter 11) and the elderly (chapter 12). The final 2 chapters provide an overview of the public health recommendations for the control of T2D (chapter 13) and the role of physical activity in the control of type 1 diabetes (chapter 14).

The contributors to this book are recognized scholars in the fields of physical activity, nutrition, insulin resistance, and/or diabetes. The chapters they have contributed not only provide current evidence-based information regarding the effects of physical activity/inactivity and nutrition on insulin resistance and diabetes, but also the underlying mechanisms to explain the observed effects. The editors are indebted to them for the time they have put into the articles and the high-quality contributions.

This book has much to offer to a variety of population groups including research scientists, clinicians, biokineticists, exercise physiologists, graduate students, patients with diabetes and the general public. The extensive references cited allow the interested reader to undertake additional and in-depth studies where necessary.

*Edward O. Ojuka  
Julia H. Goedecke*