Introduction

Why a Journal of Muscle Health? Skeletal muscle is the largest organ system within our bodies. It is skeletal muscle that determines whole body locomotion and metabolism, and the health of muscle can predict disease development, from obesity and diabetes, to cancer cachexia, and quality of life (Figure 1). Musculoskeletal disorders (comprising bone and muscle) are widespread and beget a major economic burden. In 2008, at an estimated cost of approximately $7.2 billion, musculoskeletal diseases were the third most costly condition in Canada [1]. It is also known that muscle wasting with age (sarcopenia) represented 1.5% of the total healthcare expenditures ($18.5 billion) in the US in the year 2000, an estimate which has likely escalated continuously as the number of elderly individuals increases [2]. Sarcopenia is not a rare disability; rather it affects 100% of the population, provided that individuals live a normal lifespan. As a result, the muscle weakness and frailty stemming from sarcopenia can cause falls, which are a leading cause of injury, hospitalization, and accidental death.

It is clear that there is an urgent need for understanding and advances in this area. Identifying the physiological and molecular differences between younger and older individuals will lead to the development of specific strategies for sustaining health. New knowledge of muscle health and disease, and the attenuating effects of exercise and nutrition, would have a strong economic impact through significant cost savings over the longer term. Reducing the loss of muscle mass in elderly populations, for example, or preventing the development of adult chronic conditions through interventions targeting youth, will lead to lower healthcare costs by decreasing system utilization and hospitalization, and lowering drug expenses. In addition, the resulting reduction in workplace absenteeism will increase productivity for these individuals and their families.

Muscle health issues affect a large fraction of the North American population, largely because most adults, and their children, are relatively inactive. Physical inactivity levels are remarkably high, with only a very small proportion of the population meeting recommended physical activity levels [3]. As muscle mass occupies a significant percentage of the body mass in non-obese individuals, changes to muscle mass can substantially impact whole body health and metabolism. Muscle disuse resulting from physical inactivity leads to poor metabolism of foodstuffs (lipids and carbohydrates), thereby promoting the storage of energy in the form of fat instead. In turn, this can lead to obesity if the inactivity is sustained. Poor fat metabolism is also implicated in insulin resistance and the onset of Type 2 diabetes. When these metabolic conditions are combined with continued physical inactivity and sarcopenia as one ages, the major social and economic burden that these individual ailments demands is multiplied. Thus, an intervention(s) to combat and restrain metabolic and muscle dysfunction requires serious consideration.

The role of exercise in improving muscle health

To combat the soaring incidence of numerous aging-related chronic diseases that are associated with muscle dysfunction, regular physical exercise is now widely regarded as a means of improving overall health and lifespan, and is seen as an increasingly attractive therapy for these chronic diseases [4,5]. An improvement in muscle mass and strength can be achieved by a well-prescribed dose of resistance training exercise, and this is well aligned with improving one’s health status. Increases in muscle mass and strength can serve to prevent falls in the elderly, maintain muscle mass in cancer patients, and improve recovery and rehabilitation following injury, or surgical interventions. On the other hand, aerobic exercise training can lead to improvements in cardiorespiratory fitness, measured as VO₂ max, through beneficial effects on cardiac function and peripheral oxygen extraction at the level of the muscle. Aerobic training can be performed in a variety of ways, however the most commonly studied methods involve continuous submaximal aerobic exercise, or through the use of a short duration, high-intensity interval training regimen (HIIT).

Interestingly, some of the most profound effects of exercise are seen in skeletal muscle, which comprises approximately 40% of the total body mass of a healthy adult. Skeletal muscle is generally regarded as a highly malleable tissue, which can respond to a single bout of aerobic exercise and adapt to long term aerobic training. Adherence to a training regimen can result in considerable changes in muscle phenotype and biochemical composition, leading to improvements in muscle function and performance. Many of these changes are associated with angiogenesis-induced increases in the capillary network surrounding muscle fibers, along with mitochondrial adaptations that favour enhanced lipid oxidation, improved...
aerobic metabolism and reduced reactive oxygen species (ROS) production [6].

It is well established that the benefits of exercise on muscle health can extend throughout the lifespan [7]. This is an important message for sedentary individuals who hope to improve their health through lifestyle interventions at any point in time in their life. However, much research remains to be done on the effects of pharmaceuticals and nutraceuticals on muscle health, especially when combined with an exercise program. Indeed, our previous work has shown some synergy between appropriately prescribed compounds and the mitochondrial response to exercise [8]. A number of other “under-researched” areas of muscle health are equally deserving of attention, including 1) Muscle and fat interactions with aging, in relation to metabolic rate, activity and disease, 2) Muscle function, adaptation and body composition in obesity and diabetes, 3) Muscle capillary growth and vascularity in response to aging, exercise and disease, and 4) Interactions between exercise, bioenergetics and muscle function in aging and cancer cachexia.

It is hoped that the Journal of Muscle Health can serve its readers by publishing original research on muscle, muscle health and age-related diseases, and the role of exercise and therapeutic agents in attenuating muscle dysfunction with age and in disease conditions. It is important that this research is translated to the public, and it would be desirable if each article accepted by the Journal contained a summary, translational paragraph explaining the clear implications of the research findings for public health.

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REFERENCES