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Disability and Health Journal 5 (2012) 177–184

Disability and Health Journal

www.disabilityandhealthjnl.com

Body mass index and waist circumference in persons aging with muscular dystrophy, multiple sclerosis, post-polio syndrome, and spinal cord injury

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Abstract

Background: Body mass index (BMI) and waist circumference (WC) are well-understood in the general population, but are not adequately understood among persons with disabilities.

Objective: To describe and compare BMI and WC among individuals with muscular dystrophy (MD), multiple sclerosis (MS), post-polio syndrome (PPS), and spinal cord injury (SCI). BMI scores were also compared to normative data of the U.S. population, with consideration for age, sex, and mobility limitations.

Methods: Persons with MD (n = 339), MS (n = 597), PPS (n = 443), and SCI (n = 488) completed postal surveys that included self-reported BMI and WC data. NHANES data were used to compare the current sample with a representative US sample.

Results: Participants with PPS had higher BMI than participants with MD, MS, and SCI. In addition, participants with MS had significantly higher BMI relative to participants with SCI. BMI was significantly positively associated with age, years since diagnosis, mobility, and interactions of some of these factors. Relative to the general population, BMI was lower in MD, MS, and SCI across age groups, as well as in men with PPS and women ages 60-74 years with PPS. No significant differences were identified between MD, MS, PPS, and SCI in WC.

Conclusions: The presence of group differences in BMI and absence of group differences in WC suggests that BMI may not accurately represent health risk in SCI, MD, and possibly MS, because of biasing elements of the conditions, such as changes in body composition and mobility limitations.

Keywords: Muscular dystrophy; Multiple sclerosis; Post-poliomyelitis syndrome; Spinal cord injury; Body mass index; Waist circumference

Obesity rates are high in the United States, with current prevalence at 33.8% of the adult population [1]. Little research has examined obesity rates among persons with disabilities. There are limited reports suggesting that persons with disabilities in general are more likely to be obese (e.g., more than 41% of people with disabilities are obese compared with 32.5% of adults without disabilities [2]). However, a few studies have suggested lower rates of obesity among people with specific disabilities, including muscular dystrophy (MD) [3], multiple sclerosis (MS) [4], post-polio syndrome (PPS) [5], and spinal cord injury (SCI) [6], relative to national norms. For example, previous studies have reported that 22.0% of individuals with SCI [6], 21.2% of men with MS, and 25.0% women with MS are obese [4]. We are unaware of any studies to date that have considered similarities or differences in BMI across different disabilities to determine whether there are between-disability differences in BMI.

The most work in this area has focused on persons with SCI, showing that higher BMI is related to SCI-specific complications, such as pressure ulcers, urinary tract infections, and spasticity, in addition to the chronic health risk factors already identified for the general population, such as high blood pressure, diabetes mellitus, and obstructive sleep apnea [6-8]. However, it is unclear whether the lower

The authors have no conflicts of interest.

The contents of this paper were developed under a grant from the Department of Education, NIDRR grant number H133B080024. However, those contents do not necessarily represent the policy of the Department of Education, and Federal Government endorsement should not be assumed. This manuscript was also supported in part by a grant from the National Multiple Sclerosis Society, grant number MB 0008.

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1936-6574/$ - see front matter
doi:10.1016/j.dhjo.2012.03.007

rates of obesity reported in persons with SCI (relative to US norms) are truly an indication of lower health risk in persons with SCI, or whether this is a reflection of a failure to use an accurate measure of mass for these populations, given the presence of disease-related body composition changes [8,9]. Specifically, persons with SCI are observed to have greater levels of fat mass than persons without SCI [10-12]. A better understanding of obesity patterns in people aging with specific disabilities is important, because of the known associations between obesity and premature mortality, cardiovascular disease, and type 2 diabetes in the general population [8,13-15].

The World Health Organization's (WHO) criteria for being classified as overweight or obese are based on cutoff scores for body mass index (BMI). Although BMI is studied frequently in the general population, it has been studied less frequently in individuals with disabilities, including individuals with MD, MS, PPS, and SCI. However, some investigators have suggested that the WHO's BMI cutpoints for the general population might not be appropriate in the context of changes in body composition among some populations with disabilities [9]. Among persons with SCI, typical body composition changes include less muscle and more fat across the legs, arms, and trunk, with a particularly apparent increase in central mass [11,12,16]. Because central adiposity has been shown to be a body composition variable that is closely related to adverse health outcomes [8], some researchers have begun to use waist circumference (WC) as a better indicator of global mass [17-20]. Moreover, given that loss of muscle mass is more likely to impact BMI, WC could potentially be a more accurate measure of health risk in individuals with disabilities [21].

Current study

Taken together, the literature reviewed above suggests that BMI is often lower in persons with disabilities despite the fact that adiposity may be higher among these same individuals. However, to our knowledge, no studies have compared BMI and WC among different types of disabilities or obtained such data from large, community-based samples. Given that the most information is known about the general population and persons with SCI, our inclusion of MD, MS, and PPS allows for improved understanding of between-disability differences in the previously identified BMI-WC discrepancies. Thus, the current study describes the associations between BMI and WC scores in persons with four disabilities, relative to each other and to US norms [22], building on the literature on individual disabilities to determine whether trends in BMI and WC are the same or different for different disabilities. The four disabilities included in the current study have origins and/or characteristics that make them unique from each other, but share mobility limitations as a common issue. On the basis of the literature reviewed above and inherent characteristics of the conditions studied, we hypothesized that BMI would be lowest in SCI and MD, but that WC would not differ between persons in the four disabilities groups. Further, in line with the findings of previous research suggesting lower levels of obesity in persons with MD, MS, PPS, and SCI, we hypothesized that BMI would be lower in individuals with these disabilities relative to the representative US sample.

Methods

Procedures

Participants were community dwelling individuals with MD, MS, SCI, or PPS who completed a survey by mail in 2009-2010. Eligible individuals included self-reported definitive diagnosis of MD, MS, SCI, or PPS or a history of polio and polio sequelae, and at least 18 years old. Participants were recruited from prior studies conducted at the University of Washington as well as through advertisements with national organizations serving people with MS, MD, PPS, and SCI. Eligible participants were mailed a survey and 91% responded. Participants were paid $25 for completing a survey. Informed consent was collected from every participant and survey procedures were approved by the University of Washington's Institutional Review Board.

Measures

Demographics

Participants self-reported general demographic characteristics (including age and sex, which were used in this study) as well as disability history information, including the date symptoms appeared and date of diagnosis. Degree of mobility limitations was measured using the Gross Motor Function Classification System [23], where participants reported their limitation level on a 0 to 5 scale where 0 indicated "I have no mobility limitations," 1 = "Walk without restrictions, but have limitations in more advanced gross motor skills," 2 = "Walk without an assistive device and have limitations walking outdoors and in the community," 3 = "Walk with an assistive mobility device and have limitations walking outdoors and in the community," 4 = "Limited self-mobility with assistance or device (e.g., another person, walker, wheelchair) and use power mobility outdoors and in the community," and 5 = "Severely limited self-mobility even with the use of assistive technology." Participants who rated themselves as a 4 and 5 were classified as using power mobility.

Body mass index (BMI)

Participants self-reported height (inches) and weight (pounds) as part of their survey responses, and BMI (kg/m^2) was computed from these data. The World Health