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ORIGINAL ARTICLE

Obesity, foot pain and foot disorders in older men and women

Alyssa B. Dufour^{a,*}, Elena Losina^b, Hylton B. Menz^c,
Michael P. LaValley^d, Marian T. Hannan^a

^a Institute for Aging Research, Hebrew SeniorLife, Harvard Medical School, Boston, MA, USA

^b Brigham and Women's Hospital, Boston, MA, USA

^c Lower Extremity and Gait Studies Program, La Trobe University, Bundoora, Victoria, Australia

^d Boston University School of Public Health, Department of Biostatistics, Boston, MA, USA

Received 6 May 2016; received in revised form 21 October 2016; accepted 5 November 2016

KEYWORDS

Foot pain;
Foot disorders;
Obesity;
Body mass index;
Epidemiology

Summary

Objective: We investigated obesity, foot pain and selected foot disorders, and determined if associations differed by foot posture or dynamic foot function.

Methods: We included 2445 men and women (4888 feet) from the Framingham Foot Study (2002–2008). A foot examination assessed presence of disorders and pain on each foot. Body mass index (BMI, kg/m²) was categorized as normal (<25), overweight (25–29.99), moderate-obesity (30–34.99) severe-obesity (35+). Foot posture (normal, cavus, planus) and dynamic foot function (normal, supinated, pronated) were defined using plantar pressure measurement system. We used sex-specific logistic regression with generalized estimating equations to account for correlation between two feet of the same person, adjusted for age and stratified by foot posture and dynamic foot function.

Results: Average age was 68 ± 11 years, 56% female, average BMI 28 ± 5 kg/m². 18% of feet had pain, 25% hallux valgus, 2% claw toes, 18% hammer toes, 7% overlapping toes. In men, severe-obesity was associated with foot pain (OR = 2.4, p = 0.002) and claw toes (OR = 3.4, p = 0.04). In women, overweight, moderate-obesity and severe-obesity were associated with foot pain. Women with severe-obesity were less likely to have hallux valgus. Similar patterns were evident after stratification by foot posture and dynamic foot function.

* Corresponding author at: Institute for Aging Research, Hebrew SeniorLife, 1200 Centre St., Boston, MA 02131, USA. Fax: +1 617 971 5339.

E-mail address: alyssadufour@hsl.harvard.edu (A.B. Dufour).

<http://dx.doi.org/10.1016/j.orcp.2016.11.001>

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Conclusion: Both men and women were at increased odds of foot pain as BMI increased. Data suggested foot posture and dynamic foot function had no effect, thus are unlikely mechanisms.

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Introduction

Data from the National Health and Nutrition Examination Survey 2009–2010 reported that 69% of all adults age 20 and older are overweight ($\text{BMI} \geq 25$) [1]. Older adults (≥ 60 years) have an increased prevalence of being overweight, while 37% of men and 42% of women over age 60 have obesity ($\text{BMI} \geq 30$) [1]. Many negative health-related outcomes have been associated with obesity, including increased risk for early death, cardiovascular disease, Type II diabetes, some cancers, osteoarthritis and disability [2]. Recent studies have also reported that adults who are overweight and those who have obesity are more likely than their normal weight counterparts to have foot pain [3–10], flat feet and high peak planter pressures when walking [11].

Foot pain is also a common problem among older adults. A systematic review [12] found that nearly one quarter of adults over age 45 experienced frequent foot pain. Foot pain has been associated with poor balance and gait problems [13,14], activities of daily living [15,16] and health-related quality of life [17,18]. In addition to foot pain, structural foot disorders affect up to 60% of community-dwelling older adults [19,20] and are associated with mobility limitations [14,21] and decreased health-related quality of life [7]. Given that the foot is the body's main base of support and is a key basis for mobility, balance and activities of daily living, excess weight is likely to have a negative impact on foot function.

Several recent studies have reported associations between obesity and foot pain [3–10]. However, the underlying mechanisms responsible for this association have not been explored in detail. We propose that this relationship may be mediated by the variation in foot posture and dynamic foot function, as this may alter the load bearing function of the foot. Therefore, the purpose of our current study was to describe the associations between obesity categories, foot pain and foot disorders (hallux valgus, claw, hammer, overlapping toes) in a community-based cross-

sectional study of older men and women. Further, to add insight into the potential underlying mechanisms, we examined whether these associations differed by foot posture or by dynamic foot function.

Methods

Study sample

Participants in this study were from the Framingham Foot Study Cohort, which is comprised of members from the Framingham Heart Study Original Cohort and the Framingham Offspring Cohort who were examined between 2002 and 2008 (mean age 68 years), as described previously [22,23]. In brief, the Framingham Study Original Cohort was formed in 1948 from a two-thirds sample of the town of Framingham, MA in order to study risk factors for heart disease and have been followed biennially since that time. The Framingham Offspring Cohort, formed in 1972, consists of adult offspring who had a parent in the Original Cohort, and the offspring spouses. This group has been followed every four years since cohort inception to study familial risk factors for heart disease. Members of the Framingham cohorts were examined for the Framingham Foot Study, an ancillary exam to the Framingham Heart Study, either at their scheduled Framingham clinic examination or at a call-back examination. The Framingham Foot Study conducted a physical examination of the foot and collected participant history, performance measures and other data using a validated questionnaire.

Assessment of foot disorders and foot pain

A podiatric-trained examiner performed a validated physical examination of participants' feet to determine the presence or absence of specific foot disorders. Participants were weight-bearing as

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