1-1-2009

Fat flat frail feet: how does obesity affect the older foot

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Abstract

The prevalence of obesity is rising throughout the world at an alarming rate, and the elderly are no exception with 15% of men and 28% of women aged over 60 years considered to be obese [1]. Overweight and obesity have been shown to negatively affect foot structure and function in both children [2] and adults [3]. These structural changes appear to be associated with increased foot discomfort whereby overweight children have been found to report foot pain significantly more often than their leaner counterparts [4]. As feet are our base of support during most weight-bearing activities, it is postulated that increased foot pain could act as a deterrent for obese individuals to participate in physical activity and, in turn, perpetuate the cycle of obesity. For this reason compromised foot structure and foot pain associated with obesity is deemed a major health issue for children. However, whether these negative effects associated with childhood obesity persist in the elderly foot has not been comprehensively investigated. Therefore, the purpose of this study was to determine the effects of obesity on foot structure and function, and the foot pain experienced by older adults.

Keywords

obesity, frail, flat, foot, fat, older, affect, does, feet

Disciplines

Arts and Humanities | Life Sciences | Medicine and Health Sciences | Social and Behavioral Sciences

Publication Details

Steele, J. R., Mickle, K. Julie. & Munro, B. (2009). Fat flat frail feet: how does obesity affect the older foot. XXII Congress of the International Society of Biomechanics

FAT FLAT FRAIL FEET: HOW DOES OBESITY AFFECT THE OLDER FOOT

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INTRODUCTION

The prevalence of obesity is rising throughout the world at an alarming rate, and the elderly are no exception with 15% of men and 28% of women aged over 60 years considered to be obese [1]. Overweight and obesity have been shown to negatively affect foot structure and function in both children [2] and adults [3]. These structural changes appear to be associated with increased foot discomfort whereby overweight children have been found to report foot pain significantly more often than their leaner counterparts [4]. As feet are our base of support during most weight-bearing activities, it is postulated that increased foot pain could act as a deterrent for obese individuals to participate in physical activity and, in turn, perpetuate the cycle of obesity. For this reason compromised foot structure and foot pain associated with obesity is deemed a major health issue for children. However, whether these negative effects associated with childhood obesity persist in the elderly foot has not been comprehensively investigated. Therefore, the purpose of this study was to determine the effects of obesity on foot structure and function, and the foot pain experienced by older adults.

METHODS

Three-hundred and twelve older men and women (154 women; age = 71.2 ±7.7 yr; height = 1.66 ± 0.1 m; BMI = 28.5 ± 5.4 kg.m-2) were randomly recruited. From this cohort, 105 individuals (33.7%) were identified as obese (BMI>30); 128 individuals (41.0%) as overweight (25< BMI<30), and 79 individuals (25.3%) had a BMI<25 and were therefore classified as normal weight.

Foot morphology was quantified by scanning the subjects' three-dimensional external foot shape (INFOOT 3D foot scanner). Plantar soft tissue thickness at the 1st and 5th metatarsals, midfoot and heel of each subject was measured using a SonoSite® 180PLUS ultrasound system (10-5 MHz, maximum depth 7 cm). Foot function was characterised by assessing static toe strength as well as the dynamic plantar pressures generated as the subjects walked across a Novel emed AT-4 pressure platform (25 Hz; 2nd-step method). Plantar pressure data were then analysed for 10 regions of each subject's right foot using the Novel mask set. To determine the incidence of foot pain subjects completed the Manchester Foot Pain and Disability Index. Main effects of obesity status in these foot structure, function and pain variables were assessed using a one-way ANOVA design.

RESULTS AND DISCUSSION

The obese older adults displayed larger structural foot dimensions, including a significantly thicker plantar fat pad under the heel (7.2±1.9 mm), 1st MTH (2.0±0.8 mm) and 5th MTH (1.6±0.6 mm) compared to the normal-weight (heel: 5.8±1.6 mm; 1st MTH: 1.7±0.5 mm; 5th MTH: 1.3±0.4 mm) older adults. Foot function of the obese subjects was also compromised, indicated by a significantly lower hallux (H: 11.6% BW) and lesser toe strength (LT: 8.6% BW) relative to both the overweight (H: 14.5% BW; LT: 10.7% BW) and normal weight (H: 15.0% BW; LT: 11.0% BW) older adults. When walking, the obese older adults generated significantly higher forces, with a greater plantar surface contact area and longer contact time, in turn, generating significantly higher pressure-time integrals relative to their leaner counterparts (see Table 1). Accompanying these structural and functional changes to their feet, the obese older adults suffered a significantly higher incidence of foot pain (63.5%) compared to both the normal-weight (42.3%) and overweight (43%) older adults.

CONCLUSIONS

This study is the first to confirm that obese older adults display structural and functional changes to their feet, which are accompanied by a significantly higher incidence of foot pain. Providing interventions for obese older individuals with foot pain is imperative to ensure their mobility, and in turn, social independence as they age further, is not permanently compromised.

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Table 1: Total foot dynamic plantar pressure variables generated by the normal weight, overweight and obese subjects.

Variable	Normal-weight	Overweight	Obese	*p*-value
Force (N)	674.2 ± 90.1	823.9 ± 110.8*	967.4 ± 156.9**	<0.001
Contact time (ms)	840.5 ± 136.2	829.4 ± 106.5	880.5 ± 127.0**	0.01
Area (cm)	109.6 ± 16.3	120.8 ± 16.4*	131.7 ± 16.8**	<0.001
Pressure-time integral (kPa.s)	311.6 ± 113.2	308.6 ± 110.6	352.1 ± 128.3**	0.009

* significantly greater than the normal-weight subjects; ** significantly greater than the normal-weight and overweight subjects.