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Does physical activity influence the relationship between low back pain and obesity?

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Abstract

BACKGROUND CONTEXT: Evidence supporting an association between obesity and low back pain (LBP) continues to grow; yet little is known about the cause and effect of this relationship. Even less is known about the mechanisms linking the two. Physical activity is a logical suspect, but no study has demonstrated its role.

PURPOSE: This study was designed to examine the interrelationship between physical activity, obesity, and LBP. The specific aims were to determine if obesity is a risk factor for LBP in the U.S. population, measure the strength of any observed association, and evaluate the role of physical activity in modulating this association.

STUDY DESIGN/SETTING: A cross-sectional U.S. population-based study.

PATIENT SAMPLE: A cohort of 6,796 adults from the 2003–2004 National Health and Nutrition Examination Survey.

OUTCOME MEASURES: Demographic information, an in-depth health questionnaire, physical examination details, and 7-day free-living physical activity monitoring using accelerometry (ActiGraph AM-7164; ActiGraph, Pensacola, FL, USA).

METHODS: LBP status was determined by questionnaire response. Body mass index (BMI) was calculated during physical examination and divided here into four groups (normal weight <25, overweight 25–30, obese 31–35, and ultraobese 36+). Summary measures of physical activity were computed based on intensity cutoffs, percentile intensities, and bout. Demographics, social history, and comorbid health conditions were used to build adjusted weighted logistic regression models constructed using Akaike Information Criterion. All displayed estimates are significant at level <.05. No external funding was received to support this study. None of the authors report conflicts of interest directly related to the specific subject matter of this manuscript.

RESULTS: In the U.S. population, the risk of low LBP increases in step with BMI from 2.9% for normal BMI (20–25) to 5.2% for overweight (26–30), 7.7% for obese (31–35), and 11.6% for ultraobese (36+). Smoking is consistently the strongest predictor of LBP across the BMI spectrum (odds ratio 1.6–2.9). Physical activity also modulates these risks. In the overall model, the best physical activity predictors of LBP are in the moderate and high intensity ranges with small effects (odds ratio 0.98 and 0.996 per standard deviation increase, respectively). When broken down by BMI, time spent in sedentary and moderate activity ranges demonstrate more robust influences on LBP status in the overweight, obese, and ultraobese groups.

FDA device/drug status: Not applicable.

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CONCLUSIONS: Increased BMI is a risk factor for back pain in Americans. More important, the role of physical activity in mitigating back pain risk is shown to be of greater consequence in the overweight and obese populations.

Keywords: Low back pain; Obesity; Accelerometry; Physical activity; Body mass index; NHANES; Musculoskeletal diseases

Introduction

Obesity, like back pain, negatively impacts health-related quality of life and productivity. Combined they are associated with an estimated 30% of U.S. health care expenditures [1,2]. Studies of back pain often list obesity as a confounding factor, yet research has failed to consistently demonstrate this association [3,4]. Still, the growing consensus among higher quality studies supports the presence of a positive association. Large population studies in Europe, for instance, have consistently demonstrated a link between obesity and chronic low back pain (LBP) [5–7], and two independent and well-conducted surveys each found that obese individuals with a body mass index (BMI) >30 are 1.7 times more likely to develop disabling back pain compared with healthy weight individuals [5,8]

Although evidence of the association between obesity and back pain continues to grow, little is known about the cause-and-effect relationship [9], and even less is known about the potential mechanisms linking the two [3,4]. Structural, mechanical, metabolic, and behavioral factors are all implicated [4,10]. Of these factors, physical activity is a logical suspect. An inverse relationship between physical activity and obesity is well documented [11–13], with a similar inverse relationship to back pain suggested but less well defined [14–19]. Furthermore, both exercise and weight loss is known to benefit some with back pain [14,15,20]. Yet, no study has shown that physical activity plays any role in the relationship between obesity and back pain.

The purpose of this study is to examine the interrelationship between physical activity, obesity, and LBP using the 2003–2004 National Health and Nutrition Examination Survey. Specifically, this study seeks to determine if obesity is a risk factor for back pain in the U.S. population, measure the strength of any observed association, and evaluate the role of physical activity in modulating this association.

Materials and methods

The dataset used in this study is publically available; thus, review board approval was not required. No external funding was received or used to support this study. None of the authors reports conflicts of interest directly related to the specific subject matter of this manuscript.

Data

The National Health and Nutrition Examination Survey (NHANES) is a continuous study conducted by the National Center for Health Statistics, designed to assess the health of children and adults in the United States [21]. Leveraging the U.S. Census data, NHANES provides survey samples that are representative of the U.S. noninstitutionalized population (eg, excluding the military, imprisoned, and hospitalized populations) using a multistage, weighted, complex survey design [10,22]. The NHANES survey is composed of a questionnaire plus an interview and physical examination performed in mobile examination centers.

Data were obtained from the National Center for Health Statistics website. The present analysis used data from NHANES 2003–2004, which includes demographic information, an in-depth health questionnaire, physical examination details, and consecutive 7-day free-living physical activity monitoring using accelerometry, all in a cohort of 6,796 adult subjects (see Supplementary Appendix).

Software

Statistics package R 2.11 (available at: http://r-project.org), SAS 9.2 with custom SAS macros (Cary, NC, USA), and custom Python 2.7.2 programs (available at: http://python.org) were used for complex survey analyses and model selection with Akaike Information Criterion.

Demographic variables

Subject age is discretized into decades. Age 20 to 29 is taken as the reference group. Each of the following decades is coded separately to fully characterize age effect: 30 to 39, 40 to 49, 50 to 59, 60 to 69, and 70 to 90. Subject gender is taken directly from the dataset, with male as the reference group. Subject-reported race and ethnicity is summarized into four categories. Non-Hispanic whites are taken as the reference group. The categories blacks, Hispanics, and ''other races'' are each coded separately.

Social history variables

Based on self-reported estimated quantity of alcoholic beverages consumed per week, subjects are divided into ''0 per week'' as the reference group, ''one to four alcoholic beverages per week,'' and ''five or more alcoholic beverages per week.'' Subjects who reported smoking every day or some days are classified as smokers.

Education and income

For education, the reference group is taken as less than high school. The categories high school and more than high