Weight and osteoarthritis¹⁻³

David T Felson

ABSTRACT Osteoarthritis is the most common form of arthritis. It increases in prevalence with age. About 5% of the US population is affected with hip or knee osteoarthritis; 9.5% of adults aged > 62 y have knee osteoarthritis. Because of its frequency and associated pain and disability, osteoarthritis accounts for much of the disability in lower extremities in the elderly. More than 70% of total hip and knee replacements are for osteoarthritis. Because osteoarthritis is so common, the modification of factors that increase osteoarthritis risk could prevent substantial pain and disability in the elderly and the use of costly health care services. Overweight persons are at high risk of osteoarthritis in the knee and probably also in the hips and hands. The mechanism by which overweight causes osteoarthritis is poorly understood; a contribution from both local increased force across the joint and systemic factors is likely. Better evidence is needed on the effects of weight loss, but preliminary studies suggest that weight loss can both prevent the onset of symptomatic disease and alleviate symptoms when present. Am J Clin Nutr 1996;63(suppl):430S–2S.

KEY WORDS Osteoarthritis, obesity, epidemiology, risk factors, body weight

INTRODUCTION

Osteoarthritis is the most common form of arthritis. It increases in prevalence with age. About 5% of the US population is affected with hip or knee osteoarthritis; 9.5% of adults aged > 62 y have knee osteoarthritis. More than 70% of total hip and knee replacements are for osteoarthritis. Because it is so common, osteoarthritis accounts for as much disability in lower extremities in the elderly as any disease. Also, if osteoarthritis were prevented, utilization of orthopedic procedures such as total knee and total hip replacements might also decline. Therefore, a vigorous search has been underway for several years to identify modifiable risk factors for osteoarthritis. One candidate is overweight or obesity.

Risk factors for osteoarthritis are probably different depending on which joint is affected. Knee injuries, such as those sustained in football, predispose to knee osteoarthritis but obviously not to hand osteoarthritis. Some factors may have purely local effects, whereas others have systemic effects. When examining the effect of weight, both local and systemic effects may be relevant.

OVERWEIGHT AS A RISK FACTOR FOR OSTEOARTHRITIS

What is the evidence that people who are overweight are at increased risk of osteoarthritis? Population-based studies of osteoarthritis have consistently shown that overweight persons have higher rates of knee osteoarthritis than do nonoverweight control subjects. Estimates of risk vary across populations and depend on how overweight and osteoarthritis are defined. In data from the first National Health and Nutrition Examination Survey conducted throughout the United States in 1971–1975 (1), obese women [body mass index, or BMI, (in kg/m²) > 30 yet ≤ 35] had almost four times the risk of osteoarthritis of women whose BMI was < 25. For men in the same overweight category (BMI > 30 yet ≤ 35), the risk was increased 4.8-fold. These risk estimates are typical of many population studies. On the basis of the multiplier effect of lever arms outside the body’s central axis, a force of three to six times body weight is exerted across the knee during single-leg stance in walking. Therefore, any increase in weight may be roughly multiplied by this factor to reveal the excess force across the knee when an overweight person walks.

Although studies have shown a cross-sectional association of obesity and osteoarthritis, there was the possibility that because of knee pain and a sedentary lifestyle, persons gained weight after developing osteoarthritis. Recent studies, however, have disproved this notion, showing that being overweight at an average age of 37 y, when osteoarthritis of the knee is extremely uncommon, increases the risk of developing knee osteoarthritis later in life (mean age of 73 y) (2). Also, studies in which repeated knee X-rays were used have shown that in persons without disease, being overweight strongly increases the risk of developing later knee osteoarthritis (3).

Overweight persons also appear to have a higher risk than expected of hip osteoarthritis, although the association of weight with hip osteoarthritis is not as strong nor as consistent across studies as it is for knee osteoarthritis. For example, a recent study of > 7000 persons in Finland found that the risk of hip osteoarthritis in those with a BMI of 30–35 was twice as great as the risk in those with a BMI < 25 (4). However, at

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³ Reprints not available. Address correspondence to DT Felson, Boston University, The Arthritis Center, A203, 80 East Concord Street, Boston, MA 02118.
least one study reported no association of overweight and hip osteoarthritis (5). Because the force across the hips is only about three times body weight at maximum, the multiplier effect of being overweight for the hips may not be as great as for the knees. Further, other factors may affect the risk of hip osteoarthritis, diluting any association of obesity with disease there.

Surprisingly, people who are overweight also appear to be at higher risk of hand osteoarthritis than are those who are not overweight. A recent longitudinal study over 23 y showed that those who were overweight had a higher risk of developing hand osteoarthritis than did those who were not (6). Although cross-sectional studies of the relation between overweight and hand osteoarthritis have not all been positive, most suggest an association. Because overweight persons do not necessarily have greater force across their hand joints than do those who are not overweight, the relation between overweight and osteoarthritis remains enigmatic.

POSSIBLE MECHANISMS

Weight could act through two different intermediaries to cause osteoarthritis. First, and most logically, being overweight, because it increases the load across a joint, could increase stress on cartilage and induce breakdown that then leads to osteoarthritis. Although this explanation may go a long way toward explaining the apparent causal relation of weight with knee and hip osteoarthritis, it may not explain the relation between overweight and hand osteoarthritis. To explain this, one needs to invoke a systemic factor. Following this line of reasoning, persons who are overweight may have a circulating factor, possibly a cartilage growth factor or a bone factor that may act to accelerate cartilage breakdown or affect the bone underneath cartilage and lead to osteoarthritis. Adipose tissue may be metabolically active, especially in postmenopausal women, who are at highest risk of osteoarthritis. In addition, overweight persons have higher bone mineral densities, and high bone mineral density (or the absence of osteoporosis) may itself be a risk factor for osteoarthritis (7). Additional evidence in favor of a systemic factor is the possibility that the relation between overweight and osteoarthritis is stronger in women than in men. In favor of the load theory is the stronger association of obesity with osteoarthritis in the knee, where the load multiplication factor for overweight is greater than at other joints. In fact, the association of obesity and knee osteoarthritis is so strong that confounding factors are not likely to explain it. Therefore, load almost certainly plays a role, perhaps aided by a systemic factor.

OPPORTUNITIES FOR DISEASE PREVENTION

Is there any evidence that losing weight actually lowers the risk of osteoarthritis? In the Framingham study, in which subjects have been weighed every 2 y for 40 y, we evaluated the effect of weight loss or weight gain on the risk of later symptomatic knee osteoarthritis (8). For women whose baseline BMI was ≥ 25 (over the median), weight loss significantly lowered the risk of knee osteoarthritis. The adjusted odds ratio per two units of BMI (∼5 kg, or 11 lb, for a women of normal height) was 0.41, a risk reduction of > 50%. Weight gain was associated with a slightly increased rate of later knee osteoarthritis (odds ratio 1.28 for a two-unit weight gain). For women whose baseline weight was under the median, neither weight gain nor weight loss significantly affected the risk of later disease.

How much disease might be prevented if overweight persons lost weight? To answer this question, we used the above data from the Framingham Osteoarthritis Study in which osteoarthritis was assessed through questions about symptoms and knee X-rays in an elderly group followed longitudinally. If men whose BMI was ≥ 30 lost enough weight to fall into the overweight category (BMI = 26–29.9) and men in the over-weight category (BMI = 26–29.9) lost enough weight to move into the reference range (BMI < 26), the rate of symptomatic knee osteoarthritis would decrease by 21.4%. Obviously, this decline would be even greater if men with BMIs ≥ 30 were able to lose enough weight to fall into the reference range (BMI < 26). For women, in whom the association of obesity and knee osteoarthritis may be slightly stronger, if those in the highest weight group (for women, BMI ≥ 29) drop into the overweight group (BMI = 25–28.9) and those in the overweight category drop into the reference group (BMI < 25), the total rate of knee osteoarthritis would decrease by 33%. For women, weight accounts for more osteoarthritis than any other known factor; for men, overweight is second to major knee injury as a preventable cause of knee osteoarthritis.

Osteoarthritis, especially in the knee, is extraordinarily common and causes substantial pain and disability in millions of people. Although primary prevention efforts focus on those who are overweight and do not yet have disease, is there a value for weight loss in persons with osteoarthritis? This issue needs better study. One uncontrolled natural experiment occurred when a large group of morbidly obese patients underwent gastric stapling operations and were assessed before and after the operation (9). Although many of these patients had joint pains in the knees and back, they did not necessarily have osteoarthritis. One year after surgery, with a 45-kg (100-lb) weight loss on average, the prevalence of joint symptoms fell dramatically. For example, 57% of subjects had knee pain before surgery compared with a 14% prevalence of knee pain 1 y later. In a clinical trial of an appetite suppressant in patients with knee and hip osteoarthritis, Williams and Foulsham (10) reported that the degree of weight loss (a range of 5–10 kg over 6 mo) correlated strongly with clinical improvement, especially in patients with knee osteoarthritis. Therefore, patients with osteoarthritis who are overweight will experience symptomatic relief with weight loss, although the amount of weight loss needed to alleviate symptoms and prevent disease progression is unknown. For those with knee osteoarthritis, being overweight is likely to be a risk factor for rapid disease progression; those who have osteoarthritis in one knee are at higher risk of developing it in the other knee if they are overweight. People with osteoarthritis who are overweight are often ineligible for total knee and total hip surgeries that effectively alleviate pain and suffering.

CONCLUSIONS

The risk of osteoarthritis correlates strongly with a person’s weight based on their BMI. Overweight is among the most
potent known risk factors for knee osteoarthritis: persons in the upper 20% of weight have 7–10 times the risk of disease of those in the lowest 20% of weight.

For hip and hand osteoarthritis, overweight is a less-potent risk factor. Regardless, BMIs < 25 generally reduce risk of disease. It seems prudent to recommend that individuals who are chronically overweight lower their risk for knee osteoarthritis substantially with modest weight loss, such as a loss of 2 BMI units (~4.5–7.3 kg, or 10–16 lb, depending on height).

In summary, being overweight is an important modifiable risk factor for osteoarthritis in the knees, hips, and hands. Weight loss may prevent disease, and for those with prevalent disease, it may lessen symptoms, especially in the knees. Those who are overweight are at high risk of experiencing worsening symptoms and structural joint deterioration. Because of the prevalence of osteoarthritis in society and its telling effect on disability in the elderly, weight loss programs should emphasize the likely benefit of weight loss to osteoarthritis.

REFERENCES


