

The Effect of Type 2 Diabetes on Body Composition of Older Adults



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KEYWORDS

- Diabetes mellitus • Body composition • Body fat distribution • Muscle mass
- Older adults

KEY POINTS

- Type 2 diabetes is associated with more visceral fat, less thigh subcutaneous fat, and more fat infiltration in muscle compared with persons without diabetes.
- Older adults with type 2 diabetes show accelerated decline of muscle mass.
- People with undiagnosed/untreated type 2 diabetes are at particularly high risk of unfavorable changes in fat mass and lean mass.
- Future studies are needed to examine the consequences of the changes in body composition in patients with type 2 diabetes on physical functioning, morbidity, and risk of mortality.

INTRODUCTION

The prevalence of type 2 diabetes has increased dramatically over the past decades and will continue to increase worldwide.¹ This increase is due to demographic changes such as aging and shifts toward an unhealthy lifestyle, including physical inactivity and obesity. Body weight is a well-established risk factor for type 2 diabetes.² Not only total adiposity but also fat distribution is important; visceral fat in particular is strongly associated with insulin resistance and glucose intolerance, and increased visceral adiposity predicts incident diabetes.^{3,4} By contrast, subcutaneous fat in the lower body, often measured by hip circumference, may be protective against metabolic diseases such as type 2 diabetes.^{5–7} An unfavorable body composition not only can be a cause of type 2 diabetes but also may be the consequence of the

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disease. This review focuses on observational studies of type 2 diabetes and its consequences for fat mass, fat distribution, and lean mass in older adults, and changes in these parameters.

AGING AND CHANGES IN BODY COMPOSITION

Aging is associated with changes in body composition, in that fat mass generally increases with age while lean mass decreases.^{8–11} The increases in total fat mass and the progressive loss of lean mass are independent of changes in weight.^{11,12} Older people tend to gain fat mass into early old age, while fat mass decreases in late old age. The Health, Aging, and Body Composition (Health ABC) study showed that a large group of well-functioned men and women aged 70 to 79 years lost weight gradually, while still gaining fat mass until the age of 75.¹³ After age 75, the participants started to lose weight more rapidly, accompanied by a loss of fat mass. A linear decline of lean mass was found.

In addition to the changes in total fat mass with age, there is also redistribution of fat mass over the different fat depots.¹⁴ Subcutaneous adipose tissue seems to decrease with age, while visceral fat, liver fat, and intermuscular fat increase.¹⁴ Fat storage in these depots has been strongly associated with metabolic disturbances. Together, the age-related changes in body composition are associated with increased risk of morbidity and disability.^{15,16}

DIABETES AND FAT DISTRIBUTION

Although it is generally known that type 2 diabetes is associated with overweight and obesity,¹⁷ knowledge about fat distribution and changes therein in persons with type 2 diabetes is limited. Several small case-control studies among middle-aged persons found either no differences in fat distribution^{18–20} or an unfavorable fat distribution with more truncal fat and less peripheral fat in persons with type 2 diabetes compared with healthy controls.^{21,22}

Fat distribution in older adults with type 2 diabetes was examined in a small case-control study.²³ This study found no differences in total body fat between women with type 2 diabetes ($n = 42$, mean age 64 years) and healthy age-matched and body mass index (BMI)-matched controls ($n = 42$), but did show that the women with diabetes had significantly less lower body fat (measured by dual-energy X-ray absorptiometry [DXA]) than the control group.²³ Using data from the Look AHEAD trial, which included both middle-aged and older adults, Azuma and colleagues²⁴ examined fat distribution in 67 obese persons (mean age 60) with type 2 diabetes and 35 healthy obese persons, using DXA and CT. The study showed that trunk fat mass was significantly larger in persons with type 2 diabetes than in healthy persons. Furthermore, persons with type 2 diabetes had less leg fat mass (-1.2 ± 0.4 kg), more subfascial adipose tissue (3.2 ± 1.6 cm²), and a lower liver CT attenuation (-7 ± 3 HU), indicating a higher fat content within the liver. Muscle attenuation was also lower in persons with type 2 diabetes (-2 ± 1 HU), but this was no longer significant after adjustment for sex, age, race, study site, height, and fat mass. In another study from the Look AHEAD trial, Gallagher and colleagues²⁵ compared body composition between persons with type 2 diabetes (56 women and 37 men) and matched controls, using whole-body MRI. Unlike DXA, MRI can discriminate between adipose tissue subdepots. The study found that women with type 2 diabetes had less total adipose tissue, while men with type 2 diabetes had more total adipose tissue compared with controls. Considerable differences in fat distribution were, however, found between persons with type 2 diabetes and controls in both men and women. Visceral adipose tissue mass was greater

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