A New Marker for Diabetes

Women who are fat primarily in the upper body are eight times more likely to develop diabetes than normal women

The pattern of body fat in women may be a useful tool to estimate the risk that women will develop maturity-onset diabetes, according to a team of investigators at the Medical College of Wisconsin. Ahmed H. Kissebah and his colleagues also found that such patterns can explain why some women lose weight easily when dieting, while others have much greater difficulty. The results are scheduled to be published in February in the *Journal of Clinical Endocrinology and Metabolism*.

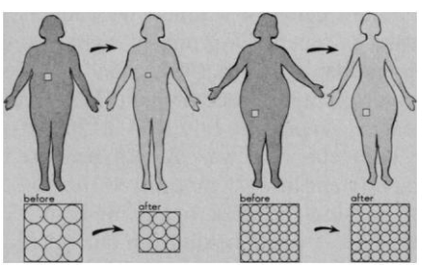
As part of a 6-year study, the Wisconsin team studied 52 women. Twenty-five of the women were upper body obese, with excess weight distributed predominantly in the waist, chest, neck, and arms; 18 were lower body obese, with excess weight mostly in the hips, buttocks, and thighs; 9 of the women were of normal weight. The obese women ranged in age from 20 to 40, were 40 to 100 percent overweight, and were judged healthy as a result of routine physical examinations given prior to the study. They were hospitalized and given oral glucose tolerance tests, analyses of blood and urine, and fat cell biopsies.

Values on the glucose tolerance test were elevated for all 25 of the upper body obese women; 15 of these had values well within the diabetic range. The tests were normal for the lower body obese women and the controls. The upper body obese women also showed significantly higher levels of fatty acids and insulin in their blood plasma. From these studies, Kissebah concluded that 60 percent of the women showed preclinical diabetes and 16 percent had clinical diabetes. None of the controls or the lower body obese women had either type of diabetes. The upper body obese women also had high levels of the male hormone testosterone.

That fat distribution might be related to diabetes was first discovered in the early 1970's when Jean Vague and his colleagues at the University of Marseilles observed that upper body obesity was more common among diabetic women than lower body obesity. This observation was confirmed by Kissebah and his colleagues in 1980 in a study of some 15,000 white American women. Both studies, however, were retrospective and involved only clinically confirmed cases of diabetes. The new study was a prospective survey in which all the participants were believed to be healthy.

The explanation for the Wisconsin findings is provided by the fat cell biopsies. Fat cells from women with lower body obesity were of normal size, but their numbers were greatly increased. It is commonly thought that excessive numbers of fat cells are produced by overeating during certain critical periods of childhood. The upper body obese women, in contrast, had normal numbers of fat cells, but their size was greatly increased. This pattern is normally thought to be produced by overeating during adulthood.

A number of investigators, particularly Jesse Roth and his colleagues at the National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases, have shown that enlargement of fat cells reduces the number of insulin receptors on their surface. The body then produces more insulin to compensate for the lower number of receptors. In individuals genetically susceptible to diabetes, the obesity leads to the development of maturity-onset diabetes. Significantly, Roth and others have found that dieting to reduce the size of the cells eliminates the symptoms of the disease and should thereby reduce the long-term complications. Interestingly, he has found that the symptoms are alleviated as soon as dieting is begun.



Medical College of Wisconsin

Some cells shrink, some do not

When upper body obese women diet, their fat cells shrink (left) and they become thinner. The fat cells of lower body obese women do not shrink, however.

Kissebah's observations thus provide a new way by which women who are most susceptible to diabetes can be identified. The Wisconsin team used sophisticated techniques, including computed tomography, to identify the upper body obese, but a rough screening tool is the ratio of waist size to hip size. A ratio of about 0.7 is normal. A ratio below 0.7 indicates lower body obesity, while a ratio above 0.7 indicates upper body obesity. Kissebah suggests that women with a ratio above 0.85 are candidates for more extensive examinations, perhaps including glucose tolerance tests, by their own physicians. The study of the 15,000 overweight women indicated that approximately 25 percent were upper body obese, 25 percent were lower body obese, and the rest were in between. Since about 40 percent of U.S. women are obese, the results suggest that 10 percent of all women are upper body obese and the risk of their developing diabetes is about eight times normal. The results also suggest that as many as 6 million of these women already have subclinical diabetes.

The study also explains some women's diet woes. It is a relatively easy matter to shrink enlarged fat cells by dieting, so that women who are predominantly upper body obese can lose weight effectively by sticking to a diet. It is much harder, however, to shrink or kill normal-sized fat cells, so that women who are predominantly lower body obese find it very difficult to lose weight, even when they adhere to a diet faithfully. A woman who is obese over all her body, furthermore, might find that her upper body will be reduced dramatically by dieting while her lower body will remain large.

The results are not directly applicable to men, who tend to have only one pattern of weight distribution. They gain weight around and above the waist, giving rise to the common potbelly. Maturity-onset diabetes is generally more common in obese men than in obese women, but Kissebah's results indicate that the incidence is higher still in upper body obese women. The observation that the upper body obese women have higher levels of male hormone suggests that the hormone may stimulate the deposition of fat in a pattern similar to that in man. Testosterone, furthermore, has previously been found to increase the incidence of diabetes, and that may be a contributing factor in these women.

—THOMAS H. MAUGH II

0036-8075/82/0205-0651$01.00/0