Ideal body mass index determined by mortality in Europe, and adequate high protein and low carbohydrate diet to maintain bodyweight

Recently, in *The New England Journal of Medicine*, papers dealing with body mass index (BMI) and mortality[1], and diet composition that maintains bodyweight reduction[2] were published.

High BMI (the weight in kilograms divided by the square of the height in meters) is well known to be associated with many diseases, as well as mortality. However, this kind of study includes many problems; the subjects were not stratified, or the follow up period was short. The first article reported the precise relationship between BMI and all-cause mortality in 1.46 million white adults in Europe[1]. The authors pooled an analysis of 19 prospective studies, which included 1.46 million white (non-Hispanic) adults aged 19–84 years (median 58) and 160,087 deaths, with median follow-up period of 10 years. As shown in Figure 1, there was a J-shaped relationship between BMI and all-cause mortality in healthy subjects who reported no cancer or heart disease and had never smoked. Compared with a BMI of 22.5–24.9, hazard ratios among women were 1.47 for a BMI of 15.0–18.4; 1.00 for a BMI of 20.0–22.4; 1.44 for a BMI of 30.0–34.9; and 2.51 for a BMI of 40.0–49.9. In general, the hazard ratios for the men were similar. More precisely, for a BMI of 25.0 or higher, as compared with a BMI of 22.5–24.9, the hazard ratios were higher for participants aged 20–49 years than for participants aged more than 70 years, because their absolute death rates were higher. For all subjects, including smokers, the hazard ratios for a BMI over 25 were lower in both women and men than in healthy
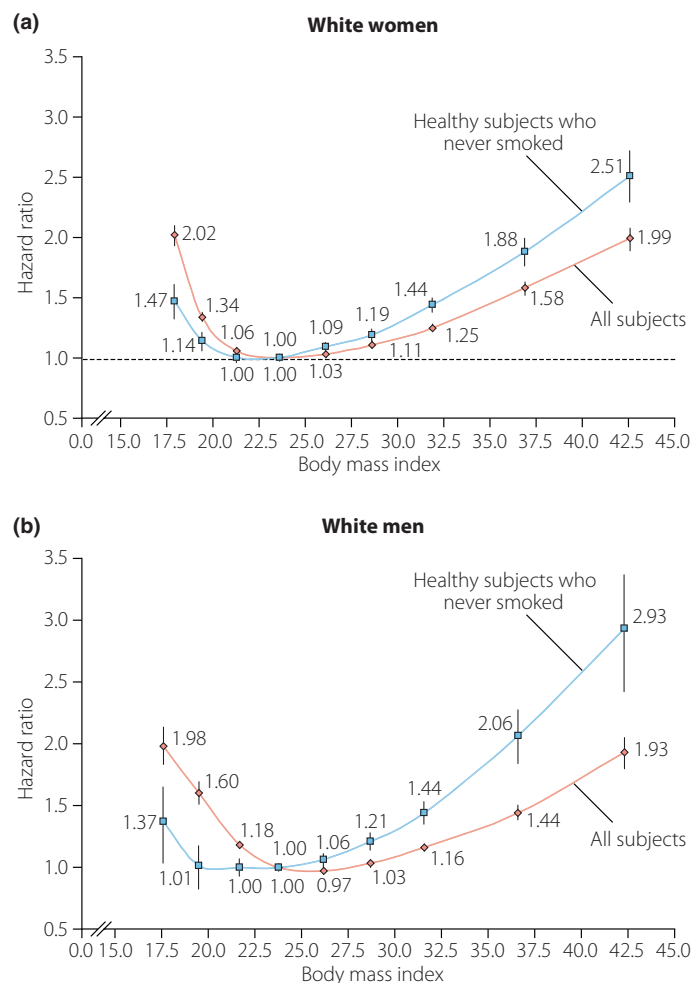
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Figure 1 | Estimated hazard ratios for death from any cause according to body mass index for all study participants and for healthy subjects who never smoked. Reproduced from Berrington de Gonzalez et al[1]. Copyright 2010 Massachusetts Medical Society.

subjects who never smoked, because the absolute death rates were high. For all subjects, including smokers, the hazard ratios for a BMI under 20 were higher in both women and men than in healthy subjects who never smoked, showing that lean smokers might be susceptible to diseases, such as cancer or infectious diseases. The increased hazard ratios were reduced as the length of follow up increased to 15 years or more.

They concluded that in white adults, overweight and obesity (and possibly underweight) are associated with increased all-cause mortality. All-cause mortality is generally the lowest with a BMI of 20.0–24.9. These results were consistent with reports dealing with obese subjects[3].

This large-scale study strengthened the importance of normal BMI maintaining good mortality. However, there are many limitations. The initial bodyweight was reported, but later on the change was ignored. Waist circumference or visceral fat might be better markers.

The problem is whether this result could be applied to other races, including Japanese or Asian populations. The severity of obesity is reduced in Asian people, but it is known that diabetes mellitus occurs at a lower BMI than Caucasians. Therefore, adequate an BMI might be lower than 22.5–24.9. Lifestyle and climates are different. Each country should have its own data. However, this paper gave the baseline data in this field.

Next, adequately maintaining bodyweight is a most difficult problem, even though the ideal bodyweight for mortality was presented.

The second article deals with the importance of the composition of a diet for the management of obesity[2]. It was mentioned that a diet with a low glycemic index can have beneficial effects on bodyweight and body composition[4], but the effectiveness of ad libitum consumption of low glycemic index diets for weight control is not definitely confirmed[5]. This paper reported the effects of weight control diet on bodyweight maintenance after an 8-week weight loss phase. During the 8-week weight loss phase, participants received a low-calorie diet that provided 800 kcal per day with the use of Modifast products (Nutrition et Sante; Meerburg Pharmacy, Rotterdam, the Netherlands). The adults from eight European countries, who had lost at least 8% of their initial bodyweight, were randomly assigned, in a two-by-two factorial design, to one of five *ad libitum* diets over a 26-week period: a low-protein and low-glycemic index diet (LPLC), a low-protein and high-glycemic-index diet (LPHC), a high-protein and low glycemic-index diet (HPLC), a high-protein and high-glycemic-index diet (HPHG), and a control diet (Con). A total of 1209 adults were screened (mean age 41 years; BMI 34). A total of 773 participants were randomly assigned to one of the five maintenance diets; 548 completed the intervention (71%). The mean initial weight loss with the low-calorie diet was 11.0 kg. After 2 weeks, the average bodyweight changes were: LPLC 0.33 kg, LPHC 1.67 kg, HPLC −0.38 kg, HPHL 0.57 kg, Con 0.84 kg. The LPHC was associated with subsequent significant weight regain (1.67 kg). The weight regain was 0.93 kg less in high protein groups than in low protein groups, and that was 0.95 kg less in the low glycemic index groups than the high glycemic index groups. Then, the authors concluded that a modest increase in protein content and a modest reduction in the glycemic index led to an improvement in maintenance of weight loss.

One of the concerns for the adaption of this result to eastern countries, especially to Japan, was the different contents of the protein:fat:carbohydrate (PFC) ratio. The contents of the PFC ratio of the five groups were: LPLC 18.2:29.7:50.0, LPHC 16.7:30.9:50.9, HPLC 21.7:32.0:44.7, HPHL 22.6:31.2:44.7, Con 18.7:33.4:40.0, respectively. In Japan, the PFC ratio for a diet or diabetes mellitus was recommended to be 20:20:60. Compared with the Japanese diet, fat was still high and carbohydrate was still low in the high carbohydrate diet group of this article. In this article, the subjects were essentially normal and healthy. The effects of diet components on glucose metabolism, lipid metabolism and hypertension were not studied. From other studies, high protein and low glycemic index diet improved metabolic markers, such as glucose and triglyceride, as well as maintaining bodyweight[5]. The study on the effect of PFC on longterm health was difficult, because to maintain the indicated PFC ratio was quite difficult. Furthermore, it is difficult to adapt this diet to Japanese or eastern countries, because the PFC is quite different. One of the methods for adjusting a low carbohydrate diet for obesity is the use of a formula diet.

The significance of high protein and low carbohydrate should be considered again, especially in Japan.

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