Subject	Equation
Nonpregnant adult female	
	$W_{\mathrm{FM}} = W_{\mathrm{B}} - (\mathrm{TBW}/0.724)$
No edema or leg edema only	
10 wk gestation	$W_{\mathrm{FM}} = W_{\mathrm{B}} - (\mathrm{TBW}/0.725)$
20 wk gestation	$W_{\mathrm{FM}} = W_{\mathrm{B}} - (\mathrm{TBW}/0.732)$
30 wk gestation	$W_{\mathrm{FM}} = W_{\mathrm{B}} - (\mathrm{TBW}/0.740)$
40 wk gestation	$W_{\mathrm{FM}} = W_{\mathrm{B}} - (\mathrm{TBW}/0.750)$
Generalized edema	
10 wk gestation	$W_{\mathrm{FM}} = W_{\mathrm{B}} - (\mathrm{TBW}/0.725)$
20 wk gestation	$W_{\mathrm{FM}} = W_{\mathrm{B}} - (\mathrm{TBW}/0.734)$
30 wk gestation	$W_{\mathrm{FM}} = W_{\mathrm{B}} - (\mathrm{TBW}/0.748)$
40 wk gestation	$W_{\mathrm{FM}} = W_{\mathrm{B}} - (\mathrm{TBW}/0.765)$

Table 14.3: Equations for estimating body fat mass (W_{FM}) during pregnancy from total body water and body weight (W_{B}). The equations assume that the fraction of water in the fat-free mass is normally 0.724. From van Raaij et al., American Journal of Clinical Nutrition 48: 24–29, 1988 © Am J Clin Nutr. American Society for Clinical Nutrition.

14.4 Other body fluid compartments and isotope dilution

The isotope dilution principle can be used to estimate the volume of various other body fluid compartments, which, in turn, can be used to derive estimates of two components of the fat-free mass (FFM): extracellular mass (ECM) and the body cell mass (BCM). The ECM is defined as the component of the fat-free mass which exists outside the cells. It consists of both fluid (e.g., extracellular fluids, plasma volume) and solid (e.g., skeleton, cartilage, tendons) components which are involved in transport and support and are not metabolically active. The BCM represents the metabolically active, energy-exchanging mass of the body. Measurements of ECM and BCM are especially critical in malnourished patients. Although values for fat-free mass in these patients may remain unchanged, the composition of the fat-free mass is abnormal. Malnutrition results in a reduced body cell mass, concomitant with an expansion of the extracellular mass. These changes are shown in Figure 14.2. Hence, any loss in body weight in such patients reflects a loss of body fat (Shizgal, 1987).

A dilution technique involving the simultaneous intravenous injection of ^{22}Na and tritiated water has been developed to measure body cell mass, extracellular mass, and body fat (Shizgal, 1985). Body fat is estimated indirectly from total body water, as described in Section 14.3. Body cell mass is derived from total exchangeable potassium ($\mathrm{K_e}$), which, in turn, is determined indirectly from the relationship:

$$\mathrm{K_e} = \mathrm{TBW} \times R - \mathrm{Na_e}$$

where R = the sum of the sodium and potassium content of a sample of whole blood, divided by its water content, and $\mathrm{Na_e}$ = total exchangeable sodium (Shizgal et al., 1977). Total exchangeable potassium is not determined directly from ^{42}K because of the short half-life of this isotope (12.5 h). The BCM is then estimated using the following relationship (Moore et al., 1963):

$$\mathrm{BCM\ (kg)} = 0.00833 \times \mathrm{K_e}$$

Total exchangeable sodium ($\mathrm{Na_e}$), measured using ^{22}Na, provides a measure of the fluid, but not the solid, component of the extra-

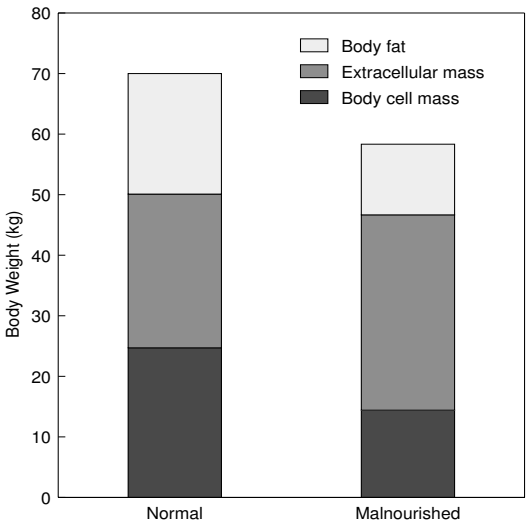

Figure 14.2: The mean body composition of 25 normally nourished healthy volunteers and 75 malnourished patients. From Shizgal, Surgery, Gynecology & Obstetrics 152: 22–26, 1981, with permission.