Influence of Physical Activity

Living systems are worn out by inactivity and developed by use.

A. Szent-Györgyi

I am convinced that anyone interested in winning Olympic Gold Medals must select his parents very carefully.

P.O. Åstrand

Athletes are in the news today, and so, too, are the astronauts: the former strive for increased muscle mass and lesser fat mass, and the latter must contend with the catabolic effects of weightlessness; both are held in high esteem, and today the adulation of the young who aspire to athletic prowess has been intensified by the large incomes that some athletes now enjoy. More women are engaged in athletics than ever before, there are several journals devoted to exercise physiology and sports medicine, and the sports sections of the daily newspapers have expanded.

Do athletes differ from nonathletes in body composition? Do various athletic types differ in body composition? Certain prerequisites must be met before these questions can be answered. It is known that body composition differs between the sexes, that it is altered by age, both in the child and in the adult, and that LBM is a function of stature at all ages thus far examined. Hence any comparisons between the athlete and the nonathlete must be controlled for all three of these influences. Unfortunately, there are several reports that are deficient in this regard and so cannot be evaluated.

An additional point concerns the need, when recording changes in body composition the result of exercise, training, or for that matter decreased physical activity, also to record concomitant changes in body weight. Then there is the matter of dietary intake. Nutrition can alter body composition, and as was shown in the previous chapter the effects of grossly abnormal energy intakes can exceed any that might accrue to changes in physical activity per se, and diets deficient in essential nutrients are known to lead to negative nitrogen balance in the face of an adequate supply of energy. A final consideration is the use of medication, especially anabolic-androgenic steroids. As will be shown later, the use of these compounds will promote nitrogen retention, and thus effect an increase in LBM, even in individuals who do not exercise.
Body Composition in Athletes

An early report by Brozek (1954) showed that 50-year-old men who were physically active differed in body composition from their sedentary age and height peers. They were heavier, on average, by 3 kg; their lean weight was 4 kg greater, and body fat 1 kg less. Cook et al. (1969) did assays of plasma volume, extracellular fluid (ECF) volume, and total body water in 20-year-old male college students. On average, wrestlers had 7 kg more lean body mass (LBM) (as estimated from total body water) and 4 kg less fat than controls of the same height; competitors in track events had 4 kg more LBM and 6 kg less body fat than controls. Although ECF volumes were higher in the athletes, values for plasma volumes were slightly lower. Aloia et al. (1978) compared 40-year-old marathon runners to sedentary men of the same age and height: the former had 4% more total body K, 15% more total body Ca (by neutron activation), and 4% more bone mineral content of the forearm bones, although they weighed 7% less.

Parizkova (1977) assayed five groups of trained athletes by densitometry, together with controls of the same age, height, and weight. Included were adolescent boys engaged in track and field events, adolescent girl gymnasts, young adult male wrestlers and female gymnasts, and 67-year-old men who were physically active. In all five groups average body fat was less in the trained subjects than in those who were relatively inactive, the difference in body fat ranging from 4 to 10%. The difference was most striking in the two groups of young adults: male wrestlers had only 5% body fat and female gymnasts only 10%, compared to 15% and 23%, respectively, for the controls.

Parizkova (1977) did a 5-year longitudinal study of adolescent boys, beginning at age 11 years. Densitometry was performed at yearly intervals. Those boys who were actively engaged in sports were generally taller than those who were not so engaged, had a greater LBM, and had less body fat than the others throughout the entire 5-year period. Since there was a height difference, the ratio of LBM to height is a better index than LBM per se. When this is calculated, the physically active boys had from age 12 on a larger LBM/height ratio (by 1–7%) than the others, the largest increment being seen in the oldest group. The active boys also had a higher maximal oxygen consumption and larger heart volumes.

Dalen et al. (1974) measured the limb bones of cross-country runners who had been actively engaged in this sport for at least 25 years. As estimated by x-ray spectrophotometry the runners had 6–19% greater density of the long bones in both the upper and lower extremities.

Huston et al. (1985) have published a detailed review of the athletic heart. Studies have included echocardiography as well as electrical and radiographic techniques. Left ventricular mass is increased in both “isotonic” and “isometric” performers: both have a thicker septum and ventricular wall, but the former has in addition a larger ventricular end-diastolic