Heat-induced illness is preventable. Physicians, teachers, coaches, and parents must be made aware of the potential hazards of high-intensity exercise in hot climates and of the measures needed to prevent heat-related illness in preadolescents. Because of the following morphologic and functional differences, exercising children do not adapt to extremes of temperature as effectively as adults when exposed to a high-climatic heat stress.1

1. Children have a greater surface area-mass ratio than adults, which induces a greater heat transfer between the environment and the body.

2. Children produce more metabolic heat per mass unit than adults when walking or running.2

3. Sweating capacity is not as great in children as in adults.3,4

4. The capacity to convey heat by blood from the body core to the skin is reduced in the exercising child.4,5

The foregoing characteristics do not interfere with the ability of the exercising child to dissipate heat effectively in a neutral or mildly warm climate. However, when air temperature exceeds skin temperature, children have less tolerance to exercise than do adults. The greater the temperature gradient between the air and the skin, the greater the effect on the child.4,6,7

Upon transition to a warmer climate, any exercising individual must allow time for conditioning for heat (acclimatization). Intense and prolonged exercise undertaken before acclimatization may be detrimental to health and might even lead to fatal heat stroke.8 Although children can acclimatize to exercise in the heat,6,9 the rate of their acclimatization is slower than that of adults.1 Therefore, a child will need more exposures to the new climate to sufficiently acclimatize.

Children frequently do not instinctively drink enough liquids to replenish fluid loss during prolonged exercise and may become gravely dehydrated.10 A major consequence of dehydration is an excessive increase in body temperature during exercise. For a given level of dehydration, children are subject to a greater increase in core temperature than are adults.10 Clinically, the dehydrated child is more prone to heat-related illness than the fully hydrated one.11,12

Children with the following conditions are at a potentially greater risk of heat stress: obesity, febrile state, cystic fibrosis, gastrointestinal infection, diabetes insipidus, diabetes mellitus, chronic heart failure, caloric malnutrition, anorexia nervosa, sweating insufficiency syndrome, and mental deficiency.

Based on the foregoing responses of children to exercise in hot climates, the Committee recommends:

1. The intensity of activities that last 30 minutes or more should be reduced whenever relative humidity and air temperature are above critical levels (zone 3 in Figure). Information concerning relative humidity may be obtained from a nearby US Weather Bureau or by use of a sling psychrometer (School Health Supplies, PO Box 409, 300 Lombard Rd, Addison, IL 60101; approximate cost $30) to compare dry bulb and wet bulb temperature levels.

2. At the beginning of a strenuous exercise program or after traveling to a warmer climate, the intensity and duration of exercise should be restrained initially and then gradually increased over a period of ten to 14 days to accomplish acclimatization to the effects of heat.

3. Prior to prolonged physical activity, the child should be fully hydrated. During the activity, periodic drinking (eg, 150 ml of cold tap water each 30 minutes for a child weighing 40 kg) should be enforced.

4. Clothing should be lightweight, limited to one layer of absorbent material in order to facilitate...
evaporation of sweat and expose as much skin as possible. Sweat-saturated garments should be replaced by dry ones. Rubberized sweat suits should never be used to produce loss of weight.

Proper health habits can be learned. The child athlete who may be exposed to a hot climate must be educated to observe the foregoing principles. Emphasis should be given to heat acclimatization, fluid intake, proper clothing, air temperature, and humidity.

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