Athletic performance and recovery from training are enhanced by attention to nutrient intake. Optimal nutrition for health and performance includes the identification of both the quantity and quality of food and fluids needed to support regular training and peak performance. As training demands shift during the year, athletes need to adjust their caloric intake and macronutrient distribution while maintaining a high nutrient dense diet that supports their training and competition nutrient needs. The following key points summarize impacts of training on energy, nutrient and fluid recommendations for competitive student-athletes as recommended by the American College of Sports Medicine (ACSM) and the American Dietetic Association (ADA).

It is helpful to think of the collegiate athletes training year as including 3 phases: base, competition and transition. During base training when training volume is high (practice are longer and or more frequent) athletes energy needs are likely to be at their highest. A high quality nutritional plan is key during this phase. Base training is also the best phase to experiment with and define event fueling and hydration strategies that can be continued throughout the year. The competitive phase usually reflects a decrease training volume, and perhaps higher intensity training sessions with extended periods of tapering leading up to competition and travel. During the competitive phase, athletes should adjust calorie and macronutrient intake to prevent unwanted weight gain, learn how to eat prior to competition and while traveling, and how to adjust fluid needs based on environmental impacts. Athletes who consume a balanced, adequate diet will likely exhibit the best performance, and experience less illness during the competitive phase. The transition phase, during which an athlete’s training volume and intensity are likely at their lowest, requires some attention to the prevention of unwanted changes in body weight (increased body fat or decreased muscle mass). During this phase, athletes may need to decrease total calorie intake and resist overindulging while still maintaining a nutrient dense diet.

**Carbohydrate, the primary fuel for higher intensity activity**, is required to replenish liver and glycogen stores and to prevent low blood sugar (hypoglycemia) during training and performance. Carbohydrate intake has been well documented to have a positive impact on adaptation to training, performance and improved immune function. During base training, a daily intake of between 5-7 grams of carbohydrate per kilogram of body weight per day is advised. As training intensity and/or volume increase, carbohydrate need may easily exceed 10 grams of carbohydrate per kilogram of body weight. Athletes should begin to think about fueling for their next athletics activity immediately following their exercise bout. Recovery carbohydrate, to replace glycogen stores, can be calculated based on 1-1.2 grams of carbohydrate per kilogram of body weight and should be consumed immediately following training sessions >90 minutes or high intensity shorter duration training sessions. Within 2 hours following training, additional carbohydrate will help continue glycogen repletion. The US Dietary Guidelines and experts in performance nutrition recommended athletes focus their food choices on less refined types of carbohydrate as these contain essential micronutrients vital to health and performance. Whole grains, breads, pasta, whole fruits and vegetables are excellent source of high quality carbohydrate.
Protein requirements are slightly higher in both endurance (1.2-1.4 grams per kilogram body weight) and strength-training student-athletes (1.6-1.7 grams per kilogram body weight) above the typical recommended daily intake (0.8 grams per kilogram body weight). Fortunately, the higher intakes recommended for athletes is easily achieved in a well-balanced diet without the use of additional supplements.

Fat intake is an important source of essential fatty acids and carrier for fat soluble vitamins necessary for optimal physiological function. During prolonged, lower intensity training, fats are a major energy contributor and are stored in muscle as triglyceride for use during activity. Dietary intake is suggested to be between 20-35 percent of total daily caloric intake. Diets low in fat intake can negatively impact training, nutrient density of the diet and the ability to consistently improve performance.

In general, vitamin and mineral supplements are not required if a student-athlete is consuming adequate energy from a variety of foods to maintain body weight. However, the risk of micronutrient deficiencies is greatest in student-athletes restricting calories, engaging in rapid weight-loss practices or eliminating specific foods or food groups from their diet. A multivitamin providing no more than 100 percent of the daily recommended intake can be considered for these student-athletes. Female student-athletes are especially prone to deficiencies in calcium and iron due to the impacts of regular menstrual cycles, avoidance of animal products and/or energy restriction. The diets and iron status of endurance athletes and vegetarians (especially females) should be evaluated. However, megadoses of specific vitamins or minerals (10 to 100 times the dose of daily requirements) are not recommended.

Hydration status impacts health and performance. Athletes should consume fluids throughout their day (water, low fat milk, 100% fruit juices) as well as pre, during and post training. Fluids containing electrolytes and carbohydrates are a good source of fuel and re-hydration. Fluids containing questionable supplement ingredients and high levels of caffeine or other stimulants may be detrimental to the health of the competitive athlete and are not effective forms of fuel or hydration.

Adequate overall energy intake spread out over the day is important for all student athletes. Insufficient energy intakes (due to skipped meals or dieting) will have a rapid negative impact on training, performance and over time on bone, immune function and injury risk. Inadequate energy intakes increase fatigue, deplete muscle glycogen stores, increase the risk of dehydration, decrease immune function and increase the risk of injury as well as result in unwanted loss of muscle mass. A low caloric intake in female student-athletes can lead to menstrual dysfunction and decreased bone mineral density.

The maintenance or attainment of an ideal body weight is sport-specific and represents an important part of a nutritional program. However, student-athletes in certain sports face a difficult paradox in their training/nutrition regimen, particularly those competing in “weight class” sports (e.g., wrestling, rowing), sports that favor those with lower body weight (e.g., distance running, gymnastics), sports requiring student-athletes to wear body contour-revealing clothing (track, diving, swimming, volleyball) and sports with subjective judging related to “aesthetics” (gymnastics, diving). These student-athletes are encouraged to eat to provide the
necessary fuel for performance, yet they often face self- or team-imposed weight restrictions. Emphasis on low body weight or low body fat may benefit performance only if the guidelines are realistic, the calorie intake is reasonable and the diet is nutritionally well-balanced.

The use of extreme weight-control measures can jeopardize the health of the student-athlete and possibly trigger behaviors associated with eating disorders. NCAA studies have shown that at least 40 percent of member institutions reported at least one case of anorexia nervosa or bulimia nervosa in their athletics programs. Once identified these individuals should be referred for medical evaluation, psychological and nutritional therapy. A more prevalent issue are the large number of sub-clinical or chronically dieting athletes. Department wide efforts to educate staff and student-athletes should include addressing the negative impacts of under fueling and weight/food preoccupation on the athlete’s performance and overall well-being. Although dysfunctional eating is much more prevalent in women (approximately 90 percent of the reports in the NCAA studies were in women’s sports), dysfunctional eating also occurs in men. Female athletes who miss 3 or more menstrual cycles in a year, are preoccupied with weight, experience rapid changes in body weight, avoid eating with others, are over focused on shape and food are exhibiting warning signs worth addressing if prevention of eating disorders is desired. The medical examination and updated history (Bylaw 17.1.5) is an opportunity to assess athletes for these risk factors and referral to appropriate professionals for further evaluation and diagnosis is critical.

**Eating disorders** are often an expression of underlying emotional distress that may develop long before the individual was involved in athletics. Eating disorders can be triggered in psychologically vulnerable individuals by a single event or comments (such as offhand remarks about appearance, or constant badgering about a student-athlete’s body weight, body composition or body type) from a person important to the individual. Coaches, athletic trainers, sport dietitians and supervising physicians must be watchful for student-athletes at higher risk for eating disorders. Disordered eating can lead to dehydration, resulting in loss of muscular strength and endurance, decreased aerobic and anaerobic power, loss of coordination, impaired judgment, and other complications that decrease performance and impair health. These symptoms may be readily apparent or may not be evident for an extended period of time. Many student-athletes have performed successfully while experiencing an eating disorder. Therefore, diagnosis of this problem should not be based entirely on a decrease in athletic performance.

Body composition and body weight can affect exercise performance but should not be used as the main criteria for participation in sports. Decisions regarding weight loss should be based on the following recommendations to reduce the risk of disordered eating.

1. Frequent weigh-ins (either as a team or individually) are discouraged.

2. Weight loss (fat loss) should be addressed during base or transition phases.

3. Weight loss goals should be determined by the student-athlete, medical and nutritional personnel, with consultation from the coach.

4. Weight loss plans should be individualized and realistic.
For each student-athlete, there may be a unique optimal body composition for performance, for health and for self-esteem. However, in most cases, these three values are NOT identical. Mental and physical health should not be sacrificed for performance. An erratic or lost menstrual cycle, sluggishness or an obsession with achieving a number on a scale may be signs that health is being challenged.

References