



## Nutrition and Cognition for Academic and Athletic Success

The number of National Collegiate Athletic Association (NCAA) student-athletes has increased tremendously over the last decade, with more than 444,000 men and women playing on 18,000 teams.<sup>1</sup> The educators and coaches of these student-athletes likely agree that a student's mood and ability to focus play significant roles in performance both in and out of the classroom. Understanding the relationship between nutrition and cognition may help those who interact with student-athletes identify nutritional issues of most concern.

Merriam-Webster defines cognition as the act or process of knowing.<sup>2</sup> This includes every mental process that may be described as an experience of knowing (including perceiving, recognizing, conceiving, and reasoning), as differentiated from an experience of feeling or of willing. Simply put, cognition is our ability to learn something new, process the information, and remember it. For many years, researchers have been studying the relationship between nutrition and cognition, looking specifically at the effects of certain nutrients or meals on brain function.

### The Nutrients

While it's important to focus on a total diet approach to meeting nutrition requirements, certain nutrients seem to play a bigger role in brain function than others. One such macronutrient is carbohydrate. Unlike other organs, the energy requirement of the brain is met almost exclusively by glucose.<sup>3</sup> In fact, the brain takes priority over working muscles when it comes to using carbohydrates for energy. For that reason, the DRI recommends a *minimum* of 130 grams of carbohydrates per day just for proper brain function.<sup>4</sup> The energy stores in the brain are extremely small compared with its high rate of glucose use, necessitating a constant supply through the bloodstream.<sup>3</sup> There is growing evidence that the provision of glucose may influence both memory and mood, particularly when intense metabolic demands are placed on the brain.<sup>3</sup> Therefore, when menu planning, meal composition and timing as related to brain function and cognition should be considered in addition to the working muscles' needs for carbohydrate.

A main micronutrient that affects brain function is iron. Even slightly lowered iron levels can cause fatigue, thinking impairments, and altered physical work capacity and productivity.<sup>5,6,7</sup> These and other symptoms associated with iron deficiency often resemble, and are subsequently mistaken for, symptoms of behavioral and learning problems. Although not completely understood, the most recent evidence points toward slowed central neural processing as a key component in the neural dysfunction exhibited in iron deficiency.<sup>7</sup>

### The Delivery

Equally important as knowing which nutrients play a significant role in academic and sports performance is the understanding of when these nutrients should be consumed to facilitate success for the student-athlete. When evaluating optimal meal timing, we should start by encouraging these nutrients be consumed with the first meal of the day.

It is widely accepted and evidence backed that breakfast is the most important meal of the day. Studies show that students who eat breakfast before school have better concentration, attention span, and memory.<sup>8,9,10</sup> On the contrary, a landmark study showed breakfast consumption declined between 1965 and 1991, with the most notable decline among older adolescents.<sup>11</sup> Much less research has been done with the collegiate population; however, one can assume the downward trend continues into the collegiate years, especially with the additional commitment and responsibilities that student-athletes face. Supporting this is a recent study in which only 27% of female college athletes reported eating breakfast regularly.<sup>12</sup>

Evidence also supports the recommendation for mid-morning snacking. One study showed that children who ate a smaller breakfast, on average only 61 calories, spent significantly less time tending to their work than those who had eaten larger meals.<sup>13</sup> The adverse effect was reversed by the consumption of a mid-morning snack. This should be emphasized to student-athletes as we encourage them to fuel early and often to support their high demands.

### **The Take-Home Message**

Student-athletes should consume a variety of foods throughout the day and around their training, as the total diet, or overall pattern of food eaten, is the most important aspect of proper fueling. Furthermore, the evidence supports breakfast as the most important meal of the day, as well as healthy snacking. To help ensure all-day success, the breakfast meal should include a variety of nutrients, with a particular focus on carbohydrates and iron for enhanced cognition.

### **Author**

Written by SCAN Registered Dietitians (RDs). For advice on customizing a nutrition plan, consult a RD who specializes in sports, particularly a Board Certified Specialist in Sports Dietetics (CSSD). Find a SCAN RD at [www.scandpg.org](http://www.scandpg.org).

### **References**

- 1.) "NCAA participation rates going up." National Collegiate Athletic Association. Web. 2 Nov. 2011.
- 2.) "Cognition." Merriam-Webster. Web. 2 Sept. 2013.
- 3.) Benton, D., and S. Nabb. "Carbohydrate, Memory, and Mood." *Nutrition Reviews* 61.5 (2006):S61-S-67.

- 4.) Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrates, Fiber, Fat, Fatty Acids, Cholesterol, Protein and Amino Acids*. Washington, D.C.: National Academy Press, 2005, print.
- 5.) Murray-Kolb, L. E., and J.L Beard. "Iron Treatment Normalizes Cognitive Function in Young Women." *American Journal of Clinical Nutrition* 85(2007):778-787.
- 6.) Verdon, F. et al. "Iron Supplementation for Unexplained Fatigue in Non-anaemic Women. Double Blind Randomized Placebo Controlled Trial." *British Medical Journal* 326(2003):1-4.
- 7.) Beard, J. "Iron Deficiency Alters Brain Development and Functioning." *Journal of Nutrition* 133 (2003):1468S-1472S.
- 8.) Gajre, N. S. et al. "Breakfast Eating Habit and Its Influences on Attention-Concentration, Immediate Memory and School Achievement." *Indian Pediatrics*. 45 (2008):824-828.
- 9.) Rampersaud G. C. et al. "Breakfast Habits, Nutritional Status, Body Weight and Academic Performance in Children and Adolescents." *Journal of the American Dietetic Association*105.5 (2005):743-760.
- 10.) Widen-Muller, Katharina.et al. "Influence of Having Breakfast on Cognitive Performance and Mood in 13- to 20- Year-Old High School Students: Results of a Crossover Trial." *Pediatrics* 122 (2008):279-284.
- 11.) Affenito, S. "Breakfast: A Missed Opportunity." *Journal of the American Dietetic Association* 107.54 (2007):565-569.
- 12.) Shriver, Lenka H., Nancy M. Betts, and Gena Wollenberg. "Dietary Intakes and Eating Habits of College Athletes: Are Female College Athletes Following the Current Sports Nutrition Standards." *Journal of American College Health*61.1 (2013):10-16.
- 13.) Benton, D. and M. Jarvis. "The Role of Breakfast and Mid-morning Snack on the Ability of Children to Concentrate at School." *Physiology & Behavior*90.2-3 (2007):382-385.