■ ELISA/ACT Biotechnologies LLC ■

LRA by ELISA/ACT® CLINICAL UPDATE #7

Gastrointestinal Disturbances Among Athletes

What gastrointestinal (GI) disturbances occur among athletes and how frequent are their complaints?

Surveys of recreational and competitive athletes indicate that digestive/ gastrointestinal (GI) disorders are common both during training and during competitive endurance events (3,4,7,12,13,15,17). Women appear to be most susceptible, but complaints by men are frequent. The most severe symptoms occur during running rather than biking or swimming, but symptoms are noted during all activities. Symptoms reported include the urge to defecate, incapacitating diarrhea, loose stools, nausea, vomiting, rectal bleeding, abdominal pain, flatulence, acid reflux and belching (3,4,7,12,13,15,17). In one study of 71 male and female recreational triathletes, over half reported symptoms on a regular basis, and 10 of these individuals took medications routinely for the symptoms (17). In another study of triathletes, 48% of the men complained of eructation and flatulence (13). Furthermore, one or more symptoms of GI distress were reported by 42% of men and 57% of women during a 67 km race (12).

Objective documentation of GI disturbances has also been carried out. After competitive running events, the frequencies of rectal bleeding range from 8 to 30% for a marathon (3,4,7) to 87% for a 100- mile running race (1). GI bleeding has also been reported after a triathlon with a frequency rate of 27% (17). These are really quite provocative numbers, providing strong evidence that GI function may be compromised by endurance exercise. To date, however, the mechanisms or causes of the symptoms are unknown.

What aspects of GI function might be altered by acute exercise or regular exercise training?

Much remains to be learned about GI function during exercise since only a few aspects have yet been studied. Gastric emptying, transit time, absorption of nutrients, and intestinal permeability studies have been conducted (2,5,8-11,14,16), but the results are far from conclusive. Gastric emptying during exercise has been shown to be delayed, accelerated, or unchanged (3,7,11,14): no significant changes in gastric emptying are noted with low intensity exercise (3,7), whereas gastric emptying of fluids appears to be delayed relative to non-exercising conditions with severe exercise (3,11). In general, the patterns of change in gastric emptying depend on the intensity and duration of the exercise and the type of meal (liquid or solid) provided before or during exercise. Similarly, the pattern of change in transit time reflects exercise intensity and meal type (2,3,7,8). For example, during prolonged exercise, oral to cecal transit time of the marker, lactulose, was delayed with exercise as compared to non-exercise (7,8). In contrast, oral to cecal transit of a liquid meal was accelerated in women during very mild exercise (6). In general, it appears that more exhausting, strenuous exercise imposes a greater stress on GI function than exercise that is of low intensity and mild.

Others have examined absorption of nutrients in an effort to determine whether symptoms reported by runners might reflect malabsorption. Probes used have included xylose, lactose, 3-O-methylglucose, polyethylene glycol (PEG), water, glucose, electrolytes and vitamin/mineral supplements (3,5,9,10,14,16). No significant differences between exercise and non-exercise conditions have been noted, but studies are few in number, and conditions of exercise have not been varied in any quantitative manner. Nonetheless, one group demonstrated an increased intestinal permeability during prolonged high intensity running when PEG was used as a marker (10). This suggests that the integrity of the GI tract in runners may be suboptimal.

INDEX

109 Carpenter Drive, Suite 100 • Sterling, VA 20164 • Phone: 703.450.2980 • 800.553.5472 • Fax: 703.450.2981

Hyperpermeability of the GI tract could provoke food allergies/hypersensitivities that could then result in performance decrements if intensive training were maintained over an extended period. Other alterations in GI function that might elicit symptoms during exercise include secretion of factors such as H+, HCO3, and pancreatic enzymes, and motility of the stomach or small bowel (4). To date, however, no studies have adequately examined these functions to speculate on their contribution to GI distress in endurance athletes. Clearly, much remains to be learned about how acute and chronic exercise affect GI function.

What physiologic processes during exercise might have an impact on GI function?

The most dramatic effect of exercise is a quantitative reduction in tissue blood flow to the GI tract. Blood flow is diverted away from the GI tract and directed toward skeletal muscle. As such, splanchnic and gastric blood flow is severely limited. This reduction in flow also results in a diminished availability of oxygen and energy sources, such that it has been hypothesized that local hypoxic conditions or ischemic insults during exercise might affect susceptible brush border enzymes and/or cause damage to mucosal cells (3,4,7). Symptoms such as diarrhea and/or blood in the feces may reflect such morphological changes induced by local hypoxia. In addition, the accumulation of toxins or intracellular/ extracellular electro-lyte imbalances resulting from ischemia could also provoke GI symptoms (13).

Although anoxic or hypoxic microenvironments may explain the occurrence of GI symptoms reported by long distance runners and triathletes, other mechanisms may be operable. Gut tissue activity and metabolism is hormonally regulated at rest, and exercise induces a variety of hormonal changes that could significantly impact GI function. For example, plasma levels of catecholamines, gastrin, motilin, and vasoactive intestinal polypeptide have been shown to increase with exercise (3,12), and could explain exercise-induced changes in transit time and gastric emptying. Unfortunately, hormone-induced changes in GI function during exercise have not been evaluated with respect to exercise intensity and duration or severity of GI symptoms. Thus, hormonal changes can only be offered as a potential explanation.

How do GI symptoms relate to dietary intake and food patterns?

The connection between food and beverage consumption and the occurrence and severity of GI symptoms during exercise has been examined by several groups (13,17). Food constituents that appear to contribute to the symptoms include: intake of dietary fiber, fat, and protein before exercise appear to increase the risk of GI dysfunction (13). Moreover, patterns of food intake such as the timing of the last meal affect the development of symptoms (3,7,13). One of the most well-studied issues that appears to have marked effects on GI distress is the ingestion of fluid replacement beverages (3,4,8,9,14). The ingestion of hypertonic carbohydrate-containing beverages is associated with an increased incidence of GI symptoms, in particular dyspepsia and gastric acid reflux (3,4,7,13). Hypertonic solutions in the intestine are known to increase secretion, and gastric acid secretion is increased with increasing beverage osmolality (3,13). Furthermore, if large amounts of carbohydrate are ingested, abdominal bloating and osmotic diarrhea may occur (13). This information and the results of many studies has led sports nutritionists/ trainers and coaches to recommend that fluid replacement beverages should be either iso- or hypotonic if GI symptoms are to be minimized. Of interest is the recent finding that dehydration strongly influences the occurrence of GI symptoms (11), and that in the absence of dehydration and/or thermal strain, GI distress may be negligible; thus ingesting either water or weak carbohydrate solutions to maintain plasma volume is recommended for events lasting over one hour to minimize GI disturbances.

America in Transition: From Disease-care to Health-care

Health care reform is the issue of the day. The current crisis in access, affordability and quality of health-care prompted Dr. George Lundberg, Editor of *JAMA* to predict imminent financial and operational "meltdown" of the current system. The national debate is crowded with proposals to reduce costs while maintaining quality by adopting one or more of the following strategies: rigid cost control, rationing of care, care management, cost shifting, voluntary restraint, and reduced waste. While of many stripes and colors, these proposals share one fundamental element. All base their success on changing the mechanisms of how care is managed, delivered, and financed. While agreeing that services can be delivered at lower costs with improvement in administration, management of care, and avenues of accessibility, we doubt that such mechanistic solutions are sufficient to reverse the catastrophic and parallel trends of ever higher costs and ever greater sufferings. The path to quality, affordable care, we suggest, is ultimately determined by what care we give, when we give it, and the involvement of the cared rather than how we deliver and pay for our care. These are the central issues that have determined the causes and contain the solution to our health-care crisis.

Continued on page 3, top right

What treatments/ approaches can be recommended to minimize GI distress in athletes and others who exercise?

Our understanding of GI distress and exercise is limited because it is such a new area of study. As more people have begun to participate in endurance activities, more GI complaints have been noted, and this has encouraged researchers and physicians to explore the relationship. Because the mech-anisms are unknown, treatment approaches are exploratory, and as described above, a careful exam-ination of diet and food intake patterns becomes essential if any treatment is to be attempted.

Although dietary patterns and fluid replacement beverages are likely contributors to the GI symptoms, other possibilities also exist. For example, the athlete may have single or multiple food allergies that over time have compromised the integrity of his/her GI tract. GI distress is commonly associated with food allergies/sensitivities, and it is likely that exercise would exacerbate the condition. Thus, until the reactive/ offending foods were eliminated or the exercise program was curtailed, the symptoms would persist. Alternatively, it is possible that continuous training with concomitant ischemia may alter the morphology of mucosal cells and make them more permeable to antigenic molecules: hyperpermeability of the GI tract could predispose an individual to food allergies/sensitivities and subsequently to significant GI distress.

A worthwhile recommendation for athletes/individuals who complain of GI symptoms during or after exercise would be to try an LRA by ELISA/ACT® program. Reactive foods can be identified easily and eliminated from the diet such that damage to cells in the intestinal tract can be repaired and the occurrence of annoying and uncomfortable symptoms decreased. Interestingly, numerous competitive athletes have gone on fairly restrictive diets in an effort to enhance their performance. Restrictive diets require elimination of many common reactive/ offending foods, and such drastic measures may not be necessary. If LRA by ELISA/ACT is used to identify specific foods, a more inclusive diet can be followed, and this should result in substantial improvements in performance. In sum, LRA by ELISA/ ACT should prove to be a valuable tool for minimizing exercise-associated GI distress and potentially improve performance.

Have we forgotten that we came to "drain the swamp" of disease's causes? Are we preoccupied "fighting the alligators" of disease's consequences? The basic bias of our current symptom-driven medical care system grows largely out of our great success in the arena of acute illness, trauma and surgical care and management. During the first half of the 20th century, substantial advances occurred in combating acute infectious and public health-linked disease with equally dramatic reductions in both maternal and infant mortality. Today, replete with our technologic wonders and magic-bullet therapies, we deserve to stand in awe of our successes in acute illness, surgical intervention, rehabilitation and diagnostic procedures.

Too often, however, our underlying assumption seems to be, 'If high technology cannot help, how can the more basic, nutritional, life-style or outlook remedies possibly be effective?' While appropriate use of health technology is desirable, breakthroughs in molecular biology, human nutrition and behavioral sciences compel us to reassess both our fundamental beliefs about the causes of and effective strategies for managing chronic illnesses which consume 90% of our health-care resources. These conditions include heart disease and cancer, chronic pain, mood disorders and autoimmune illnesses such as arthritis, asthma, inflammatory bowel diseases, adult diabetes, multiple sclerosis, migraine headaches, eczema and psoriasis, thyroiditis and endocrinopathies. *See Page 4.*

References

1. Baska RS, Moses FM, Deuster PA. Cimetidine reduces running-associated gastrointestinal bleeding: A prospective observation. *Dig Dis Sci*. 1990;35:956-960.

2. Bingham SA, Cummings JH. Effect of physical fitness on large intestinal function. *Gastroenterology.* 1989;97:1389-1399.

3. Brouns F. Etiology of gastrointestinal disturbances during endurance events. *Scand J Med Sci Sports*. 1991;1:66-77.

4. Brouns F, Saris WHM, Rehrer NJ. Abdominal complaints and gastrointestinal function during long-lasting exercise. *Int J Sports Med*. 1987;8:175-189.

5. Gisolfi CV, Spranger KJ, Summers RW, Schedl HP, Bleiler TL. Effects of cycle exercise on intestinal absorption in humans. *J Appl Physiol*. 1991;71:2518-2527.

6. Keeling WF, Harris A, Martin BJ. Orocecal transit during mild exercise in women. *J Appl Physiol.* 1990;68:1350-1353.

7. Moses FM. The effects of exercise on the gastrointestinal tract. *Sports Med*. 1990;9:159-172.

8. Moses F, Ryan C, DeBolt J, Smoak B, Hofmann A, et al. Oral cecal transit time during a two hour run with ingestion of water or glucose polymer. *Am J Gastroent*. 1988;83:1055.

9. Moses F, Singh A, Villanueva V, Kelsey B, Smoak B, et al. Lactose absorption and transit during prolonged high intensity running. *Am J Gastroent*. 1989;84:1192.

10.Moses F, Singh A, Smoak B, Hollander D, Deuster P. Alterations in intestinal permeability during prolonged high intensity running. Unpublished data.

11.Rehrer NJ, Beckers EJ, Brouns F, Ten Hoor F, Saris WHM. Effects of dehydration on gastric emptying and gastrointestinal distress while running. *Med Sci Sports Exerc*. 1990;22:790-795.

12.Rehrer NJ, Brouns F, Beckers EJ, Frey WO, Villiger B, Riddoch CJ, Menheere PPCA, Saris WHM. Physiological changes and gastro-intestinal symptoms as a result of ultra-endurance running. *Eur J Appl Physiol.* 1992;64:1-8.

13.Rehrer NJ, Kemenade M, Meester W, Brouns F Saris WHM. Gastrointestinal complaints in relation to dietary intake. *Int J Sports Nutr.* 1992;2:48-59.

14.Rehrer NJ, Wagenmakers AJM, Beckers EJ, Halliday D, et al. Gastric emptying, absorption, and carbohydrate oxidation during prolonged exercise. *J Appl Physiol*. 1992;72:468-475.

15.Riddoch C, Trinick T. Gastrointestinal disturbances in marathon runners. *Brit J Sports Med*. 1988;22:71-74.

16.Singh A, Moses FM, Smoak BL, Deuster PA. Plasma zinc uptake from a supplement during submaximal running. *Med Sci Sports Exerc*. 1992;24:442-446.

17.Worme JD, Doubt TJ, Singh A, Ryan CJ, Moses FA, Deuster PA. Dietary patterns, gastrointestinal complaints, and nutrition knowledge of recreational triathletes. *Am J Clin Nutr.* 1990;51:690-697.

Continued from page 3

Thinking like wise corporate managers and prudent homemakers, we can apply a health based approach, the most basic of whose principles are "an ounce of prevention is worth a pound of cure" and "first of all, do no harm."

The more common current medical philosophy is disease-reactive in philosophy and its system-driving assumptions take health for granted, mostly applying symptom-suppressive therapies only when signs and symptoms of ill health appear. However, any health care system that doesn't embrace true disease prevention and health promotion as its guiding beacon is as bankrupt as a welfare system that doesn't embrace job training and work incentives. We have the means to bring people the self-confidence, sense of self-worth and skills to raise their standard of living and of health.

You can speed the transition to a health-based philosophy and practice by choosing therapies aimed to correct or eliminate the fundamental and underlying causes of ill health. The rapid rise of our consumer driven health care system, involving a growing number and variety of health care professionals and self care approaches, providing active lifestyle (dietary, behavioral, and attitudinal) therapies, reflects the demand for effective, pro-active care. This is the single change that can alter our dismal probable future of slowly failing health and dwindling resources. Outcome effectiveness studies confirm the value of health-based care. Fortunately, such care is compatible with any operational and administrative mechanism.

If we begin today, we project that over the next three decades, this approach can reduce the fraction of our GDP devoted to disease-care as we shift from caring for consequences to caring for causes. Our model concludes that with this fundamental change to a health-based system, affordable quality health care can become both accessible and attainable for all Americans. While shifting our center from caring for consequences to a focus on causes is a tall order, the results for both personal and social health at lower costs are enough to propel the transition.

The health-based approach is a flexible "no loser" approach. Fundamental in method, time and resource efficient and clinically effective, it can be married to public or private systems of health-care. It can be central to administrative and delivery systems of all types. By embracing the strategies of disease prevention and health promotion, we also embrace the only true avenue of access to:
1) Substantial improvement in personal, community and national health,
2) Marked rise in national productivity,
3) Dramatic reduction in the expense of disease, and,
4) Reduced, sustainable, value-added cost of health care.
John Knowles, then President of the Rockefeller Foundation, summarized and prophesied our current dilemma in the spring of 1978 when he wrote, "America is spending more and feeling worse." A healthy America can renew itself. An unhealthy America will rapidly decline.

Reprinted from American Medicine in Transition: From Disease-Care to Health-Care by Russell Jaffe, MD, Ph.D. and Edward Morris, Ph.D.

Contact

If you have any questions or would like more information about LRA by ELISA/ACT testing, please contact our Client Services Department at 800-553-5472.