

INTERNATIONAL JOURNAL OF
**ATHLETIC
THERAPY & TRAINING**

THE PROFESSIONAL JOURNAL
OF CERTIFIED ATHLETIC TRAINERS
AND ATHLETIC THERAPISTS

Volume 17 / Number 5 / September 2012

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Dealing With the Fatigued Athlete

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All athletes go through periods of time when they run out of energy and can't get through a workout. Although some degree of fatigue may be normal for any athlete during periods of high-volume training, the athletic trainer or therapist (AT) is normally on the "front lines" of healthcare and must be able to differentiate between physiological fatigue and more prolonged, severe fatigue, which may be due to a pathological condition. Because fatigue can be the presenting symptom of many curable and harmful diseases, medical conditions that cause fatigue have to be excluded. The AT must be able to effectively screen for fatigue associated with training versus fatigue from other medical causes and know when to refer to other health professionals. The purpose of this report is to introduce a clinical approach to the work-up and diagnosis for the athlete presenting to the training room with fatigue. The strength of this approach is that it involves the participation of a multidisciplinary team in the diagnosis and management of the athlete with fatigue. The multidisciplinary team is made up of the physician, athlete, AT, coach, dietician, exercise physiologist, physical therapist, and sport psychologist. Each member of the team plays an important role in the evaluation, correct diagnosis, and effective treatment of the athlete.

Etiology of Fatigue in Athletes

The causes of fatigue in athletes are numerous. An athlete may go through many exhaustive clinical tests, which makes the work-up long and frustrating for everyone involved. Before referral to a physician, the AT should obtain a thorough history of the athlete's recent training, diet, sleep patterns, and exercise recovery

patterns. If indicated, rest and dietary changes should be implemented for a trial period of several days to weeks. If symptoms persist, possible underlying medical conditions should be excluded. A brief review of systems can rule out many worrisome conditions or alert the AT to the need to refer the athlete to appropriate healthcare professionals. Because entire textbooks are dedicated to the work-up of fatigue, the medical conditions addressed by this report were limited. The conditions addressed include common causes of fatigue, such as inadequate recovery, nutritional deficiency, cardiac dysfunction, pulmonary dysfunction, hematological abnormalities, and endocrine dysfunction. Other less common causes, such as metabolic enzyme deficiencies, are also discussed. Table 1 presents an abbreviated list of possible causes of fatigue in the athletic population.

Recovery

The most common cause of fatigue in endurance athletes at every level of competition is inadequate recovery time. Athletes rarely lack the will to train and work hard. Combine the time demands of training with school, work, and family responsibilities and the hours available for rest quickly diminish. The body makes physiologic gains during rest. Athletes who understand this principle are often able to make the necessary adjustments to achieve more rapid performance gains. Adequate nightly sleep of 7–10 hours is best, but naps and scheduled recovery time may also be implemented. Individuals vary in terms of the amount of rest needed, but there is no question that as training demands increase, attention to rest and recovery must also increase.¹

TABLE 1. POSSIBLE CAUSES OF FATIGUE IN THE ATHLETIC POPULATION

Cardiac	Hypertrophic cardiomyopathy, coronary artery disease, congenital heart disorders, arrhythmias
Pulmonary	Asthma, exercise induced bronchospasm, allergic rhinitis
Metabolic/endocrine	Anemia, hypothyroidism, diabetes, electrolyte abnormalities, kidney disease, liver disease, Cushing's disease, adrenal insufficiency, metabolic enzyme deficiency
Infectious disease	Infectious mononucleosis, hepatitis, tuberculosis, cytomegalovirus, HIV, influenza, malaria
Neoplasm	Occult malignancy, leukemia, lymphoma
Nutritional	Poor diet, anorexia nervosa, bulimia nervosa
Hematologic	Anemia, iron deficiency
Psychosocial	Depression, anxiety, stress, alcohol/drug abuse
Medications	Anti-depressants, anti-anxiety medications, sedatives, antihistamines, steroids, hypertensive medications
Sleep problems	Sleep apnea, insomnia, narcolepsy
Other	Overtraining, pregnancy

Nutritional Deficiencies

Inadequate caloric intake is a common cause of fatigue that can be easily detected by ATs and coaches. Endurance athletes frequently limit calories in an effort to lose weight. Others unintentionally ingest an inadequate amount of calories for a given volume of training. Finding the balance between adequate caloric intake to maintain performance and to maintain appropriate body composition is essential to maximize performance. Combining consistent adherence to a structured nutrition program with use of a caloric expenditure calculator over an extended period of time is the best way to manage this common cause of fatigue.

The existence of an eating disorder should be considered when an athlete in a judged or weight-classified sport presents fatigue. These athletes are often chronically glycogen-depleted. The athlete who is a perfectionist or overachiever has elevated risk for development of an eating disorder.²

Anorexia Nervosa is present in approximately 1 % of the adolescent and young adult female population. Diagnostic criteria include (a) refusal to maintain body weight at or above a minimally normal weight for age and height (e.g., weight loss leading to maintenance of body weight less than 85 % of that expected or failure to make expected weight gain during period of growth,

leading to body weight less than 85 % of that expected); (b) intense fear of gaining weight or becoming fat, even though underweight; (c) disturbance in the way in which one's body weight or shape is perceived, undue influence of body shape on self-evaluation, or denial of the seriousness of the current low body weight; and (d) among postmenarcheal females, amenorrhea, i.e., the absence of at least three consecutive menstrual cycles.³

Bulimia Nervosa is present in approximately 1–3 % of the general population. Diagnostic criteria for Bulimia Nervosa include (a) recurrent episodes of binge eating; (b) recurrent inappropriate compensatory behavior in order to prevent weight gain (e.g., self-induced vomiting, misuse of laxatives, diuretics, enemas, or other medications), fasting, or excessive exercise; (c) binge eating and inappropriate compensatory behaviors occur, on average, at least twice a week for three months; (d) self-evaluation is unduly influenced by body shape and weight; and (e) eating disturbance does not occur exclusively during episodes of Anorexia Nervosa. Bulimia can be further differentiated as a “purging” versus “non-purging” type (i.e., exercise & fasting).³

Disordered eating presents a serious health risk and should be addressed immediately. A multidisciplinary approach to treatment including the AT, physician, nutritionist, and behavioral therapist should be utilized.²

Cardiac Dysfunction

Cardiac disease is a potential cause of fatigue that should never be overlooked. Initial symptoms of cardiac disease in the athlete are often nonspecific, such as exertional fatigue, decreased performance, and respiratory difficulty. Part of the history obtained by the AT for any athlete presenting exertional fatigue should include the presence or absence of chest pain, palpitations, skipped heart beats, syncope, or family history of sudden cardiac death before the age of 50.⁴ The existence of any of these symptoms or a positive family history warrants urgent referral to a physician for further evaluation.

Pulmonary Dysfunction

Pulmonary causes for fatigue should be suspected when there is a history of exercise-related fatigue, cough, shortness of breath, wheezing, chest tightness, becoming easily winded, or simply experiencing a decrease in performance. Exercise-induced bronchospasm (EIB) is a fairly common condition that has been reported to be present in 11 to 50% of cold-weather athletes.⁵ Athletes with EIB may present any of the previously specified complaints. In such cases, appropriate clinical testing should be performed and, if necessary, treatment should be provided before the athlete is allowed to return to play. Pulmonary function testing is considered the standard for diagnosis of EIB, which may identify asthma or some other obstructive or restrictive lung disorder.

Hematological Abnormalities

Iron deficiency is a common cause of fatigue that should be considered. Iron is the key building block of hemoglobin, which is the molecule within red blood cells that is responsible for carrying oxygen. Without adequate iron, the body cannot optimally deliver oxygen to working muscles. Iron deficiency may occur with or without anemia. Athletes at greatest risk for iron deficiency are female athletes, endurance athletes, and vegetarians. Any combination of these factors should raise suspicion for iron deficiency.⁶ Some dietary sources of iron include red meats, spinach, and kidney beans. Iron deficiency can occur due to insufficient intake, failure of absorption in the gastrointestinal tract, or losses through menstrual bleeding, gastroin-

testinal bleeding, or sweating. The diagnosis of iron deficiency and its cause ultimately requires referral to an appropriate health care professional for evaluation and blood testing. Health risks associated with excess iron intake necessitate that athletes not institute iron supplementation without medical supervision. In addition, there are additional causes of anemia that can be revealed by blood testing.⁶

Endocrine Dysfunction

Hypothyroidism is a common cause of fatigue in adults. It is the most commonly identified endocrine disorder when adults present fatigue. Cold intolerance is another classic symptom. Edema, dry skin, menstrual irregularities, constipation, slowed mentation, weight gain, weakness, muscle pain, and aching are also common manifestations of this disorder. The existence of any combination of these symptoms warrants referral to a physician for appropriate serological testing.⁷

Less commonly, adrenal conditions can be a cause of fatigue. The AT should be alert for symptoms associated with adrenal insufficiency, which can be life threatening if untreated. Many of the associated symptoms are nonspecific, but recognition of the triad of decreased energy, decreased appetite, and weight loss is associated with nearly 100% sensitivity for identification of adrenal insufficiency. When these three symptoms are present, the athlete should be immediately referred to a physician for baseline cortisol and ACTH testing and, if necessary, replacement of glucocorticoids and mineralcorticoids.⁸

Metabolic Enzyme Deficiencies

Much less commonly diagnosed, mitochondrial enzymatic deficiency can be a cause of unexplained exercise-related symptoms and performance limitation of an athlete at any level of competition. Recent studies suggest that the prevalence of the disorder may be greater than that previously recognized or expected. Exercise limitation associated with symptoms of dyspnea, tachycardia, muscle fatigue, or cramping should alert the AT to a possible abnormality in cellular energy metabolism.^{9,10}

Among the numerous enzyme deficiencies, muscle carnitine deficiency is well-documented and it is often assessed in sports medicine settings. Symptoms of carnitine deficiency can appear in the first years of life, but

they may also occur during the second or third decade. An athlete may experience proximal muscular weakness of varying degrees, exercise intolerance, or myalgia.¹¹ Several studies of athletes have demonstrated that carnitine supplementation may improve exercise performance. The majority of studies have documented an increase in maximal oxygen consumption and a lowering of the respiratory quotient, which indicates that dietary supplementation has the potential to stimulate lipid metabolism. Treatment with l-carnitine also has been shown to significantly decrease post-exercise plasma lactate concentration. Study findings have also indicated that l-carnitine plays an important role in the prevention of cellular damage and favorably affects recovery from exercise stress. Uptake of l-carnitine by blood cells may promote at least three different physiologic processes: (a) stimulation of hematopoiesis, (b) dose-dependent inhibition of collagen-induced platelet aggregation, and (c) prevention of programmed cell death of immune cells. According to Karlic and colleagues,¹² there is evidence for a beneficial effect of l-carnitine supplementation in terms of training adaptations, competitive performance capabilities, and recovery from strenuous exercise. Thus, carnitine deficiency should be considered when an athlete presents fatigue and muscular cramping symptoms, which may be managed through dietary supplementation.

Summary

Fatigue is a common complaint among athletes that is important to address. It may affect an athlete's ability to train effectively, lead to musculoskeletal injury, or negatively affect competitive performance capabilities. Because an AT is often the first health professional that an athlete encounters, ATs should be aware of the various conditions that may lead to fatigue. A height-

ened awareness of the potential for serious health risk should be aroused when an athlete presents a vague complaint of fatigue. ■

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