

# Energy Balance, Eating Disorder Risk, and Pathogenic Behaviors Among Athletic Trainers

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**Context:** Research exists on energy balances (EBs) and eating disorder (ED) risks in physically active populations and occupations by settings, but the EB and ED risk in athletic trainers (ATs) have not been investigated.

**Objective:** To assess ATs' energy needs, including the macronutrient profile, and examine ED risk and pathogenic behavioral differences between sexes (men, women) and job statuses (part time or full time) and among settings (college or university, high school, nontraditional).

**Design:** Cross-sectional study.

**Setting:** Free living in job settings.

**Patients or Other Participants:** Athletic trainers (n = 46; male part-time graduate assistant ATs = 12, male full-time ATs = 11, female part-time graduate assistant ATs = 11, female full-time ATs = 12) in the southeastern United States.

**Main Outcome Measure(s):** Anthropometric measures (sex, age, height, weight, body composition), demographic characteristics (job status [full- or part-time AT], job setting [college/university, high school, nontraditional], years of AT experience, exercise background, alcohol use), resting metabolic rate, energy intake (EI), total daily energy expenditure (TDEE), EB, exercise energy expenditure, macronutrients (carbohydrates, protein, fats), the Eating Disorder Inventory-3, and the Eating Disorder Inventory-3 Symptom Checklist.

**Results:** The majority of participants (84.8%, n = 39) had an ED risk, with 26.1% (n = 12) engaging in at least 1 pathogenic behavior, 50% (n = 23) in 2 pathogenic behaviors, and 10.8% (n = 5) in >2 pathogenic behaviors. Also, 82.6% of ATs (n = 38) presented in negative EB (EI < TDEE). Differences were found in resting metabolic rate for sex and job status ( $F_{1,45} = 16.48, P = .001$ ), EI ( $F_{1,45} = 12.01, P = .001$ ), TDEE ( $F_{1,45} = 40.36, P < .001$ ), and exercise energy expenditure ( $F_{1,38} = 5.353, P = .026$ ). No differences were present in EB for sex and job status ( $F_{1,45} = 1.751, P = .193$ );  $\chi^2$  analysis revealed no significant relationship between ATs' sex and EB ( $\chi^2_{1,46} = 0.0, P = 1.00$ ) and job status and EB ( $\chi^2_{1,46} = 2.42, P = .120$ ). No significant relationship existed between Daily Reference Intakes recommendations for all macronutrients and sex or job status.

**Conclusions:** These athletic trainers experienced negative EB, similar to other professionals in high-demand occupations. Regardless of sex or job status, ATs had a high ED risk and participated in unhealthy pathogenic behaviors. The physical and mental concerns associated with these findings indicate a need for interventions targeted at ATs' health behaviors.

**Key Words:** health behaviors, physical activity, occupational wellness

## Key Points

- Athletic trainers' negative energy balance, high eating disorder risk, and pathogenic behaviors raise concerns about long-term consequences for their physical and mental health, their longevity in the profession, and their ability to be good stewards of health and wellness.
- Health and wellness policies, including dietary education, targeted at athletic trainers are warranted to improve their physical and mental health.

Health care professionals promote health and wellness in their patients by applying evidence-based principles and preventive measures with the goal of improving public health outcomes. For practitioners to promote high-quality job performance and patient care, including patient safety and outcomes, they have the responsibility of maintain-

ing their own health and wellness. Making time for oneself (both physically and mentally) may mitigate some negative responses to chronic stress, which include burnout, attrition from the profession, feeling exhausted,<sup>1</sup> headaches, disrupted sleep patterns, poor appetite, increased alcohol and tobacco use, and anxiety or depression.<sup>2,3</sup>

Athletic trainers (ATs) primarily work in traditional settings (college or university [CU], secondary school, professional sports) in which nontraditional work hours, a high level of work stress, and limited physical activity (PA) are common.<sup>4,5</sup> Previous research on ATs' self-reported health behaviors (eg, PA, nutrition, alcohol use) demonstrated that ATs did not meet PA recommendations<sup>6,7</sup>; also, despite ATs' adequate nutrition knowledge,<sup>8</sup> they engaged in unhealthy eating behaviors and did not meet nutritional recommendations.<sup>6,7</sup> Inadequate PA levels and poor dietary habits in ATs are similar to those in health care professionals such as nurses and physicians.<sup>9,10</sup>

Inadequate dietary intake along with low PA levels can result in energy imbalances. *Energy balance* (EB) is defined as the total dietary energy intake (EI) minus the total daily energy expenditure (TDEE). The energy balance can indicate how body weight will change over time in response to EI and TDEE changes. When an individual has a positive EB, adverse health effects can include obesity, cardiovascular disease, high blood pressure, type 2 diabetes, sleep apnea, decreased metabolic processes, and decreased bone mass.<sup>11</sup> Obese individuals tend to experience high levels of dieting, overeating, and body image dissatisfaction, whereas those who are overweight tend to engage more in binge eating or compulsive overeating.<sup>12,13</sup> Undernutrition is a complex concern associated with a negative EB. A negative EB can lead to being underweight, which increases the risk for a decline in metabolism, malnutrition, decreased bone mass, reduced metabolic and reproductive hormones, and inability to concentrate.<sup>14</sup> Both negative and positive EBs have implications for body weight regulation (ie, weight gain or weight loss)<sup>15,16</sup> and may lead to self-consciousness, anxiety, stress, body image dissatisfaction, depression, anxiety, eating disorders (EDs), and low self-esteem.<sup>17,18</sup> These psychosocial factors may also be comorbid with EDs or the disordered eating (DE) risk,<sup>19</sup> which are not often examined when health care providers' health and wellness are assessed. The multidimensional ED model describes perpetuating factors that involve psychological, emotional, and physical starvation effects, which in turn link to starvation, dieting, binge eating, purging, and nonpurging behaviors.<sup>18</sup> It is important to note that these underlying psychological constructs (especially feeding and eating disorders and depression) are frequently associated with pathogenic behaviors (eg, dieting, excessive exercise, vomiting, use of diuretics).<sup>20–22</sup>

Previous research<sup>6,7</sup> on ATs' health behaviors was specific to self-reported PA and dietary intake; however, ATs' PA levels in a free-living environment (ie, real time), dietary habits, and psychological constructs related to ED/DE have not been examined in conjunction. To support prevention and management strategies aimed at improving ATs' overall quality of life, it is necessary to understand how these health concerns may exist in ATs. Therefore, the purposes of our study were to examine the EB, ED/DE risk, and pathogenic behaviors among ATs and to assess differences between sexes (male, female) and job statuses (part-time as a graduate assistant AT [PT-AT]; full-time AT [FT-AT]) and among job settings (CU, high school [HS], nontraditional [NT]). We hypothesized that FT-ATs and CU ATs would have a higher prevalence of positive EB, increased ED risk, and increased pathogenic behaviors compared with PT-ATs and HS and NT ATs. Because of

the stressors already placed on ATs (eg, long hours, job-related stressors, burnout), we hypothesized that women would have greater negative EB and increased ED/DE risk and pathogenic behaviors.

## METHODS

This study was part of a larger cross-sectional, descriptive, and free-living design. A convenience sample of ATs (men = 23, age = 29.1 ± 7.9 years; women = 23, age = 28.9 ± 7.9 years) from the southeastern region of the United States were recruited from local CUs, HSs, and NT (eg, clinics, recreations centers, outreach programs) settings. The inclusion criterion was having been certified by the Board of Certification. The exclusion criterion was working primarily under a different credential (eg, ATC, PT; ATC, PA). Institutional review board approval was obtained, and all participants provided consent before the study.

### Demographic and Anthropometric Measurements

Basic anthropometric and demographic information obtained was sex, age, height, weight (self-reported height, weight, ideal weight, and mental weight [perceived weight if not trying to control weight]), body composition, job status (PT-AT or FT-AT), job setting (CU, HS, or NT), years of AT experience, exercise background, and alcohol use. We measured participants' height, weight, and body composition in compliance with American College of Sports Medicine (ACSM) standards.<sup>23</sup> Height was measured using a stadiometer (Shorr Productions LLC, Olney, MD) to the nearest 0.1 cm. Weight was measured, with minimal clothes, to the nearest 0.1 kg (model SC331S Body Composition Scale; Tanita Corp, Tokyo, Japan). Body fat percentage was obtained using dual-energy X-ray absorptiometry (Lunar Prodigy densitometer; GE Healthcare, Chicago, IL).

### Resting Metabolic Rate

Resting metabolic rate (RMR) was measured via indirect calorimetry (model Microlite MedGem; HealthTech, Inc, Golden, CO) to determine the participant's total calories used at rest. The MedGem has been clinically validated for assessing RMR.<sup>24</sup>

### Energy Intake

Energy intake was assessed and analyzed using online daily food logs (FoodProdigy Food Processor 8.0; ESHA Research, Salem, OR) for 7 consecutive days. Participants were briefed about portion sizes and given at-home examples for their logs. Food logs were assessed for total kilocalories (EI) and macronutrient intake (proteins, carbohydrates [CHOs], and fats). Using 7 consecutive days of logs minimizes daily bias.<sup>25</sup> The Dietary Reference Intakes (DRIs)<sup>26</sup> were used to determine whether individuals met recommendations for protein (10%–35% of total kilocalories), CHOs (45%–65% of total kilocalories), and fat (20%–35% of total kilocalories).

### The TDEE and Exercise Energy Expenditure

*Total daily energy expenditure* is the amount of energy required for essential life processes to occur; the energy

expended to digest, absorb, and convert food; and the energy expended during PA and recovery. An armband (SenseWear; BodyMedia, Pittsburgh, PA) with an accelerometer continuously monitored TDEE and exercise energy expenditure (EEE). The armband was initiated using the manufacturer's software and synchronized with the metabolic measurements system. Participant's sex, age, height, and weight were programmed to each armband. They were required to wear the armband approximately 23 h/d for 7 consecutive days. The SenseWear armband is valid for assessing energy expenditure in free-living conditions.<sup>27</sup> If participants were unable to wear the armband, they self-reported exercise and PA using FoodProdigy for 7 consecutive days. They recorded exercise duration, mode, and intensity, and we used the collected PA data to determine the appropriate metabolic equivalent for the exercise performed.<sup>28</sup> Exercise energy expenditure was estimated using the following equation:  $EEE = \text{duration (minutes)} \times 3.5 \times \text{weight (kilograms)}/200$ .<sup>29</sup>

### Energy Balance

Energy balance was defined as  $EB = EI - TDEE$ . Energy balance is described as negative, positive, or balanced; therefore, participants were categorized into 3 groups: (1) negative EB ( $EI < TDEE$ ), (2) positive EB ( $EI > TDEE$ ), and (3) balanced EB ( $EI = TDEE$ ).

### Eating Disorder Risk and Pathogenic Behavior

We assessed ED risk using the Eating Disorder Inventory-3 (EDI-3; PAR Inc, Lutz, FL), a self-report measure for identifying ED patterns and associated psychological constructs.<sup>30</sup> It consists of 91 items organized into scales: Drive for Thinness, Bulimia, Body Dissatisfaction, Low Self-Esteem, Personal Alienation, Interpersonal Insecurity, Interpersonal Alienation, Interoceptive Deficits, Emotional Dysregulation, Perfectionism, Asceticism, and Maturity Fears. The EDI-3 comprises 6 composites: ED-specific (ED Risk) and general integrative psychological constructs (Ineffectiveness, Interpersonal Problems, Affective Problems, Overcontrol, and General Psychological Maladjustment). It is valid in individuals aged 13 to 53 years for identifying DE patterns and has high reliability. The coefficient and median values for the ED Risk were  $r = 0.98$  and median = 0.95 and for General Psychological Maladjustment were  $r = 0.97$  and median = 0.93.<sup>30</sup> The EDI-3 Symptom Checklist identifies the associated symptoms and frequency of ED risk behaviors, such as binge eating, self-induced vomiting, exercise patterns, and use of laxatives, diet pills, and diuretics. To be considered at risk for an ED, participants must have at least 1 composite score rated as *typical clinical* or *elevated clinical*, meet the criteria for pathogenic behavior risk, or both.

### Procedures

Participants were recruited through a local AT listserv via email. Interested volunteers were sent a short survey to determine if they met the inclusion criteria, and then individual meetings were scheduled so that each person could review the study details and sign the consent forms. Participants underwent anthropometric and RMR measurements, scheduled a dual-energy X-ray absorptiometry scan,

and completed the EDI-3 and EDI-3 Symptom Checklist. They were given written and oral overviews of the weekly procedures, which included detailed instructions on use of the 7-day food and exercise logs and armband. Participants began self-reporting foods, fluids, and any planned and intentional exercise in the online log starting at the end of the information session and continued for 7 consecutive days. We emphasized the importance of continuing their normal PA and food and fluid consumption during the 7 days. After the 7 days, participants returned the armband and emailed the food and exercise logs to the researchers.

### Data Analysis

For all analyses, we used SPSS (version 26; IBM Corp, Armonk, NY) with an a priori  $\alpha$  of .05. To calculate power, we used G\*Power software (version 3.1.9.4; Franz Faul, Universität Kiel, Germany). Based on an  $\alpha$  of .05 and a large effect size (0.9), the power calculation indicated that 21 men and 21 women (42 participants total) were needed for an estimated power of 0.9. Descriptive statistics were conducted to examine demographic information (eg, height, weight, job status). Data for body mass index (BMI) were categorized using the ACSM's classification of disease risk based on BMI and the ACSM's body composition norms by sex and age.<sup>23</sup> Analyses of variance addressed differences between sexes (male, female) and among job statuses (PT-AT, FT-AT) and job settings (CU, HS, NT) with respect to all anthropometric measurements and energy needs (RMR, EI, TDEE, EEE, EB, macronutrients). We calculated frequencies and proportions with 95% CIs for categorical variables along with means and standard deviations for continuous variables. Chi-square analysis was conducted to investigate the relationship between sex and macronutrient recommendations met by the ATs (below, within, or above). Chi-square analyses also examined the proportions of participants classified as at risk for EB and ED or pathogenic behaviors.

## RESULTS

### Demographics and Anthropometric Measurements

We achieved appropriate statistical power: a total of 46 ATs completed this study, distributed equally between women and men and between PT-ATs and FT-ATs. However, power was insufficient to assess both sex and job status (male PT-ATs = 12, male FT-ATs = 11, female PT-ATs = 11, female FT-ATs = 12) and job setting (CU = 16, HS = 19, NT = 11). All physical and self-reported demographic and anthropometric measurements are shown in Table 1. Overall, 34.8% ( $n = 16$ ) of ATs were within the normal BMI range, 2.2% ( $n = 1$ ) were underweight, 44.4% ( $n = 20$ ) were overweight, and 20% ( $n = 9$ ) were obese. Regarding body fat recommendations, 43.5% ( $n = 20$ ) of ATs were within normal limits, 17.4% ( $n = 8$ ) displayed an elevated level, and 39.1% ( $n = 18$ ) were at a high level. Overall, 15.2% of ATs did not exercise, 23.9% exercised 1 to 2 times/wk; 32.6%, 3 to 4 times/wk; and 28.2%, >5 times/wk. Self-reported alcohol consumption indicated that 91.3% ( $n = 43$ ) drank alcohol, with the majority (37.2%,  $n = 16$ ) consuming alcohol at least 1 d/wk; 20.9% ( $n = 9$ ), 2 d/wk; 23.2% ( $n = 10$ ), 3 d/wk; 14.0% ( $n = 6$ ), 4 d/wk; and 4.7% ( $n = 2$ ), more than 4 d/wk.

**Table 1. Participants' Characteristics**

Characteristic	Athletic Trainers, Mean ± SD					P Value <sup>a</sup>
	All	Males (n = 23)		Females (n = 23)		
		Part Time	Full Time	Part Time	Full Time	
Age, y	29.0 ± 7.9	24.6 ± 3.0	34.19 ± 8.8	23.5 ± 0.68	33.9 ± 8.3	.93
Height, cm						
Self-reported	172.1 ± 10.5	182.2 ± 6.2	177.8 ± 8.1	164.8 ± 5.9	163.6 ± 6.6	<.001
Measured	171.8 ± 10.2	181.3 ± 6.2	177.7 ± 7.8	164.5 ± 6.1	163.7 ± 6.6	<.001
Mass, kg						
Self-reported	78.7 ± 16.4	91.7 ± 13.3	89.7 ± 10.2	59.2 ± 5.4	73.4 ± 9.2	<.001
Measured	77.4 ± 17.1	91.3 ± 14.2	84.9 ± 16.8	59.2 ± 5.9	73.3 ± 9.7	<.001
Highest	84.2 ± 18.7	98.5 ± 18.8	96.2 ± 9.1	62.7 ± 7.8	78.5 ± 9.3	<.001
Lowest	69.6 ± 13.6	82.4 ± 7.6	76.9 ± 11.5	54.9 ± 4.9	63.7 ± 8.5	<.001
Mental <sup>b</sup>	81.3 ± 18.3	96.0 ± 16.3	92.2 ± 11.0	59.5 ± 5.8	76.5 ± 10.5	<.001
Ideal	73.5 ± 13.9	88.3 ± 6.7	81.6 ± 8.0	57.9 ± 3.7	65.7 ± 7.7	<.001
Self-reported: ideal	5.17 ± 6.8	3.4 ± 8.2	8.1 ± 6.7	1.4 ± 3.6	7.7 ± 6.0	.63
Measured: ideal	3.9 ± 9.0	3.0 ± 9.4	3.4 ± 13.7	1.4 ± 3.6	7.6 ± 6.3	.61
Self-reported: mental	-2.9 ± 4.6	-4.3 ± 5.3	-2.5 ± 4.8	-0.3 ± 2.4	-3.1 ± 7.8	.22
Measured: mental	-3.9 ± 9.1	-4.7 ± 4.6	-7.2 ± 16.9	-0.3 ± 2.3	-3.2 ± 4.9	.13
Body mass index						
Self-reported	26.4 ± 4.3	27.7 ± 4.6	28.5 ± 3.8	21.8 ± 2.0	27.5 ± 3.3	.009
Measured	26.5 ± 4.4	27.9 ± 4.9	28.4 ± 3.3	21.9 ± 2.4	27.5 ± 3.5	.009
Body fat, % <sup>c</sup>	29.2 ± 8.5	23.9 ± 8.7	27.8 ± 8.6	29.6 ± 5.9	35.4 ± 7.0	.005

<sup>a</sup> P values represent the comparisons of anthropometric measures and sex.

<sup>b</sup> *Mental weight* indicates the perceived weight if one did not consciously try to control weight.

<sup>c</sup> Body fat percentages were obtained using dual-energy X-ray absorptiometry (Lunar Prodigy densitometer; GE Healthcare).

### Energy Assessment

Over 80% of ATs exhibited negative EB. We found no differences within sex–job status and sex–job setting for EB. However, differences were present in female ATs' EB with regard to job status ( $\chi^2_{1,46} = 4.44, P = .035$ ), with 100% (n = 11) of female PT-ATs demonstrating negative EB. Comparatively, 34.8% (n = 8) of female FT-ATs displayed negative EB and 17.4% (n = 4), positive EB. Among males, 43.5% (n = 10) of PT-ATs and 39.1% (n = 9) of FT-ATs showed negative EB, whereas 8.7% (n = 2) of PT-ATs and 8.7% (n = 2) of FT-ATs had positive EB. Between-sexes differences occurred for RMR ( $F_{1,45} = 16.48, P = .001$ ), EI ( $F_{1,45} = 12.01, P = .001$ ), TDEE ( $F_{1,45} = 40.36, P < .001$ ), and EEE ( $F_{1,38} = 5.353, P = .026$ ). For sex, job status, or job setting, no difference was evident for RMR, EI, TDEE, EB, EEE, protein, CHO, or fat (Table 2). Macronutrient intake differed by sex for CHO ( $F_{1,45} = 6.32, P = .016$ ), protein ( $F_{1,45} = 22.5, P < .001$ ), and fat ( $F_{1,45} = 5.21, P < .027$ ), with men reporting more grams consumed. No other differences were found for energy needs or macronutrients with respect to job status or job setting (Tables 2 and 3).

### The ED Risk and Pathogenetic Behaviors

Overall, 84.8% (n = 39) of ATs presented with ED risk. No difference was evident for sex–job status or sex–job setting. The ED risk for men was 82.6% (n = 19 of 23); women, 87.0% (n = 20 of 23); FT-ATs, 91.3% (n = 21 of 23); PT-ATs, 78.3% (n = 18 of 23); CU ATs, 81.3% (n = 13 of 16); HS ATs, 84.7% (n = 18 of 19); and NT ATs, 72.7% (n = 8 of 11). A total of 26.1% (n = 12) engaged in at least 1 pathogenetic behavior; 50% (n = 23) in 2 such behaviors; and 10.8% (n = 5) in >2 such behaviors. Several ATs were categorized in the *typical clinical* or *elevated clinical*

ranges for subscales (Table 4). Dieting behaviors were exhibited by 78.3% (n = 36). No significant relationships were found between sex and dieting ( $\chi^2_{1,46} = 0.511, P = .475$ ). Dieting and job status were associated ( $\chi^2_{1,46} = 4.6, P = .032$ ), with the highest risk in FT-ATs (45.7%, n = 21) compared with PT-ATs (32.6%, n = 15). For women, the dieting risk was highest in FT-ATs (52.2%, n = 12) versus PT-ATs (30.4%, n = 7;  $\chi^2_{1,46} = 5.28, P = .022$ ). No relationship was present between the percentage of time ATs exercised to lose weight and sex ( $\chi^2_{1,46} = 0.517, P = .475$ ). However, to lose weight, 21.7% (n = 10) exercised more than 50% of the time; 56.6% (n = 26), less than 25% to 50% of the time; and 21.7%, never. No differences were evident for pathogenetic behaviors with respect to sex (Table 5) or job status. All definitions for the ED and pathogenetic risk sections are provided in Table 6.

### DISCUSSION

In this study, we extended the literature<sup>6,7</sup> by focusing on ATs' EB, macronutrient needs, and ED risk and pathogenetic behaviors. In this free-living environment (real-time) investigation, wherein we estimated TDEE and EI, we captured ATs' work environment during 1 week. The ACSM<sup>23</sup> recommended that healthy adults engage in moderate-intensity aerobic activity for  $\geq 30$  min/d, 5 d/wk or vigorous-intensity aerobic activity for  $\geq 20$  min/d, 3 d/wk. Regardless of sex, job status, or job setting, approximately 60% of ATs met the ACSM's minimum PA recommendations,<sup>23</sup> which was a higher value than self-reported PA data from previous research.<sup>6,7</sup> Athletic trainers' long work hours can explain why they do not exercise or engage in more PA. Although a large portion of our ATs presented as moderately active, more than half were overweight or obese based on both BMI and body fat

**Table 2. Energy Needs Assessment**

Variable	Athletic Trainers, Mean ± SD						P Value
	Males (n = 23)			Females (n = 23)			
	All	Part Time <sup>a</sup>	Full Time	All	Part Time <sup>a</sup>	Full Time	
Energy needs, kcal							
Resting metabolic rate	1933.0 ± 359.8	2142.5 ± 334.0	1704.5 ± 228.2	1534.4 ± 304.0	1468.2 ± 306.3	1595.0 ± 301.9	<.001
Energy intake	2223.1 ± 469.4	2239.4 ± 2205.4	2205.4 ± 635.4	1698.3 ± 554.1	1462.0 ± 387.7	1914.9 ± 608.5	.001
Total daily energy expenditure	2737.7 ± 260.1	2833.6 ± 188.5	2633.1 ± 294.4	2353.9 ± 127.6	2305.5 ± 94.5	2398.5 ± 141.1	<.001
Energy balance	-455.1 ± 491.5	-480.2 ± 384.5	-427.7 ± 605.9	-655.6 ± 535.5	-843.3 ± 447.2	-483.6 ± 569.3	.19
Exercise energy expenditure	584.2 ± 284.7	492.6 ± 146.6	686.1 ± 368.9	384.6 ± 254.0	361.6 ± 127.7	407.5 ± 344.7	.03
Macronutrients, g							
Protein	107.2 ± 28.9	117.4 ± 31.6	96.0 ± 21.7	70.7 ± 22.9	64.4 ± 21.3	76.4 ± 23.7	<.001
Carbohydrate	257.5 ± 86.3	258.8 ± 75.9	256.2 ± 10.2	201.2 ± 64.0	183.2 ± 53.5	217.6 ± 70.6	.02
Fat	81.7 ± 22.6	82.9 ± 17.5	80.4 ± 28.0	66.1 ± 23.8	57.0 ± 17.1	74.4 ± 26.6	.03
	College/University	High School	Nontraditional	College/University	High School	Nontraditional	
Energy needs, kcal							
Resting metabolic rate	1922.2 ± 322.2	1861.8 ± 410.1	2226.7 ± 101.2	1638.6 ± 327.2	1562.5 ± 304.7	1415.0 ± 278.9	.58
Energy intake	2317.7 ± 402.6	2145.6 ± 581.1	2223.6 ± 120.1	1982.3 ± 516.3	1661.3 ± 634.5	1486.9 ± 447.7	.55
Total daily energy expenditure	2637.1 ± 334.2	2772.9 ± 198.9	2909.9 ± 52.7	2370.2 ± 128.1	2408.8 ± 123.8	2284.8 ± 112.3	.28
Energy balance	-319.4 ± 353.8	-593.1 ± 558.1	-356.0 ± 629.5	-387.9 ± 593.7	-747.6 ± 568.6	-797.9 ± 474.9	.14
Exercise energy expenditure	546.1 ± 122.1	603.9 ± 381.5	618.9 ± 208.7	364.0 ± 546.1	460.6 ± 452.5	342.9 ± 90.7	.41
Macronutrients, g							
Protein	109.0 ± 16.0	99.6 ± 30.6	297.1 ± 85.9	78.7 ± 16.5	68.8 ± 25.8	65.8 ± 25.5	.55
Carbohydrate	257.9 ± 57.2	246.4 ± 108.1	297.1 ± 85.9	236.6 ± 62.2	188.3 ± 63.5	183.1 ± 60.9	.49
Fat	87.1 ± 25.9	76.5 ± 21.8	84.4 ± 15.9	77.0 ± 22.8	63.4 ± 28.6	59.2 ± 18.2	.17

<sup>a</sup> No differences occurred between part-time and full-time athletic trainers for any variables.

percentage. This indicates the importance of examining diet, PA, and psychosocial constructs related to eating behaviors to better understand why a large portion of ATs were overweight or obese.

Consistent with earlier literature,<sup>31</sup> our male participants displayed higher RMR, EI, TDEE, and EEE. However, no relationship was demonstrated between sex and EB, which

may be attributed to females' efficiency in conserving energy-storing fat and having lower RMRs.<sup>31</sup> When we examined both men and women, EI was slightly higher than RMR. Yet their total daily EI was less than their TDEE, leading to most ATs' having negative EB. It is alarming that the majority of ATs had negative EB, especially because occupational activity has declined over the last 5

**Table 3. Distribution of Micronutrients**

Macronutrient Ingestion per Recommendation	Athletic Trainers					
	All		Males (n = 23)		Females (n = 23)	
	% (No.)	P Value <sup>a</sup>	% (No.)	P Value <sup>a</sup>	% (No.)	P Value <sup>a</sup>
Protein		—		—		—
Below	0 (0)		0 (0)		0 (0)	
Within	100 (46)		100 (23)		100 (23)	
Above	0 (0)		0 (0)		0 (0)	
Carbohydrate		.53		.57		.22
Below	39.1 (18)		47.8 (11)		30.4 (7)	
Within	58.7 (27)		47.8 (11)		69.6 (16)	
Above	2.2 (1)		4.3 (1)		0 (0)	
Fat		.77		.11		.29
Below	0 (0)		0 (0)		0 (0)	
Within	58.7 (27)		65.2 (15)		52.2 (12)	
Above	41.3 (19)		34.8 (8)		47.8 (11)	

<sup>a</sup> P values represent comparisons of Dietary Reference Intake recommendations and sex. Percentages and sample sizes are presented for all athletic trainers and within male and female athletic trainers.

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**Table 4. Eating Disorder Characteristics**

Scale	Athletic Trainers							
	Males (n = 23)				Females (n = 23)			
	Raw Score, Mean ± SD	% (No.)			Raw Score, Mean ± SD	% (No.)		
Low Clinical		Typical Clinical	Elevated Typical	Low Clinical		Typical Clinical	Elevated Clinical	
<b>Eating Disorders Risk Scale</b>								
Drive for Thinness	4.9 ± 3.2	50.0 (23)	0 (0)	0 (0)	6.1 ± 4.1	47.8 (22)	0 (0)	2.2 (1)
Bulimia	1.5 ± 2.1	45.7 (21)	4.3 (2)	0 (0)	2.2 ± 4.1	45.7 (21)	2.2 (1)	2.2 (1)
Body Dissatisfaction	10.2 ± 7.5	45.7 (21)	4.3 (2)	0 (0)	13.3 ± 9.2	41.3 (19)	8.7 (4)	0 (0)
<b>Psychological scale</b>								
Low Self-Esteem	1.6 ± 2.4	47.8 (22)	2.2 (1)	0 (0)	1.9 ± 2.6	47.8 (22)	2.2 (1)	0 (0)
Personal Alienation	2.5 ± 2.3	47.8 (22)	2.2 (1)	0 (0)	2.9 ± 2.5	50.0 (23)	0 (0)	0 (0)
Interpersonal Insecurity	7.1 ± 6.0	26.1 (12)	15.2 (7)	8.7 (4)	5.4 ± 4.7	32.6 (15)	15.2 (7)	2.2 (1)
Interpersonal Alienation	5.0 ± 3.6	32.6 (15)	15.2 (7)	2.2 (1)	4.4 ± 3.4	32.6 (15)	17.4 (8)	0 (0)
Interceptive Deficits	3.2 ± 3.8	45.7 (21)	4.3 (2)	0 (0)	2.7 ± 3.9	47.8 (22)	2.2 (1)	0 (0)
Emotional Dysregulation	2.8 ± 3.1	34.8 (16)	13.0 (6)	2.2 (1)	2.3 ± 2.3	39.1 (18)	10.9 (5)	0 (0)
Perfectionism	13.7 ± 4.8	13.0 (0)	23.9 (11)	13.0 (6)	12.9 ± 4.8	13.0 (6)	28.3 (13)	8.7 (4)
Asceticism	3.7 ± 2.9	45.7 (21)	2.2 (1)	2.2 (1)	4.0 ± 2.4	45.7 (21)	4.3 (2)	0 (0)
Maturity Fears	5.0 ± 3.6	32.6 (15)	15.2 (7)	2.2 (1)	5.6 ± 4.5	28.3 (13)	17.4 (8)	4.3 (2)
<b>Composite</b>								
Eating Disorder Risk	96.3 ± 12.2	50.0 (23)	0 (0)	0 (0)	101.5 ± 20.1	47.8 (22)	2.2 (1)	0 (0)
Ineffectiveness	63.3 ± 7.1	47.8 (22)	2.2 (1)	0 (0)	64.3 ± 7.6	50.0 (23)	0 (0)	0 (0)
Interpersonal Problems	83.0 ± 15.2	37.0 (17)	8.7 (4)	4.3 (2)	79.2 ± 12.5	34.8 (16)	15.2 (7)	0 (0)
Affective Problems	73.5 ± 9.1	45.7 (21)	4.3 (2)	0 (0)	72.0 ± 7.1	47.8 (22)	2.2 (1)	0 (0)
Overcontrol	83.0 ± 11.4	34.8 (16)	13.0 (6)	2.2 (1)	83.3 ± 8.8	34.8 (16)	15.2 (7)	0 (0)
General Psychological Maladjustment	344.5 ± 35.6	45.7 (21)	4.3 (2)	0 (0)	341.2 ± 30.1	50 (0)	0 (0)	0 (0)

decades while EI has increased.<sup>32</sup> Negative EB can lead to a multitude of adverse health outcomes, such as a decline in metabolism, poor physical performance, decreased thyroid hormones, and reduced concentration.<sup>33</sup> This illuminates a possibility that ATs' occupational demands could be higher than those of the general population, but future authors need to explore the occupation's energy expenditure demands. The high number of ATs who reported dieting may suggest that they use pathogenic behaviors to lose weight. It may seem counterintuitive that a population can be in negative EB, suggesting weight loss, but not meet

ACSM or general body fat percentage guidelines.<sup>23</sup> This may be due to the metabolic state: because the body does not receive enough energy to sustain itself, it will begin to burn glycogen stores. Glycogen stores are the most readily available nutrient the body can use for energy, and if the body is in an extended state of needing this glycogen to function, decreased muscle mass and increased body fat percentage may result.

No relationships were noted between EB and sex, job status, or job setting. Despite these findings, differences were present between women of various job statuses. All of

**Table 5. Pathogenic Behaviors at Risk for Associated Behavior**

Behavior	Athletic Trainers							
	Males (n = 23)				Females (n = 23)			
	% (No.)				% (No.)			
	All	Part Time	Full Time	P Value <sup>a</sup>	All	Part Time	Full Time	P Value <sup>a</sup>
<b>Pathogenic</b>								
Dieting	73.9 (17)	34.8 (8)	39.1 (9)	.37	82.6 (19)	30.4 (7)	52.2 (12)	.04
Binge eating	13.0 (3)	4.3 (1)	8.7 (2)	.48	4.3 (1)	0 (0)	4.3 (1)	.33
Purging	0 (0)	0 (0)	0 (0)	NA	0 (0)	0 (0)	0 (0)	NA
Laxatives	8.7 (2)	4.3 (1)	4.3 (1)	.95	8.7 (2)	4.3 (1)	1.3 (1)	.95
Diet pills	17.4 (4)	13.0 (3)	4.3 (1)	.32	13.0 (3)	4.3 (1)	8.7 (2)	.59
Diuretics	0 (0)	0 (0)	0 (0)	NA	0 (0)	0 (0)	0 (0)	NA
<b>Exercise to control weight, % of time</b>								
0	30.4 (7)	17.4 (4)	13.0 (23)	.13	13.0 (3)	8.7 (2)	4.3 (1)	
<25	39.1 (9)	21.7 (5)	17.4 (4)		17.4 (4)	13.0 (3)	4.3 (1)	
25–50	13.0 (3)	13.0 (3)	0.0 (0)		43.5 (10)	17.4 (4)	26.1 (6)	
>75	8.7 (2)	0.0 (0)	8.7 (2)		26.1 (6)	8.7 (2)	17.4 (4)	
100	8.7 (2)	0.0 (0)	8.7 (2)		0.0 (0)	0.0 (0)	0.0 (0)	

Abbreviation: NA, not applicable.

<sup>a</sup> P values represent comparisons of pathogenic behaviors measures and sex. No significant differences were found across job status.

**Table 6. Eating Disorder Inventory-3 Scale Terminology Continued on Next Page**

Scale	Brief Description of Assessment	Example
<b>Eating disorder risk scales<sup>a</sup></b>		
Drive for Thinness	Preoccupation with restrictive dieting, concern about dieting, and fear of weight gain	Terrified about gaining weight and preoccupied with the desire to be thin; spends an inordinate amount of time thinking about dieting
Bulimia	Tendency to think about, and engage in, bouts of uncontrollable overeating and then some form of purging	Binge eating followed by purging episodes (ie, self-induced vomiting, excessive exercise)
Body Dissatisfaction	Discontent with the overall shape and size of physical appearance of the body	Concerns about overall shape and size of body (ie, stomach, hips, thighs, buttocks)
<b>Psychological scales<sup>a</sup></b>		
Low Self-Esteem	Negative self-evaluation with questions tapping into feelings of insecurity, inadequacy, ineffectiveness, and lack of personal worth	Persistent negative self-perception about inability to achieve personal standards
Personal Alienation	Overlaps with low self-esteem but via a broader domain of feelings pertaining to pervasive sense of emotional emptiness and aloneness and poor sense of self-understanding	Withdrawal or isolation from one's environment or other people and often rejection of loved ones or society
Interpersonal Insecurity	Discomfort, apprehension, and reticence in social situations	Feelings of not being loved, protected, trusted, supported, or cared for by others
Interpersonal Alienation	Disappointment, distance, estrangement, and a lack of trust in relationships	Strong tendency to feel trapped in relationships and failure to experience understanding and love from others
Interoceptive Deficits	Confusion related to accurately recognizing and responding to emotional states	Intense fear and mistrust of certain emotions when they are too strong or experienced as out of control; emotions are evaluated to determine if they are "valid," "appropriate," "justified," or "legitimate," rather than simply accepted
Emotional Dysregulation	Tendency toward mood instability, impulsivity, recklessness, anger, and self-destructiveness	Poor impulse regulation, mood intolerance, and self-harm; may be associated with substance abuse involving alcohol, drugs, or both
Perfectionism	Extent to which a person places a premium on achieving goals and the highest possible standards for personal achievement	Need to be the best at doing things, achieve goals, and avoid disappointing others; failure to achieve goals results in self-criticism.
Asceticism	Tendency to seek virtue through pursuit of spiritual ideals, such as self-discipline, self-denial, self-sacrifice, and control of bodily urges	Strong tendency to place positive connotations on achieving virtue through self-restraint; considerable guilt and shame surrounding the experience of pleasure
Maturity Fears	Desire to return to the security of childhood	Weight loss becomes a mechanism for avoiding adolescent turmoil, conflicts, and developmental expectations because it results in a return to prepubertal appearance and hormonal status.
<b>Composites for Eating Disorder Inventory-3</b>		
Eating Disorder Risk	Global measure of eating and weight concerns; Drive for Thinness, Bulimia, and Body Dissatisfaction scales	Eating and weight concerns: fear of weight gain, desire to be thinner, binge-eating tendencies, and body dissatisfaction
Ineffectiveness	Deficit in self-concept that involves extreme and pervasive feelings of emotional emptiness and aloneness and a poor sense of self-understanding; Low Self-Esteem and Personal Alienation scales	Low self-evaluation and sense of emotional emptiness that reflects a basic deficit in personal identity
Interpersonal Problems	Experience that social relationships are tense, insecure, disappointing, and generally of poor quality; Interpersonal Insecurity and Interpersonal Alienation scales	Social self-doubt and insecurity, overall distrust in relationships
Affective Problems	Ability to correctly identify, understand, or respond to emotional states; Interoceptive Deficits and Emotional Dysregulation scales	Problem identifying emotions or responding with fear, confusion, or mistrust; mood instability, intolerance, impulsivity, recklessness, anger, self-destruction, and the misuse of substances to control mood
Overcontrol	Premium placed on achieving a high standard of personal achievement and belief that engaging in self-denial, self-sacrifice, and suffering is virtuous; Perfectionism and Asceticism scales	One believes there is shame around personal weaknesses and a wish to rigidly control bodily urges.

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**Table 6. Continued From Previous Page**

Scale	Brief Description of Assessment	Example
General Psychological Maladjustment	All 9 psychological scales	High level of distress across a range of psychological constructs, including low self-esteem, personal alienation, interpersonal insecurity, interpersonal alienation, interceptive deficits, emotional dysregulation, perfectionism, asceticism, and maturity fears
Pathogenic behaviors <sup>b</sup>		
Binge eating	Consuming large quantities of food very quickly, even when not physically hungry, and to the point of being uncomfortably full	Eating a larger than normal amount of food over a short period of time and lacking a sense of control
Dieting	Restricting oneself to small amounts or special kinds of food to lose weight	Paleo diet, vegan diet, South Beach Diet, Zone Diet, keto diet, Mediterranean diet, raw food diet, Atkins Diet, intermittent fasting, etc
Diet pills/drugs	Using diet pills (appetite suppressants or thermogenics) or thyroid medication in an attempt to control weight	Keto pills, garcinia cambogia extract, Hydroxycut, Orlistat, glucomannan, Meratrim, conjugated linoleic acid, etc
Diuretics	Using diuretics to facilitate the body's removal of excess fluid	Thiazide diuretics, loop diuretics, potassium-sparing diuretics, water pills, <i>Nigella sativa</i> , hibiscus, alcohol, caffeine
Laxatives	Using laxatives to aid the body in removing excess water through stool excretion	Detoxification and colon cleanse, Miralax, Metamucil, Colace, Senokot, PediaLax, etc
Purging	Ridding the body of food or calories (or both) consumed to prevent weight gain or to lose weight	Self-induced vomiting, excessive exercise, fasting

<sup>a</sup> Eating disorder risk scales and psychological scales were assessed using the Eating Disorder Inventory-3 (PAR, Inc).<sup>30</sup>

<sup>b</sup> Pathogenic behaviors were assessed using the Eating Disorder Inventory-3 Symptom Checklist.<sup>30</sup>

the female PT-ATs reported negative EB, compared with 34.8% of female FT-ATs, and EI for female PT-ATs was less than for female FT-ATs. Female PT-ATs may experience strain on their dietary habits and exercise profile due to financial stress and work-life balance with academic responsibilities and other duties deemed necessary by their graduate assistant positions.<sup>5</sup> Athletic trainers with negative EB are similar to other health care professionals and shift workers who do not balance their PA and diet, among whom more than half the population is overweight or obese.<sup>3,10,34</sup> Shift work is associated with increased BMI and has demonstrated a possible clash with diurnal dietary and exercise behaviors.<sup>34</sup> Athletic trainers who work nontraditional hours may reduce meal frequency but increase snacking throughout their workday or late at night.

When examining macronutrient profiles, we observed that the CHO consumption of approximately 40% of ATs was below the DRI recommendations. Despite low-carbohydrate fad-diet trends, CHOs are the body's primary fuel source and a necessary component of an individual's macronutrient profile. All ATs were within the DRI recommendation for protein, suggesting they had appropriate knowledge of their macronutrient requirements. Most ATs were within the DRI recommendations for fat consumption; however, the consumption of more than a third exceeded the recommendation. Overall, the consumption of the majority of ATs was within the DRI recommendations for all 3 macronutrients, which is consistent with the previous literature<sup>8</sup> that showed ATs had appropriate nutrition knowledge.

### Eating Disorder Risk and Pathogenic Behaviors

To better understand eating behaviors, we must also assess comorbid psychosocial constructs and pathogenic

behaviors. The ED risk in ATs was attributed primarily to comorbid psychosocial constructs, the use of pathogenic behaviors, or both. We applied a multidimensional approach to assess traditional and comorbid psychosocial components related to EDs. This approach is meaningful for those with EDs as well as those with subclinical variants, which was important in our study because many ATs did not primarily display traditional ED psychological risks. Athletic trainers have a duty to optimize health and wellness for their patient populations; still, their high ED risk does not portray good stewardship of personal health and wellness. Although males are at risk for ED and are commonly underdiagnosed, undertreated, and misunderstood,<sup>35</sup> the literature established females as at higher risk,<sup>36</sup> and we hypothesized a relationship would exist between sex and ED risk, with female ATs having increased risk. Contrary to our hypothesis, our results suggest that men and women were at similar risk for EDs.

Most ATs in our study did not experience the traditional ED risks (eg, drive for thinness, body image dissatisfaction, bulimia), with regard to comorbid psychosocial risks, yet interpersonal insecurity, interpersonal alienation, emotional dysregulation, perfectionism, and maturity fears were prevalent in ATs. Despite the primary contributions of these other factors to the increased ED risk, a minimal risk for bulimia and body dissatisfaction was also demonstrated. The Interpersonal Insecurity scale assesses discomfort, apprehension, and silence in social situations; expressing personal thoughts and feelings to others; and the tendency to withdraw and isolate from others.<sup>30</sup> Typically, people worry about interpersonal rejection or hurt. This hurt is caused not only by social rejection or exclusion but by lack of support, trust, or protection.<sup>37</sup> For ATs, this may be due to several factors: (1) not feeling part of a team; (2)

difficulty gaining trust from patients, peers, coaches, and other health care providers; and (3) frequently educating people on the AT's role.

The Interpersonal Alienation scale assesses disappointment, distance, estrangement, and a lack of trust in relationships or among a group of people in a work environment, implying a strong tendency to feel trapped in relationships.<sup>30</sup> Depending on the job setting and medical model under which ATs provide services, they may have a difficult time establishing themselves in an environment where trust is lacking and medical oversight is at the discretion of the athletic director or coach. Athletic trainers may then feel underappreciated, not valued, and emotionally exhausted.<sup>1,5</sup> These behaviors may lead to emotional dysregulation, which may produce mood instability, impulsivity, recklessness, anger, and self-destructiveness.<sup>30</sup> An internal or external event might provoke an experience that triggers an emotional and physiological response (eg, increased heart rate), followed by risky behavior (eg, drugs, alcohol, avoidance, physical action). In our study, a significant number of ATs consumed alcohol on a regular basis, which may, in part, be a reactive response to their emotional dysregulation.

Typical and elevated clinical Perfectionism scores are reflected when much importance is placed on achieving the highest possible standards, but there is a subsequent failure to meet these standards, coupled with self-criticism.<sup>30</sup> Considering that ATs are historically socialized into the profession by athletic participation, it is reasonable to assume that perfectionism is a by-product of their athletic careers.<sup>7</sup> The Maturity Fears scale represents the desire to return to the security of childhood; higher scores are associated with a strong preference to avoid developmental demands and are seen in those trying to return to the fewer demands of childhood or adolescence.<sup>30</sup> Maturity fears in almost two-thirds of ATs in our study can be linked to their desire for weight loss and the finding in both sexes of a negative value for mental weight (ie, perceived weight if they did not try to control their weight). A negative value signified that ATs believed they would weigh more if they did not try to control their weight.

When assessing pathogenic behaviors, we identified that the men engaged in binge eating more frequently than the women, correlating with previous research.<sup>38</sup> A desire to achieve a lower weight was observed in the significant number of dieting ATs, which is concerning given that the majority were in negative EB. A large portion of both women and men associated exercise with weight control rather than health and wellness. Along with their exercise habits, this factor may also be associated with the overall high negative EB prevalence. Athletic trainers also used diet pills to control their weight, which can lead to adverse health outcomes (eg, increased heart rate, high blood pressure, kidney problems, liver damage).<sup>39</sup>

### Limitations

Although our results revealed EB concerns and increased ED risk for ATs, the following limitations should be recognized. We assumed that all self-reported information and questionnaires were completed entirely with accurate and honest answers. This possible limitation is especially relevant when exploring food-log validity, as respondents

can adjust the log to fit social norms. Furthermore, diet hypersensitivity may occur during the 7-day reporting period because of the delicate nature of the ED/DE risk. Our sample consisted of ATs working in the southeastern United States; energy-need profiles and ED risk may vary by geographic region and should be examined. Future researchers should also explore the number of hours worked and PA levels throughout the duration of work.

### CONCLUSIONS

Health care professionals have a responsibility to maintain their own health and wellness. In this investigation, regardless of job status and setting, most ATs presented with negative EB and a substantial ED risk. Their ED risk was not revealed in terms of traditional factors (eg, body image dissatisfaction, bulimia) but by the high prevalence of comorbid psychosocial constructs and pathogenic behaviors. Combined, these may have influenced behaviors that reflected poorly on diet and exercise, leading to negative EB. The long-term consequences for physical and mental health should raise concerns for ATs' longevity in the profession, burnout, and a decline in the workforce, as well as their ability to be good stewards of health and wellness. Medical conditions associated with negative EB and additional psychosocial constructs related to diet may be linked with AT role strain and burnout. The American Medical Association designed prevention and intervention wellness programs for physicians to improve health and wellness, job satisfaction, burnout, and enhance the quality of patient care. The athletic training profession should consider implementing similar policy and wellness programs for ATs.

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