A Study to Determine if University Athletic Teams in Desert Environments Experience Risky Diet-related Behaviours

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Abstract

Training and competing in desert environments may exacerbate concerns related to disordered eating, supplement use, and hydration in some student athlete populations. A survey administered equitably to both genders solicited self-reported responses from members of 18 different teams over four years from a southwestern United States university athletic program. More than 1,700 athletes responded to 42 items on the questionnaire. Teams, not individual student athletes, were the units of measure for statistical analyses. Initial analysis of results indicated that there were no overt concerns regarding dietary behaviors due to training and competing in the desert environment. Further analysis subjected the team responses to principle component factor analysis and determined the construct validity using Varimax rotation with Kaiser normalization. Six factors were identified which accounted for 93% of total variance associated with reported risky dietary related behaviors among athletic teams. Specifically, the factors contributing to dietary related behavior total variance were; 1) weight loss and exercise issues and practices -47.15%, 2) self-image - 26.00%, 3) hydration - 10.92%, 4) supplement use - 3.85%, 5) disordered eating - 3.70%, and 6) hormonal issues - 1.71%. University athletic programs should use routine assessment of dietary related behaviours, including hydration, to help identify team members practicing risky dietary related behaviours.

Background

University athletes in extreme environments should be attentive to dietary issues. Similar to all entering university freshmen, university athletes experience major lifestyle changes in dietary choices and habits with little or no period of adaptation. It is well documented that entering college freshmen often experience a noticeable increase in body weight associated with the changes in lifestyle they encounter (Levitsky, Halbmaier, & Mrdjenovic, 2004; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). Educators and coaches have identified numerous factors thought to be associated with these changes and the performance of their athletic team members. Additionally, university athletes, many of whom are dependent on financial assistance or scholarships are subject to the pressures of maintaining academic and athletic eligibility. For some maintaining their team status is dependent upon body weight, body composition, and performance (Bayios, Bergeles, Apostolidis, Noutsos, & Koskolou, 2006; Drinkwater, Pyne, & McKenna, 2008; Malousaris, Bergeles, Barzouka, Bayios, Nassis, & Koskolou, 2008). These pressures have been thought to encourage university athletes to use ergogenic aids and seek unprofessional dietary advice. A previous study has also shown that although university athletes may have knowledge of proper hydration their scores on hydration attitudes and behaviors reflected that they did not always implement the best practices (Nichols, Jonnalagadda, Rosenbloom, & Trinkaus, 2005). No studies have reported the additive effects of desert environments on dietary related issues typically encountered by student athletes; disordered eating, dietary supplements, and hypohydration. Furthermore, questionnaires to assess these considerations for student athletes training and competing in desert environments have not been

developed as acertained through a review of the literature and after consultation with affiliated athletic association members.

Sports associated with a higher risk of eating disorders have been those that emphasize body definition (or weight) or utilize judges rather than referees in evaluating performance outcomes. Levels of competition have been associated with increased risk of developing disordered eating, with more elite athletes being at greater risk (Johnson, Powers, & Dick, 1999). Male and female university athletes have been reported to be at higher risk of having disordered eating compared to non-athletes (Johnson, Powers, & Dick, 1999; Sundgot-Borgen, & Torstveit, 2004) particularly when a sport categorises players by body weight, as in wrestling and rowing (Sundgot-Borgen, & Torstveit, 2004; Thiel, Gottfried, & Hesse, 1993).

Athletes, because of their desire for enhanced performance, are major consumers of dietary supplements when compared to the general public (Krumbach, Ellis, & Driskell, 1999; Schwenk, & Costley, 2002; Sobal, & Marquart, 1994). According to a position paper by the American Dietetic Association (Position of the American Dietetic Association, 2000) "in general, no vitamin and mineral supplements should be required if an athlete is consuming adequate energy from a variety of foods to maintain body weight. Moreover, "athletes should be counselled regarding the use of ergogenic aids, which should be used with caution and only after careful evaluation of the product for safety, efficacy, potency and legality." Nutrition does play a role in athlete performance, but dietary supplements are not generally needed by athletes and in many instances may contribute to negative outcomes experienced by athletes. Habitual intakes of multiple substances add to the complexity and physiological stresses of extreme training regimes and environments (Kraemer, Ratamess, Volek, Häkkinen, Rubin, French, Gómez, McGuigan, Scheett, Newton, Spiering, Izquierdo, & Dioguardi, 2006).

The Food and Nutrition Board of the Institute of Medicine (IOM) recently established new Dietary Reference Intakes for water for healthy people (Food and Nutrition Board, 2004). Most individuals are able to accomplish daily water balance "with precision despite highly variable water needs and intakes and exposure to variable stressors on hydration status" (Food and Nutrition Board, 2004). However, the greatest challenges to body water homeostasis are presented with exercise and exercise-heat stress (Sawka, Cheuvront, & Carter, 2005). Reports have documented that in moderate climates body water needs may increase 1.2-1.4 L/d paralleling sweat volume losses and replacement needs. In warmer environments these increases would likely be exacerbated, dependent upon exercise intensity and duration.

Achieving adequate hydration is a constant challenge for athletes, especially in desert climates. High environmental temperatures have been hypothesized to suppress appetite, thus increasing athletes' risk of not obtaining sufficient carbohydrates to restore muscle glycogen stores between workouts. Athletes today typically train to some degree throughout the year, regardless of their competition schedules, increasing potential exposure time to high temperatures during competition or training. Many elite and collegiate athletes have been educated about the benefits of replenishing fluids lost during exercise (National Collegiate Athletic Association, 2005). However, not all athletes are able to replenish fluid losses when training in extreme environmental temperatures (Shirreffs, Aragon-Vargas, Chamorro, Maughan, Serratosa, & Zachwiej, 2005). The human body does not successfully acclimatize to all environmental stresses (Armstrong, 1988; Armstrong, Casa, Millard-Stafford, Moran, Pyne, Roberts, 2007). Moving athletes to unfamiliar hot and arid locations requires time and training for adequate acclimatization. Likewise, university athletes in the desert are likely at increased risk of heat related compromised performance and heat injury compared to other athletes. Many student athletes during their initial months of training in a desert climate are not physiologically acclimatized, if having relocated from more moderate climates. Thus, a lack of acclimatization puts collegiate athletes exercising under hot conditions at additional risk and compromised performance.

In summary, university athletes in desert environments may be at a relatively higher risk of developing undesirable dietary behaviours leading to related unhealthy conditions and compromised performance than athletes in more temperate environments. Consequently, their

dietary behaviours should be evaluated on a regular basis and interventions designed to specifically address the problem areas identified (Position of the American Dietetic Association, 2000). The purpose of this study was twofold; 1) to identify risky dietary behaviors by assessing student athletes' responses to the Preparticipation Physical Evaluation and medical history questionnaires required of all university athletes in Division I programs and 2) to identify components of a survey instrument best suited to assess dietary behaviors of concern to student athletes in desert environments.

Methods

Study Design and Selection of Subjects

Students enrolled in competitive athletic programs over a four year period participated in this cross-sectional study designed to survey dietary behaviours. All members of 18 different sports teams at a NCAA Division I Mountain West Conference university located in the south western part of the U.S. were included in the sample. All participating athletes completed a questionnaire administered by staff members in the Department of Athletic Training at the beginning of the school year before the competitive seasons began. All data from student athletes eligible for the study were coded and analyzed by year and team thus making the unit of measure the team response, not individual student athletes' responses. The Institutional Review Board at the University of Nevada Las Vegas approved this study for implementation and completion.

Construction of Questionnaire

NCAA regulations require all universities to complete a medical history questionnaire as part of their Preparticipation Physical Evaluation. The questions included in the medical history questionnaire to assess risky health behaviors were selected by the authors based on recommendations from the American Academy of Family Physicians, American Academy of Pediatrics, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, the American Osteopathic Academy of Sports Medicine, and Student Psychological Services in the Student Health Center. The Director of Athletic Training, a trained psychologist in eating disorders from the University Student Health Center, and dietitians and Nutrition Faculty employed by the university selected the questionnaire items from those recommended. The instrument relied on student athletes' self-reported responses to closed-ended questions (yes/no or check the answer that applies) and short answer statements. Section one of the questionnaire included information regarding the athlete's sport, age, height, weight, body fat, serum cholesterol and the highest and lowest body weight experienced in the past year. One question asked if they wanted to gain, lose or maintain their body weight. Section two included 42 closed-ended items (yes/no) regarding dietary issues, weight loss/gain issues, hydration, eating habits, exercise habits, and supplements use. In four items athletes were allowed to explain their response or add additional information: "Have you ever experienced any adverse effects to any food or supplements?", "Have you ever taken supplements?", "Are you currently taking dietary or nutritional supplements?" and "Other than during a pregnancy, have you ever not had a menstrual period for more than 3 months?"

Question face validity was confirmed through the recommending organizations and societies (Binkley, Beckett, Casa, Kleiner, & Plummer, 2002) and question content and relevance was confirmed by an athletic trainer, eating disorder psychologist and registered dietitians (Bowling, 2002).

Statistical Analysis

Due to the large number of individual items, an Exploratory Factor Analysis was conducted using SPSS 12.0. A Varimax rotation with Kaiser Normalization was used on the 42 closed-ended items to delineate distinct clusters of relationships and ensure that the factors could be meaningfully interpreted for possible future predictive value (Munro, 2005).

After the items were identified with a particular factor and the factors were interpreted, Discriminant Function Analysis was used to determine which variables discriminate between the sport teams. The purpose was to determine which variable(s) could be considered the best predictors of potential nutritional concerns within individual sports. This would allow the trainers and coaches to identify potentially risky behaviours before they result in problems with health and athletic performance. Although teams vary depending on whether they practice or compete indoors or outdoors, many athletes reported additional personal training, i.e., running out doors, and outside of normal practice protocols. Thus, for all athletes living in the

desert, regardless of their collegiate sport, optimal hydration was considered an environmental factor of concern impacting overall dietary health and athletic performance.

Results

Originally, there were 1,780 completed surveys collected from the members of 18 different athletic teams over the four-year period. The final analysis included 1,667 surveys (93.7% of total) after excluding surveys from a team (men's basketball, n = 4) with too few surveys completed to maintain confidentiality. Also, excluded were surveys from athletes under 18 years of age. The overall internal reliability, based on the average inter-item correlation, using Cronbach's alpha (Cronbach, 1951) for the instrument was 0.84.

Demographic Characteristics

The mean age of the athletes was 19.77 ± 1.44 years (mean ± standard deviation) (Figure 1). All students 23 years of age and older were combined to achieve a more normal distribution. The sex of respondents among all 18 sports was fairly equitably distributed, with 924 (55.4%) males and 743 (44.6%) females. Over a four year period, the number of student athletes varied slightly. From year one to year four 385, 394, 453, and 435 surveys were completed annually, representing, 23.1%, 23.6%, 27.2% and 26.1%, respectively, of the total surveys utilized during the study (Table 1). Some individual student athletes completed the surveys, more than once as they returned each fall during the four year data collection period. Their responses are thus presented with their team each year and team data, not individual data, was the unit of measure for statistical analyses. The majority of respondents did not provide their body fat percentages and total serum cholesterol concentrations, therefore these data were not included in the results.

Exploratory Factor Analysis

The researchers used the information from the exploratory factor analyses with the Varimax rotation with Kaiser Normalization analyses as well as their expertise in the subject matter to construct the new hypothetical understanding of the factors (Figures 2 and 3). The criterion used for considering whether an item loaded substantially on a factor was an item eigenvalue greater than 0.30. Of the original 42 items, 90% were retained for further analysis with only four items being excluded because of item eigenvalues below 0.30. The four questions with eigenvalues below 0.30 were; "Do you have any food-related preferences associated with cultural or religious beliefs?", "Do you have "rituals" around food or getting ready to eat?", "Have you been told you have lost too much weight?", and "Have you for the past 12 months been menstruating on a regular basis; do you cycle every 21 to 35 days? (females only)".

Principle components analysis identified six factors from the 38 items analyzed (Table 2). The rotated sums of squared loadings for each factor can be interpreted as the percent of the total variance accounted for by each factor. The six factors that emerged from the analysis were interpreted and reported in Table 2 with correlation coefficients and rotated sums of squared loadings, respectively, as: Factor 1 = weight loss and exercise issues and practices, (0.90; 47.15), Factor 2 = self-image issues (0.89; 26.00), Factor 3 = hydration issues (0.85; 10.92), Factor 4 = supplementation (0.96; 3.85), Factor 5 = disordered eating practices (0.98; 3.70), and Factor 6 = hormonal issues (0.75; 1.71).

Discriminant Function Analysis

A Discriminant Function Analysis was conducted to examine if the six factors could be used to discriminate between the sports teams. A stepwise Discriminant Analysis using Wilks' Lambda was utilized to examine a set of independent variables in order to predict or explain a nonmetric dependent variable. Lambda is interpreted as opposite to squared multiple correlations, R^2. Specifically, it is interpreted, as the variance not accounted for by the independent variables, therefore, the smaller the Lambda, the greater the explained variance (Munro, 2005). One minus Lambda would be equivalent to R^2.

The analysis produced a significant result ($P<0.01$) for the following: women's sport teams and self-image issues (Wilks's Lambda = 0.178); disordered eating (Wilks's Lambda = 0.156), and hormonal issues (Wilks's Lambda = 1.54). Further, the analysis also produced a significant result in both male and female sport teams and hydration issues (Wilks's Lambda = 0.115); and supplementation (Wilks's Lambda = 0.097).

Discussion

In this study, the cooperation and high rate of return from survey results from student athletes

over a four year period of training and competition provided a complete dataset from which to analyze teams' dietary behaviours. The results indicated that there were no teams or team members apparently at risk for eating disorders, dietary supplement misuse, or dehydration (data not presented). By virtue of the nature of eating disorders, a highly secretive disease, it may be unreasonable to consider the use of a self-reported survey. However, with extended conversation with the staff in the Department of Athletic Training we concluded that an anonymous survey of this type might encourage a student that has reached the point of sharing their status with professionals regarding a potential or existing eating disorder not yet disclosed. Likewise, a survey of this type may communicate to students at risk, again primarily for eating disorders, that their staff is willing and able to provide support for a student inclined to disclose their disorder. This may only be the first step in a well developed protocol for assisting students with eating disorders, dietary supplement use or dehydration concerns. It is generally recognized that any type of eating or dietary intake disorder is likely to complicate the stresses of a very hot, arid environment if fluids are lost due to purging, or electrolyte imbalances are exacerbated due to excessive sweating. For example, the use of creatine supplements has been associated with a number of side effects, including dehydration and muscle cramping (American Academy of Orthopaedic Surgeons, 2007).

From these analyses it was determined that in addition to the original issues of concern, i.e., disordered eating, dietary supplement use, and hydration, there were three additional issues meaningful to university athletes. The new factors were: weight loss and exercise issues and practices, self-image issues, and hormonal issues. Although weight loss, exercise, self-image, and hormonal issues are frequently reported by researchers and health care workers as public nutrition related concerns, as well as common concerns of student athletes, it was reassuring that the current survey demonstrated that the student athletes surveyed were also able to identify these factors as important concerns with regard to their health and performance.

During the outset of the study, identifying students with potential eating disorders was a factor of great concern. Screening tools have been developed and validated for eating disorders and related factors. For example, a screening tool has been validated for female athletes (FAST) (McNulty, Adams, Anderson, & Affenito, 2001). For the general population several surveys exist: Eating Disorder Examination-questionnaire (EDE-Q, Fairburn, & Beglin, 1994) and Bulimia Test Revisited (BULIT-R, Brelford, Hummel, & Barrios, 1992) and Eating Disorder Inventory-2 (EDI-2, Garner, 1991). However, these instruments contain as many as 64 items, were reported to take up to 15 minutes to complete and thus, were too cumbersome for the purposes identified by our Department of Athletic Training. These instruments, specifically designed as screening tools to identify eating disorders in female athletes, did not address our additional original concerns that included screening for dietary supplement and ergogenic aid use and hydration among men and women athletes.

The National Collegiate Athletic Association (NCAA) has addressed the issues of dietary supplements and ergogenic aids relevant to university athletes by regulating substances reported to be harmful (National Collegiate Athletic Association, 2005). However, hydration, another original concern at the outset of this study had not attracted the attention of the NCAA to the point of regulation across all sports teams at this time. In 1999, the NCAA Medical Advisory Committee established and mandated a comprehensive weight certification program to safeguard wrestlers. Many state high school programs followed with similar regulations. Starting with the 2006-07 season, all states following National Federation of State High Schools Association (NFHS) rules, were required to have protocols in place that control the practice of "making weight" among wrestlers at the high school level. Tragically, these regulations were in response to dehydration issues among college athlete wrestler fatalities (Finn, & Wood, 2004; MMWR, 1998). Finn and Wood (2004) reported concern regarding hypohydration among international athletes and have recommended that hydration education specifically target high risk groups. Those at increased risk are team members that are not accustomed to desert environments. Members that are not accustomed to desert environments are those that have not lived, trained or competed in desert environments prior to travelling for competitions held in hot, arid climates. Discussions have also addressed the need for education irrespective of the time allowed for

adaptation to their environments prior to competition. In order to heighten athletes' self awareness of hypohydration they have been educated to note urine color. A high correlation (r=0.87) has been reported between urine color and specific gravity, yet detectable changes (darker) in urine color tended to underestimate hydration levels (Finn, & Wood, 2004). This "layman's" method is not sensitive enough to effectively be used as a means of preventing student athlete dehydration or positively affecting performance and health, yet it establishes an attentiveness to self-monitor hydration status.

A second finding from our study was the observation that the original 42 questions could conceivably be reduced to six constructs, one for each issue detected from the factor analysis. From the outset of the study the director of Athletic Training had been conscious of the number of questionnaires, forms, and preliminary paperwork student athletes must complete prior to participating in sanctioned training and competitions. Any means of reducing the time and tediousness of collecting and documenting required preparticipation information would be beneficial to future students and would likely improve response attentiveness by student athletes. In order to assess the dietary related behaviours of athletes in the desert an efficient, reliable and valid assessment tool is needed. Our results indicated that the 42 questions addressing all issues thought to be of potential concern to these athletes could be reduced to six factors. Therefore, our data suggest that a quick survey instrument containing one question developed from each of the significant factors identified can be constructed. Validation and reliability testing of a survey tool developed based on the six key factors identified will be required prior to its use. Student athletes will likely be more attentive when responding to fewer, directed questions when inundated with forms and questionnaires at the beginning of the academic year. A shorter survey instrument with direct questions should improve identification of at-risk student athletes, particularly those in need of dietary assessment and/or counselling early in the school year. Once the shorter survey instrument is completed, any athletes identified can be 1) more closely monitored by the staff, 2) asked to complete the original, full survey with 42 questions after the initial 'paperwork' phase, and 3) provided with enhanced educational opportunities tailored by the athletic training staff to the individuals/teams with extreme environmental adjustments if relocating from areas considerable different from southwestern United States. This will also help alleviate the concerns by some that measuring constructs with one question may not be adequate.

Like the general population, athletes possess varied nutritional practices and cultural backgrounds which influence nutritional status, and ultimately performance. In this study, students did not report concerns that differed from other cohorts in the literature (Dunn, Turner, & Denny 2007). It is possible that upon recruitment and throughout their student athlete careers prior to arriving at the university the existing support for maintaining healthy dietary and hydration related practices was sufficient in this cohort.

Limitations in this study were associated with survey administration. Self-reported data collected from athletes reportedly were at greater risk of precision and validity errors (Black, Goldberg, & Jebb, 1991) compared to other non-athlete cohorts. Hill and Davies (2001) reported that athletes exhibited a habitual under self reporting of energy intake. Additionally, accurate self-reported data concerning eating disorders is also difficult to document (Fraser, & Shavlik, 2004). It may be assumed that under-reporting, and possibly misreporting, is extremely variable across individuals within a given sport. Some degree of bias is likely to exist within the results in this study that cannot be identified. However, intentional misreporting may be minimal because the students were not concerned about negative consequences associated with survey participation/responses due to anonymity. Also, directly assessed dietary intakes, which have been used in numerous other studies of athlete dietary behaviours were not a component of the current study and thus would not have been a concern for the respondents (Hinton, Sanford, Davidson, Yakusho, & Beck, 2004).

Conclusions

The need for procedures to monitor dietary behaviours and practices affecting hydration have been well publisized and promoted for wrestlers. Yet the need for procedures to monitor dietary behaviours and practices impacting hydration and heat acclimatization for those less attentive and not yet targeted for education still exists (Binkley et al, 2002; CCIW

Conference, 2007; NCAA News Release, 2003). This information will assist university professionals that offer student athletes nutrition education and counselling needed to adjust their dietary habits. Such adjustments are needed by student-athletes by virtue of their every day environment, such as in desert locales, rather than by virtue of their sport only, in order to support their athletic performance and lifelong health. Survey instruments accurately and effectively assessing dietary habits that might place college athletes at risk for compromised performance and acute and chronic health consequences may be beneficial to student athletes in other arid regions of the world. Based on our findings, further research will be needed to design useful and effective survey assessment tools to identify during the preseason student-athletes with risky diet related behaviours including behaviors affecting the quintessential nutrient, water.

In addition to identification and screening protocols, nutrition education programs and self-management interventions for the purpose of achieving optimal nutritional status will need to be implemented. Since the beginning of this study in the southwestern region of the nation, bold steps have been undertaken nation-wide in an attempt to manage hydration and weight control issues among student-athletes competing in wrestling. In addition, some individual state conferences have established policies specifically for hydration in teams such as football and men and women's soccer (CCIW, 2003-2004). Professionals have developed seminars and educational messages targeting primarily young wrestlers (Figure 2.). Today, an authoritative website (http://www.nwcaonline.com/), developed by the The National Wrestling Coaches Association (NWCA), in cooperation with the American Dietetic Association, and many other collegiate and state high school collaborating organizations, has been developed to help coaches, parents, administrators and student-athletes. The NWCA Optimal Performance Calculator promotes fitness for life and has expanded to be a weight assessment and management system for all sports and health and physical education programs across the nation. For example, preseason assessments are outlined for hydration, body fat and weight to establish minimum wrestling weights, safe weight loss plans and dietary nutrient goals. During the 2006-2007 academic year 34 high school athletic associations and all collegiate governing bodies using the OPC program completed 220,000 student-athlete assessments.

Since April 2005 the NFHS Medical Advisory Committee and the NFHS Wrestling Committee mandated that the recommendations be required regulations. Minimum wrestling weights are now based on 7% body fat for males and 12% body fat for females. Hydration levels must be determined by specific gravity tests on urine samples using refractometers or urine test strips, and a weight loss can be no greater than 1.5% of the athlete's body weight. A nutrition education program for student-athletes is also required. The primary goal of the NWCA is to position wrestlers (and athletes in general) to be the ultimate role models for promoting fitness and nutrition in schools across America. National governing bodies such as the NCAA, National Federation of State High School Associations, the National Athletic Trainers Association, the United States Department of Agriculture, and Action for Healthy Kids are all lending considerable credibility to the NWCA in the sport science area of competition performance.

The model established by the wrestling community to safeguard their student-athletes can be a standard by which all athletic administrators, coaches and staff use it to establish protocols to be implemented during preseason screenings, season competition and post season self-monitoring for all athletes, and especially those in arid environments, in order that they develop lifelong habits of assessment and practice to promote healthful living.

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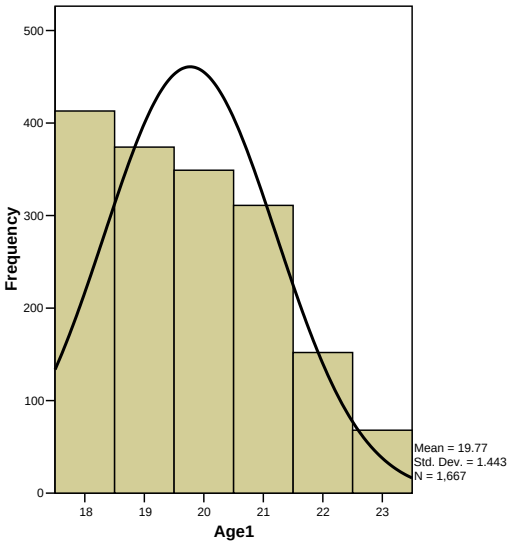
Figures and Tables

Figure 1. Histogram of Ages of Athletes

Teams	2001	2002	2003	2004	Total	%
Male Sports						
Baseball	33	29	33	40	**135**	14.6%
Football	110	120	117	103	**450**	48.7%
Golf	7	10	12	17	**46**	5.0%
Soccer	23	36	29	30	**118**	12.8%
Swimming	21	19	24	33	**97**	10.5%
Tennis	7	8	15	10	**40**	4.3%
Cheerleaders*	11	2	12	13	**38**	4.1%
Total Males	**212**	**224**	**242**	**246**	**924**	**100.0%**
Female Sports						
Basketball	7	14	13	21	**55**	7.4%
Cross Country	0	10	13	16	**39**	5.2%
Golf	6	11	9	12	**38**	5.1%
Soccer	29	27	26	3	**85**	11.4%
Softball	23	22	19	17	**81**	10.9%
Swimming	21	25	30	38	**114**	15.3%
Tennis	8	9	7	8	**32**	4.3%
Track	34	34	37	17	**122**	16.4%
Volleyball	18	18	14	13	**63**	8.5%
Cheerleaders*	27	0	43	44	**114**	15.3%
Total Females	**173**	**170**	**211**	**189**	**743**	**100.0%**
Total	**385**	**394**	**453**	**435**	**1667**	



Note. N=1754.

Table 1. Demographic Information Sport by Year
Note: N = 1667. * Cheerleaders and Dancers combined; this team includes both males and females.

Table 2. Results from Exploratory Factor Analysis

Component/Interpretation	Correlation Coefficient	Rotated Sums of Squared Loadings
Factor 1 *Weight Loss and Exercise Issues and Practices*	.903	47.145
Factor 2 *Self-image Issues*	.891	26.000
Factor 3 *Hydration Issues*	.850	10.920
Factor 4 *Supplementation*	.960	3.846
Factor 5 *Eating Disorder Practices*	.975	3.704
Factor 6 *Hormonal Issue*	.753	1.709

Note. Varimax Rotation with Kaiser Normalization; Rotated Sums of Squared Loadings interpreted as variance accounted for by factors after rotation

Table 3. Factor Loading for Each of the Six Factors with Eigenvalues Greater than 0.30

	Factor Loadings					
Items	1	2	3	4	5	6
Factor 1: Weight Loss Practices						
Are you unsatisfied with body weight?	.861					
Have you ever experienced a bone stress fracture?	.738					
Have you always been worried about your weight, even as a child?	.608					
Do you frequently feel guilty after eating?	.629					
Do you sometimes feel you can't stop eating once you start?	.535					
Have you tried many different diets but they don't seem to work?	.519					
Would you say that food is either your best friend or your worst enemy?	.517					
Does the number on the scale dictate your mood and self-worth?	.476					
Do you have a fear or intense disgust with anything that has fat in it?	.458					
Do you find that you can't stay warm or that you are always cold?	.418					
Do you exercise excessively to lose weight and/or fat?	.408					
Have you ever tried diet pills?	.390					
Have you ever been told that if you were to decrease weight, you would improve performance?	.373					
Do you believe that you have to be perfect at everything you do?	.368					
Do you lose weight regularly?	.336					
In addition to training for sports, do you participate in extra physical activity?	.320					
Factor 2: Self-image Issues						
Do you think about food and weight constantly?		.672				
Is your self-evaluation influenced a lot by weight and shape concerns?		.616				
Do you eat because you feel bored, angry, stressed, lonely, etc?		.478				
Does your weight fluctuate dramatically?		.435				
Have people commented to you about what or how much you eat?		.419				
Do you eat large amounts of food, especially in secret?		.392				
Do you wear clothes that divert attention away from your shape?		.304				
Factor 3: Hydration Issues						
Do you ever experience nausea before, during or after a game or workout?			.512			
Do you ever experience diarrhea or other gastrointestinal disturbances before, during or after a game or workout?			.466			
Do you ever experience muscle cramping before, during or after a games?			.438			
Have you ever experienced any dehydration illnesses?			.332			
Factor 4: Supplementation						
Have you ever experienced any adverse effects to any foods or supplements?				.672		
Are you currently taking any dietary or nutritional supplements?				.435		
Have you ever taken any supplements in the past?				.355		
Factor 5: Eating Disorders						
Have you ever tried diuretics to lose weight?					.702	
Have you ever tried laxatives to lose weight?					.631	
Have you ever been diagnosed or treated with an eating disorder?					.613	
Have you ever tried vomiting or any other techniques to lose weight?					.579	
Do you ever induce vomiting or use laxatives to get rid of food?					.418	
Have you ever tried sitting in a sauna to lose weight?					.408	
Do you eat what others would think are unusual food selections?					.342	
Factor 6: Hormonal Issues						
Other than during a pregnancy, have you ever not had a menstrual period for more than 3 months?						.327

Table 2. Tips for Coaches and Wrestlers

Weight Management Tips

- Eat light p.m. meals.
- Eat slowly.
- Eat one serving.
- Decrease intake of calories, but to no less than 1,500 per day.
- Eat low calorie snacks (carrots, celery, lettuce, plain popcorn).
- Eat low calorie desserts or no dessert.
- Avoid fast foods that have a high fat content.
- Cut out butter, margarine, sauces, gravy, and dressings.
- Grill, bake, broil, or boil—do not fry.
- Avoid caffeine.
- Avoid salt.
- Avoid any situations where you will eat to excess.
- Restrict weight loss to no more than two pounds per week.
- Substitute low calorie items whenever possible.
- Keep a daily diary of everything you eat and analyze its caloric content.

Hydration tips

Two Days Prior to Testing
- Drink plenty of fluids throughout the day (water has no calories).
- Increase intake of foods high in fiber (such as salads, cereal, vegetables, and fruits)—which will help with the removal of excess weight from the body.
- Eat smaller, more frequent meals.
- Avoid foods high in fat (fried foods, meat, french fries, pizza).
- Avoid salty foods (potato chips, pretzels, tuna, crackers, soft drinks).
- Be sure you eat and drink—do not dehydrate!

One Day Before Testing
- Continue drinking fluids. Urine should be clear if you are fully hydrated.
- Continue eating fibrous foods to eliminate excessive waste from the body.
- Stay away from fatty foods and snacks.
- Avoid caffeinated drinks (coffee, tea, soda, etc.)
- Avoid any vitamins or mineral supplements.

Day of Testing
- Avoid caffeinated drinks.
- Drink about 17 ounces of fluid (a sports drink is an excellent choice).
- No vigorous activity on the day of testing.
- Avoid any vitamin or mineral supplements.

Adapted from Eileen Bowker, MA, ATC, Athletic Trainer at Pemberton Township (N.J.) High School. Bowker works with USA Wrestling and holds seminars across the country on conducting body fat assessments. She provides these tips on weight loss and hydration for coaches and wrestlers. Retrieved November 3, 2008 from *http://www.momentummedia.com/articles/tc/tc1602/wrestling.htm*