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Use and rationale for taking nutritional supplements among collegiate athletes at risk for nutrient deficiencies

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ABSTRACT

This study examined aspects of collegiate athletes' eating habits, weight, and their use and perception of nutritional supplements. The purpose of this study was to determine if athletes at risk for nutrient deficiencies use nutritional supplements, and if their concerns about positive drug tests discouraged their use of nutritional supplements. This study examined 134 athletes from collegiate universities across the United States. They answered a questionnaire, developed by the researchers through Psychdata. From the athletes' responses to questions about their eating habits, the study categorized participants into two groups: athletes at risk for nutrient deficiencies and athletes not at risk for nutrient deficiencies.

In this study, 49 athletes were considered at risk for nutrient deficiencies. More at-risk athletes (53%) took nutritional supplements than those not at risk (33%). Among those at risk, more athletes (69%) took supplements who were not concerned about nutritional supplements causing a positive drug test, than those athletes who were concerned (38%). Athletes need education about reliable sources of information about supplements, dosing of supplements, and safety of supplements. Athletes also need to be informed of the potential consequences of taking unsafe supplements.

1. Introduction

To succeed in sports, athletes must perform at their best. They face external pressures and internal drives for success that can lead them to change their eating patterns and/or take supplements. Most commonly in image-conscious sports, athletes believe that an athletic physique will help them succeed in their sport, which can lead them to restrict calories to lose body weight (mass) (Hinton, Sanford, Davidson, Yakushko, & Beck, 2004; Ziegler et al., 1997). Other athletes consume diets that eliminate certain foods and food groups, or increase the intake of low nutrient dense foods due to increased intake of high fat food from dining out eating patterns (Hinton et al., 2004; Venderly & Campbell, 2006). These diets lack important micronutrients and may put athletes at risk for nutrient deficiencies that can hinder their health and their athletic performance (Hinton et al., 2004; Mullins, Houtkooper, Howell, Going, & Brown, 2001; Rodriguez, DiMarco, & Langley, 2009; Venderly & Campbell, 2006; Ziegler et al., 1997). The micronutrients of most concern to athletes include calcium, vitamins D, C, and E, B vitamins, iron, zinc, magnesium, beta carotene, and selenium (Rodriguez et al., 2009). Athletes at risk for nutrient deficiencies may need to be treated with nutritional supplements if their diets lack the appropriate nutrients; however, many athletes use nutritional supplements to improve their athletic performance regardless of nutritional status (Froiland, Koszewski, Hingst, & Kopecky, 2004; Herbold, Visconti, Frates, & Bandini, 2004; Maughan, 1999; Nieper, 2005; Thomson, Cotugna, Kalman, & Saldanha, 2005; Tian, Ong, & Tan, 2009). According to the Food and Drug Administration, a nutritional supplement is defined as "an orally consumed product that contains an ingredient intended to supplement the diet. Dietary ingredients include: vitamins; minerals; herbs and other botanicals; amino acids; enzymes or tissues from organs or glands; and concentrates, metabolites, constituents or extracts" (FDA, 2013). In contrast, a performance enhancing supplement is defined by the World Anti-Doping Agency as "any pharmacological substance listed in the World Anti-Doping Code, or that has not been approved by a governmental regulatory health authority for human therapeutic use" (WADA, 2009). This current study asked athletes only about their use of nutritional supplements and not performance enhancing supplements.

Nutritional supplements may contain harmful or illegal substances not listed on the label, which can lead to positive drug tests for athletes (Geyer et al., 2004; Kamber, Baume, Saugy, & Rivier, 2001; Maughan, 2005; Pipe & Ayotte, 2002; Van de Merwe & Grobbelaar, 2005). A study of the international nutritional supplement market found that anabolic androgenic steroids, such as testosterone and nandrolone, contaminate ~15% of supplements, and consumption of a contaminated supplement was

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found to cause positive urine tests up to 2 h after ingestion in study participants (Geyer et al., 2004). This potential contamination may also be preventing at risk athletes from taking nutritional supplements. The World Anti-Doping Agency (WADA), and the National Collegiate Athletic Association have regulations regarding substances that are prohibited for use by competitive athletes including anabolic agents, growth hormones, etc. The World Anti-Doping Agency strict liability rule holds an athlete responsible for substances in their body regardless of intent (World Anti-Doping Agency, 2009). The purpose of this study was to determine: (a) if athletes who are at risk for nutrient deficiencies use nutritional supplements and (b) if fear of positive drug tests from supplement use discourages the use of nutritional supplements in athletes who are at risk for nutrient deficiencies.

2. Methods

2.1. Participants

This study survey N = 134 male and female collegiate athletes of various ethnicities between the ages of 18 and 26 years who played varsity sports at universities across the United States. Before participants completed the voluntary questionnaire, they read through an outline of the study and gave their informed consent. Texas Woman's University (TWU), Denton, Texas, Institutional Review Board gave approval for this study.

2.2. Instrumentation

The researchers developed an original questionnaire through Psychdata specifically for this study concerning the use of nutritional supplements. The questionnaire consisted of 40 questions grouped into categories of similar concepts. All participants were asked about demographics, sports played, eating habits, perceptions of body weight, and supplement use. Those participants who took supplements were asked a series of questions regarding their supplement use, sources of information, and concern for the risk of a positive drug test from taking supplements. The questionnaire included open and closed questions and many were multiple choice allowing participants to choose multiple options. Four collegiate sports dietitians who work with athletes at universities in the United States reviewed the content validity of the questionnaire and athletes from the TWU gymnastics, volleyball, and basketball teams ($N = 10$) pilot tested the questionnaire. The official study excluded these athletes. Based on the form of the questions in the questionnaire, no reliability test was able to be calculated from the data. The results of the pilot test were reviewed and the wording of some questions was changed to make them more understandable.

2.3. Procedures

To recruit participants, the researchers contacted collegiate sports dietitians through the Collegiate and Professional Sports Dietitians Association Listserv and Facebook page, through colleagues of the researchers, and athletes through TWU's coaches. The dietitians and athletes received an email with a link to the questionnaire on Psychdata. The sports dietitians were asked to forward the email to their university's athletes. The email contained instructions for voluntary, anonymous completion of the questionnaire through the internet link to the Psychdata questionnaire. The questionnaire took an estimated 10 min to complete, and the Psychdata system saved the results for later analysis.

Table 1
Frequency and percentage of diets followed by athletes.

Diet	F[a]	Percent
High protein	19	15
Low calorie	17	13
Low fat	14	11
Low carbohydrate	8	6
High carbohydrate	6	5
High calorie	4	3
Diabetic	2	2
Vegetarian	3	2
Low sodium	1	<1
Vegan	1	<1

[a] $N = 131$; F = frequency.

2.4. Design and analysis

The researchers used SPSS 15 (SPSS Inc., Chicago, IL) and Microsoft Excel (Microsoft Corp., Redmond, WA) for statistical analysis of the results. Descriptive statistics were analyzed for frequencies, percentages, and means as appropriate for each question on the questionnaire. Since this study did not draw blood to test athletes for nutrient deficiencies, athletes' responses to certain questions determined their risk for nutrient deficiencies. For data analysis, athletes were divided into two groups. One group was at risk for nutrient deficiencies and one group not at risk for nutrient deficiencies. If the athlete entered a zero for any of the food groups, the survey categorized the athlete as 'at-risk' for nutrient deficiencies. The at-risk group included athletes who followed restrictive diets that eliminated certain foods or food groups such as a vegan, vegetarian or lacto-ovo-vegetarian diets, those who restricted calories to lose body weight, those who rated their eating habits less than 4 on the poor to excellent scale of 1–10, and those who omitted one or more foods groups. At the time of this study, the Food Guide Pyramid (visual representation for the Dietary Guidelines) was used to indicate daily intake. Each athlete was counted only once in the group at-risk for nutrient deficiencies. Two-way chi-square was used for analysis of data with a significance level set at $p < 0.05$.

3. Results

The participants played collegiate sports at various universities across the United States. These athletes were 16% male and 84% female, 31% of whom were college freshmen, 20% were sophomores, 25% juniors, 21% seniors, and 3% fifth-year seniors. The athletes' ages ranged from 18 to 26 years, with a mean age of 19.5 years. The two most common ethnicities of the participants were Caucasian (76%) and African American (8%).

Body weight (mass) of the athletes ranged from 100 to 250 lbs and height from 4 ft and 11 in. to 6 ft and 4 in., with an average body mass index (BMI) of 23 kg/m^2. Gymnasts represented the highest percentage of athlete responses (60%). Other significant sports played by the athletes included track and field (9%), soccer (8%), and wrestling (7%). Less than 5% of the athletes played other sports. To provide a sampling of athletes who train in different climates, participants from all regions of the United States answered the questionnaire. Illinois (53%) and Texas (11%) had the highest percentage of participating athletes. Those with 15 or more years of experience playing sports represented 61% of the participants, and athletes with 12–15 years of experience playing sports represented 26% of the participants.

The questionnaire asked the participants several questions about their eating patterns. When asked if they followed a specific diet, 28% of the athletes responded in the affirmative. Athletes were then asked to select all of the diets they followed which are