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Nutrition-related knowledge, attitude, and dietary intake of college track athletes

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ABSTRACT

Although it is recognized that athletic performance is enhanced by optimal nutrition, nutrition-related knowledge deficits and dietary inadequacies continue to persist among many college athletes. The purpose of this study of college track athletes was to measure nutrition knowledge, attitude regarding healthy eating and athletic performance, and dietary intake, identifying relationships among these parameters. A self-administered nutrition knowledge and attitudes survey and the youth/adolescent semi-quantitative food frequency questionnaire were used to measure nutrition knowledge and nutrition attitude and to assess diet quality, employing a convenience sample of 113 track athletes from two NCAA Division I schools. Mean knowledge was fair, with highest component scores attained for carbohydrate, vitamins and minerals, and protein. Low scores were found for vitamins E and C. Mean attitude scores were high and similar by sex. Overall mean diet quality was 84 ± 10 (M ± SD) of 110 possible. High mean dietary intake scores were found for vitamins C and A, cholesterol, saturated fat, calcium, and magnesium; low mean dietary intake scores were found for vitamin E, fiber, sodium, and potassium. Weak correlations existed between nutrition knowledge and attitude versus diet quality. In summary, we identified adequate intake and knowledge (carbohydrates), poor intake and knowledge (vitamin E), and adequate intake and lack of knowledge (vitamin C and protein). Future research should explore factors other than knowledge and attitude that may have primary influence on dietary intake among college athletes.

INTRODUCTION

It is well recognized that athletic performance is enhanced by optimal nutrition (American College of

Sports Medicine, American Dietetic Association, and Dietitians of Canada, 2000). However, college athletes encounter numerous barriers that can hinder healthy eating, including lack of time to prepare healthy foods (due to rigorous academic and training schedules), insufficient financial resources to purchase healthy foods, limited meal planning and preparation skills, and travel schedules necessitating "eating on the road"(Malinauskas, Overton, Cucchiara, Carpenter, & Corbett, 2007; Palumbo, 2000). Research has demonstrated that athletes are interested in nutrition information, and that sport nutrition information is increasingly available (Froiland, Koszewski, Hingst, & Kopecky, 2004; Jonnalagadda, Rosenbloom, & Skinner, 2001; Zawila, Steib, & Hoogenboom, 2003).

Nevertheless, nutrition-related knowledge deficits and dietary inadequacies persist among many college athletes (Jacobson, Sobonya, & Ransone, 2001; Rosenbloom, Jonnalagadda, & Skinner, 2002; Malinauskas, Overton, Cucchiara, Carpenter, & Corbett, 2007; Zawila, Steib, & Hoogenboom, 2003). College athletes exhibit a lack of knowledge about the roles of protein, vitamins, and minerals in the body and also about supplementation with these nutrients (Jacobson, Sobonya, & Ransone, 2001; Rosenbloom, Jonnalagadda, & Skinner, 2002; Zawila, Steib, & Hoogenboom, 2003). For example, Jacobson and colleagues (2001) reported that male athletes are likely to believe that protein provides immediate energy and that high-protein diets increase muscle mass. Zawila and colleagues (2003) reported nutrition knowledge deficits among female cross-country runners.

Nutrition can play a key role in optimizing physical performance and recovery from strenuous exercise (American College of Sports Medicine, American Dietetic Association, and Dietitians of Canada, 2000). However, many college athletes have diets that warrant change to promote health and support performance (Malinauskas, Overton, Cucchiara, Carpenter, & Corbett, 2007). Specifically, diets that are low in fruits, vegetables, and whole grains and high in fat and processed foods are common among college athletes (Clark, Reed, Crouse, & Armstrong, 2003; Hinton, Sanford, Davidson, Yakushko, & Beck, 2004). To improve dietary intake among college athletes, further research is warranted identifying dietary inadequacies as well as factors influencing the dietary intake of athletes (Hinton, et al, 2004; Turner & Bass, 2001).

It is unclear if college athletes' nutrition knowledge and attitudes about nutrition have an association with their dietary intake. Wilta and colleagues (1995) found that greater nutrition knowledge was associated with healthier dietary practices among runners, whereas

Turner and colleagues (2001) reported no significant correlate relationships between knowledge and dietary intake among female athletes. These conflicting findings suggest that further research is needed to learn whether knowledge and attitude are primary factors impacting college athletes' dietary intake. The purpose of the present study was to assess the nutrition knowledge, nutrition-related attitudes, and dietary intake of college track athletes. Specific research objectives were (a) to measure nutrition knowledge in regard to carbohydrate, protein, vitamins and minerals in general, and selected antioxidant vitamins; (b) to assess attitude regarding healthy eating and athletic performance; (c) to evaluate dietary intake; and (d) to identify if, for college track athletes, relationships exist among nutrition knowledge, attitude, and dietary intake.

METHODS

Approval to conduct the study was secured from the appropriate Institutional Review Board prior to data collection. Written consent was obtained from each participant. All data collection was performed by a single researcher.

Nutrition knowledge and attitude survey

A registered dietitian constructed a nutrition knowledge and attitude pilot survey (Jonnalagadda, et al, 2001; Zawila, et al, 2003). The knowledge section included five subject areas (carbohydrates, protein, vitamins and minerals in general, vitamin C, vitamin E) with 2–5 true/false statements per subject area. The attitude section included five statements of belief that healthy eating supports athletic performance. Participants used a 5-point Likert scale (1 = strongly disagree, 3 = neither agree nor disagree, 5 = strongly agree) to indicate level of agreement with each statement. The survey was reviewed for content validity by a second registered dietitian and for content clarity by a person in a profession other than health care. To pilot test the survey, 47 track athletes (26 males, 21 females) from a NCAA Division I program in the Piedmont region of the United States completed the self-administered survey. Only minor syntax modifications were necessary based on participant responses.

Assessing diet quality

The semi-quantitative youth/adolescent food frequency questionnaire (YAQ) assesses dietary intake over the 12 preceding months. The YAQ has demonstrated reproducibility and validity in youth and has been used to measure nutrient intakes among college athletes (Hinton, et al, 2004; Rockett, Wolf, & Colditz, 1995; Rockett et al., 1997). In the present study, data obtained with the YAQ were used to calculate diet quality scores. The total score was the sum of 11 "nutrient component

scores," including nutrients of concern (fiber, calcium, potassium, magnesium, and vitamins A, E, and C) and nutrients promoting metabolic dysregulation (saturated fat, cholesterol, added sugar, and salt) as indicated in the 2005 Dietary Guidelines for Americans (U.S. Department of Health and Human Services [USDHH] & U.S. Department of Agriculture [USDA], 2005). Under a framework provided by the Healthy Eating Index, each nutrient component score was 10 at maximum and 0 at minimum (Basiotis, Carlson, Gerrior, Juan, & Lino, 1999). A component score of 10 was assigned for a nutrient when intake met or exceeded the Dietary Reference Intake. Proportionately lower scores were assigned to nutrients when was intake less than recommended (Food and Nutrition Board, Institute of Medicine [FNBIM], 1997, 2000, 2001). Cholesterol, saturated fat, sodium, and fiber recommendations were based on 2005 Dietary Guidelines, while sugar recommendations were based on Recommended Dietary Allowances (USDHH & USDA, 2005; Food and Nutrition Board, Institute of Medicine, 2003). To obtain the maximum score of 10, criteria to be met included intakes of $\leq$ 300 mg cholesterol, $\leq$ 10% calories from saturated fat or sugar, $\leq$ 2300 mg sodium, and $\geq$ 14 g fiber/1,000 calories. To obtain the minimum score of 0, criteria to be met included intakes of $\geq$ 15% calories from saturated fat or sugar, $\geq$ 450 mg cholesterol, and $\geq$ 4600 mg sodium (USDHH & USDA, 2005; Food and Nutrition Board, Institute of Medicine, 2003). Values between the maximum and minimum criteria were scored proportionately (Basiotis, et al, 1999).

Survey administration

A convenience sample of track athletes (N = 113) from two NCAA Division I track programs in the southeastern United States participated in the study during the fall of 2006.

Statistical analysis

All statistical analysis was conducted using SPSS 13.0. Descriptive statistics include means, standard deviations, 95% confidence intervals, and frequency distributions. Independent t-tests were used to compare mean knowledge and diet quality scores by sex. Simple linear regression was used to examine relationships between knowledge, attitude, and diet quality. An alpha level of .05 was used for all statistical tests.

RESULTS

A total of 118 participants completed the study. Data from 5 were excluded due either to incompleteness (n = 2), to a respondent's age being less than 18 years (n = 1), or to a respondent's competing only in field events (n = 2). The final sample size was 113 (61 males, 52 females), and the overall participation rate was 71%. Demographic

characteristics of participants are reported in Table 1. The majority (67%) of participants were freshmen and sophomores. The participants' reported event specialties were sprinting (45%), middle-distance (27%), and long-distance (29%). YOU ARE HERE

Table 1

Demographic Characteristics of College Track Athletes

Parameter (M ± SD)	Males (*n* = 61)		Females (*n* = 52)	
Age (in years)	19.3 ± 1.2		19.1 ± 1.1	
	n	%	*n*	%
Academic classification				
Freshman	22	36	20	39
Sophomore	19	32	17	33
Junior	13	21	8	15
Senior	5	8	7	13
5th-year senior	2	3		
Ethnic origin				
American Indian	1	2	1	2
African American	21	35	19	37
Hispanic	1	2		
Caucasian	30	49	26	50
Asian	1	2		
Other	7	11	5	9
Not reported	1	1		
Event specialty				
Sprinting	25	41	24	46
Middle-distance running	12	20	4	8
Long-distance running	14	23	16	31
Not reported	10	16	8	15

Note. An athlete was described as a sprinting specialist if he or she reported primary competition events shorter than 800 m; as a middle-distance specialist if he or she reported primary competition events 800 m to 1500 m; and as a long-distance specialist if he or she reported primary competition events longer than 1500 m.

Mean nutrition knowledge and attitude scores are reported in Table 2. The mean knowledge score for all participants was 58% ± 13% (M ± SD), which did not differ significantly by sex. Although mean knowledge component scores were similar for males and females, by subject area the rate of correct responses ranged widely, from 26% to 76%. The highest mean knowledge scores were for carbohydrate, vitamins and minerals, and protein. Mean scores of less than 50% were found for vitamin E and vitamin C. Mean attitude scores were

high and were similar for males and females.

Table 2
Nutrient Knowledge* and Attitude† Scores of College Track Athletes

Parameter (*M* ± *SD*)	Males (*n* = 61)	Females (*n* = 52)	95% CI
Nutrition knowledge	58.7 ± 1.6	57.8 ± 1.8	(55.9, 60.9)
Carbohydrate	76.1 ± 20.9	74.6 ± 17.3	(17.2, 33.3)
Protein	55.1 ± 19.9	54.2 ± 16.0	(0.2, 6.1)
Vitamins and minerals	63.0 ± 20.6	62.3 ± 20.0	(-6.9, 8.2)
Vitamin C	26.2 ± 34.9	33.7 ± 36.7	(7.8, 20.8)
Vitamin E	43.0 ± 30.7	47.1 ± 33.8	(5.2, 16.7)
Nutrition attitudes	80.4 ± 14.0	77.6 ± 12.4	(19.2, 20.4)

*Percent correct.
†Percent agreement that healthy eating supports athletic performance.

Mean diet quality scores are reported in Table 3. Overall mean diet quality for all participants was 83.6 ± 9.8. There were no significant differences in diet quality between the sexes. High mean dietary component scores were found for vitamin C, vitamin A, cholesterol, saturated fat, calcium, and magnesium, while low mean dietary component scores were found for vitamin E, fiber, sodium, and potassium. Mean fiber, cholesterol, and magnesium scores were significantly greater for females than males.

Table 3
Diet Quality Scores of College Track Athletes

Parameter (*M* ± *SD*)	Males (n = 61)	Females (n = 52)	95% CI
Diet quality	82.6 ± 8.8	84.8 ± 10.8	(-5.8, 1.6)
Vitamin E	5.6 ± 2.1	5.3 ± 2.4	(-0.6, 1.2)
Vitamin C	9.4 ± 1.5	9.6 ± 1.2	(-0.7, 0.4)
Vitamin A	8.4 ± 2.3	8.5 ± 2.2	(-1.0, 0.7)
Fiber	6.1 ± 1.6	6.8 ± 1.7*	(-1.3, -0.1)
Cholesterol	7.6 ± 3.5	8.6 ± 2.9*	(-2.2, .2)
Saturated fat	8.0 ± 2.7	8.3 ± 2.6	(-1.3, 0.7)
Sucrose	7.8 ± 3.1	7.5 ± 3.2	(-0.9, 1.5)
Sodium	6.9 ± 3.1	7.1 ± 3.3	(-1.4, 1.0)
Potassium	6.8 ± 2.1	6.2 ± 2.3	(-0.3, 1.4)
Calcium	8.5 ± 1.7	8.4 ± 2.1	(-0.6, 0.9)

Magnesium 7.7 ± 1.9 8.5 ± 2.1* (-1.5, 0.1)

Note. Dietary intake was assessed using the youth/adolescent food frequency questionnaire (Rockett, Wolf, & Colditz, 1995). With this instrument, dietary quality is represented as the sum of the 11 nutrient component scores. Each component score ranged from 0 (minimum) to 10 (maximum), based on actual dietary intake as compared to recommended intakes (FNBIM, 1997, 2000, 2001, 2003; USDHH & U.S. Department of Agriculture, 2005). Higher scores indicate nutrient intakes relatively close to recommended levels.
*$p < .05$

There were very weak correlations for diet quality and attitude (r = 0.048) and diet quality and knowledge (r = 0.001). There was little correlation between knowledge scores for specific nutrients and corresponding dietary intake: carbohydrate (r = 0.011), protein (r = -0.009), vitamin C (r = -0.004), and vitamin E (r = -0.005).

DISCUSSION

The purpose of this study was to assess nutrition knowledge, attitude, and dietary intake of college track athletes. Specifically, we asked if knowledge and attitude were related to dietary intake. This research is novel because we examined relationships between knowledge about specific nutrients (carbohydrate, protein, and vitamins C and E) and actual intakes of these nutrients. Further, there is a lack of research on college athletes' knowledge concerning antioxidant vitamins, despite the fact that many of them do supplement their diets with antioxidants (Froiland, Koszewski, Hingst, & Kopecky, 2004; Herbold, Visconti, Frates, & Bandini, 2004).

Among the college track athletes participating in this study, knowledge about carbohydrate and general knowledge of the roles of vitamins and minerals in exercise was fair. These athletes lacked knowledge, however, about the roles of protein, vitamin C, and vitamin E. For example, 82% (n = 93) of the athletes believed that vegetarian athletes require protein supplements to meet their protein needs, and 40% (n = 45) believed that the body relies on protein for immediate energy. Previous studies have similarly indicated a lack of knowledge of the specified nutrients among college athletes. Rosenbloom and colleagues (2002) found that 46% of athletes believed protein is the main energy source for the muscle and 34% believed athletes require protein supplementation.

Indeed, athletes may be tempted to use supplements to

gain a competitive edge. Primary reasons athletes give for nutrient supplementation include increasing strength and energy and improving athletic performance (Froiland, Koszewski, Hingst, & Kopecky, 2004; Herbold, Visconti, Frates, & Bandini, 2004). In the present study, a majority (67%, n = 76) of the athletes believed athletes must take a multivitamin each day and 56% (n = 66) believed vitamins and minerals supply energy. Other studies, as well, have reported many athletes believing vitamins and minerals can increase energy (Jonnalagadda, et al, 2001; Rosenbloom, Jonnalagadda, & Skinner, 2002).

Furthermore, misconceptions about antioxidant vitamins characterized the majority of athletes in our study. For example, 53% (n = 60) believed it was necessary for an athlete to supplement with vitamin C to boost immune functioning, and 56% (n = 63) believed that vitamin E supplementation was necessary to protect red blood cells from oxidative damage and to promote oxygen transport to muscles. Other researchers have reported athletes supplementing with vitamins C and E to enhance their immune system and prevent illness (Froiland, Koszewski, Hingst, & Kopecky, 2004; Neiper, 2005). Overall, the nutrition knowledge deficits identified in the present study confirm that many college athletes lack understanding of the roles of protein, vitamins, and minerals in the body, and thus lack the ability to assess whether their dietary intake of nutrients warrants use of a supplement. Education strategies for sports professionals and athletes should focus on the roles of selected nutrients in exercise, how to obtain adequate dietary intake of the nutrients, and how to evaluate need for nutrient supplementation.

The mean nutrition attitude score was high for both sexes. Seventy-one percent (n = 80) strongly agreed that “Eating healthy foods will improve my athletic performance.” Our findings about positive nutrition-related attitudes are consistent with those of Zawila and colleagues (2003), who reported that runners exhibited positive attitudes regarding nutrition education. College athletes may be receptive to learning how to improve their dietary intake to correct nutrient inadequacies that can impact their sport performance.

The mean diet quality for both males and females was greater than 80%, indicating an overall healthy diet among those surveyed. In regard to mean component scores, males and females alike had high scores (greater than 8) for vitamin A, vitamin C, and calcium. In contrast, mean scores for intake of vitamin E, potassium, fiber, and sodium were low, indicating a need for nutrition education moving dietary intake of these nutrients into line with dietary recommendations.

We found that neither nutrition knowledge nor attitude correlated with dietary intake; knowledge was less than 1% predictive of dietary intake. Conflicting results have been reported for athletes regarding relationships between nutrition knowledge and dietary intake. Wilta and colleagues (1995) found that dietary intake was 27% predictive of nutrition knowledge among runners and thus concluded that runners with greater nutrition knowledge make better food choices. On the other hand, Turner and colleagues (2001) reported that osteoporosis knowledge was only 3% predictive of dairy intake among athletes and thus concluded that, among college athletes, there was no significant correlation between knowledge of osteoporosis and intake of dairy products. In the present study, nutrition-related attitude was only 5% predictive of dietary intake, indicating that attitude about eating to support performance was not the primary influence on dietary intake. In addition, no significant correlations were found between knowledge of specific nutrients and actual dietary intake of the nutrients. While examining these relationships, we identified adequate intake with adequate knowledge (carbohydrate), poor intake with lack of knowledge (vitamin E), and adequate intake with lack of knowledge (protein and vitamin C). As a result of this study's findings, we suggest that future research should explore factors other than nutrition knowledge and attitude that influence dietary intake among college athletes, since knowledge and attitude were not found here to be primary factors impacting dietary intake.

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