Supplements of interest for sport-related injury and sources of supplement information among college athletes

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Abstract

Purpose: This study examined incidence of sport-related injury, interest in supplements to treat injury, and sources of supplement information among 145 college athletes (89 males, 56 females).

Materials and methods: A survey was used to assess sport-related injuries, interest in three categories of supplements to treat injury, and sources of supplement information among college athletes who used athletic training room and weight training facilities. Pearson χ^2 was used to evaluate differences in frequency distribution of responses by sex.

Results: Sport-related injuries were experienced by 91% of athletes (93% males, 88% females). Overall, 17% of participants were interested in supplements to improve circulation, 34% for joint and soft tissue repair, and 22% to reduce inflammation. Significant sex differences were not found for any supplements in any categories evaluated. Males were more likely than females to rely on strength coaches (37%, 20%) for supplement information. Athletic trainers (71% of athletes), coaches (60%), and physicians (41%) were the primary professionals, and the internet (79%), magazines (68%), and television (52%) the most popular sources of media for supplement information.

Conclusions: The majority of athletes experience injury during their college athletic career and 17% to 34% express an interest in supplements for injury treatment. Athletes would benefit from scientifically sound guidance to identify appropriate supplements for injury treatment and internet sites for supplement information. Future research should identify if athletes are more likely to increase supplement use when they are injured or if supplement use is more prevalent among athletes who are prone to injury.

Key words: male, female, circulation, soft tissue, inflammation.

Introduction

Supplements are marketed to athletes to improve health and performance and accelerate the body's recovery from exercise, injury, and the healing process [1-3]. Supplements, also referred to as dietary or nutritional supplements, were defined into law by the Food and Drug Administration in the Dietary Supplement Health and Education Act as substances that are taken by mouth, contain a dietary ingredient that is intended to supplement the diet, and are not represented for use as a conventional food or sole item of a meal or diet [4]. Use of vitamin, mineral, and herbal supplements are a popular practice among adults for nonspecific reasons such as "health" [5]. Among athletes, supplements are reportedly taken to improve athletic performance, build muscle, prevent illness, to provide nutrients that are lacking in the diet, and based on recommendations by sports professionals, family members, and friends [6]. Supplement use among college athletes is a reportedly common practice. For example, Burns and colleagues [7] found that 88% of National Collegiate Athletic Association (NCAA) Division I athletes used one or more supplements and Krumbach and colleagues [6] reported 31% to 83% of college athletes taking supplements.

It has been proposed that injury rate is high among young adult athletes (20 to 24 years old), as compared to younger and older athletes, because training and competition are extremely intense at this age [8]. Among children and young adult athletes, 20 to 24 year olds have the greatest incidence of sport

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Received 11.12.2006 Accepted 19.03.2007

injuries [8]. For team sports, 46% to 59% of injuries occur during competition, whereas for individual sports, 70% occur during training [8]. Furthermore, overuse injuries are common among highly competitive athletes, such as college athletes, due to a combination of factors [9], including high training volume, high training load, and repetition associated with developing, fine-tuning, or changing techniques. Because many college athletes want to quickly recover from sport-related injuries, supplements that are marketed to treat sport-related injury may be of special interest to them.

The specific objectives of this study were to: (a) identify the incidence of sport-related injuries among college athletes, (b) identify if three categories of supplements related to injury treatment, including those marketed to improve circulation, accelerate joint and soft tissue repair, and reduce inflammation, are of interest among college athletes, (c) identify sex differences for supplements of interest, and (d) determine the primary sources of people and media used by college athletes for supplement information. Adapted from the Food and Drug Administration definition of dietary supplements [4], and the descriptions of supplements of Burke [1] and Juhn [3], supplements are defined in this study as amino acids (e.g., L-arginine), herbs (white willow bark), fatty acids (omega-3 fatty acids), food supplements (flax seed), and products with combinations of these substances (joint support supplements) that are marketed by the supplement industry to treat sport-related injury.

Materials and methods

From mid-January through March, 2006, three trained research assistants recruited NCAA Division I athletes and one institution-sponsored sport program (cheerleading) at a single college from athletic training room and athletic weight training facilities that are used exclusively by college student-athletes. The institution is a state university, located in the Southeastern region of the United States, with an undergraduate enrollment of approximately 18,000 students. Research assistants recruited all student-athletes who entered the athletic training room or athletic weight training facility when the research assistant arrived. To diversify our sample, research assistants varied the time of day between 06:00 and 18:00 hour and days of the week during weekdays to recruit participants. In compliance with the university's Institutional Review Board for Research with Human Subjects, athletes were informed of the study protocol. Written informed consent was obtained and those willing to participate completed the self-administered questionnaire.

Overall, 145 athletes completed the study, which represents a 30% participation rate among all student-athletes at the university, as determined by team rosters. There was a 95% participation rate among student-athletes who were invited to participate. Those who declined participation reported not having enough time or not being interested in completing the survey. All university-sponsored non-club sport teams, with the exception of golf, were represented. Football (24% of participants), swimming and diving (13%), track and cross country (12%), soccer (11%), and basketball (6%) were 3% to 6% over-represented as compared to total athletes competing in their respective sport as a student-athlete at the university. Baseball or softball (9% of participants), tennis (3%), and volleyball (3%) were representative of athletes by sport, whereas cheerleading (3% of total participants) was under-represented; 6% of total-student athletes at this university were cheerleaders. Mean (± SD) age of participants was 20 ± 1.4 years. Participation was fairly evenly distributed between lower- and upper-classmen; 48% were 1st- and 2nd-year classmen, whereas the remainder were 3rd-, 4th-, and 5th-year classmen. Sixty-eight percent of participants were non-Hispanic white, 29% were non-Hispanic black, 2% were Asian, Pacific Islander, or Hispanic, and 1% did not indicate their racial origin.

We designed a questionnaire that assessed demographic information, prevalence of sport-related injuries, and supplements that student-athletes expressed interest (had used, were using, or presently considering using) to treat sport-related injury. The questionnaire was developed by a Registered Dietitian after interviews were conducted with three student-athletes who had used supplements to treat sport-related injuries, and a strength coach, all from the university, and two nutrition store employees. The questionnaire was reviewed for content validity by the head athletic trainer, a strength coach, and two student-athletes, all from the university, and two nutrition store employees. To pilot test the survey, eight college student-athletes from various sports completed the questionnaire. Only minor syntax modifications to the questionnaire were necessary, based on their responses. The supplements listed in the final questionnaire contained three categories for injury treatment; supplements to improve circulation, joint or soft tissue repair, and to reduce inflammation. Three to four supplements were listed for each category. Each of the supplements listed were unique to that category, with the exception of methyl-sulfonyl-methane (MSM), which was listed in joint and soft tissue repair as well as to reduce inflammation categories. MSM had a dual-listing because it is marketed by the supplement industry for both of these purposes. Athletes checked the supplements, by category, that they had an interest. The following are the original main questions that elucidated the "interest in three categories of supplements" as stated above:

The following are supplements and diet changes (grouped into areas) that are promoted as preventing or enhancing recovery of sport injuries.

Put a check by all of the following supplements and diet changes you would consider using, have used, or are currently using to prevent or enhance recovery of sport injuries:

Improve circulation

nitric oxide supplement (NO_2 hemodilator); example – Oxylene

L-arginine supplement

alpha-ketoglutarate (AKG) supplement.

Joint or soft tissue repair

glucosamine, chondroitin, and/or methyl-sulfonyl-methane (MSM) supplement

joint support supplements; examples – Triflex, Trivestin, Lubri-Joint, Therajoint, Phosphoplex

***Table 1*. Sport-related Injury Rate of College Student-Athletes by Sex and Academic Classification**

Academic Class	Males (n=89)		Females (n=56)	
	n	% males by academic class reporting injury	n	% females by academic class reporting injury
Freshmen	19 of 21	90%	13 of 15	87%
Sophomore	22 of 23	96%	8 of 10	80%
Junior	10 of 13	77%	13 of 15	87%
Senior	21 of 21	100%	10 of 11	91%
5th-year senior	10 of 10	100%	4 of 4	100%

Note: Academic class was not reported by one male and one female

***Table 2*. Supplements College Athletes Report an Interest to Improve Circulation**

Variable	Frequency "yes" response (%)	χ^2	p (by sex)
Nitric oxide (NO_2 hemodilator)		2.85	.09
Males[a]	17%		
Females[b]	7%		
L-arginine		0.34	.56
Males[a]	8%		
Females[b]	5%		
α-ketoglutarate		<0.01	.95
Males[a]	3%		
Females[b]	4%		

Note: χ^2 = (1, N=145). [a]n=89; [b]n=56

***Table 3*. Supplements College Athletes Report an Interest to Repair Joint or Soft Tissue**

Variable	Frequency "yes" response (%)	χ^2	p (by sex)
Glucosamine, chondroiton, MSM		0.21	.65
Males[a]	25%		
Females[b]	21%		
	Joint support*	0.84	.36
Males[a]	12%		
Females[b]	18%		
S-adenosyl-methionine (Sam-e)		0.34	.56
Males[a]	3%		
Females[b]	5%		
Shark cartilage		0.06	.81
Males[a]	4%		
Females[b]	5%		

Note: χ^2=(1, N=145). [a]n=89; [b]n=56; *Joint support examples included Triflex, Trivestin, Lubri-Joint, Therajoint, and Phospholex; MSM – methyl-sulfonyl-methane

S-adenosyl-methionine (Sam-e) supplement
shark cartilage supplement.

Reduce inflammation
flax seed supplement
increase omega-3 fatty acids in my diet (eating more fish or flax seeds)
methyl-sulfonyl-methane (MSM) supplement
omega-3 fatty acid supplement
white willow bark supplement.

Analyses were performed using JMP IN® software [10]. Descriptive statistics included means, standard deviations, and frequency distributions. Pearson χ^2 was used to evaluate differences in frequency distribution of responses by sex. An alpha level of .05 was used for all statistical tests.

Results

Regarding the first research question, 93% of male (83 of 89) and 88% of female (49 of 56) participants reported injuries from sport participation, which did not differ significantly by sex, χ^2 (1, N=145)=1.36, p=.24, or by academic classification, χ^2 (4, N=143)=5.56, p=.23. Injury incidence ranged 77% to 100% by sex and academic classification, as reported in *Tab. 1*.

Regarding the second and third research questions, 17% of athletes reported an interest in one or more supplements to improve circulation, 34% for joint or soft tissue repair, and 22% to reduce inflammation. By sex, supplements that participants reported an interest to improve circulation are reported in *Tab. 2*, to repair joint or soft tissue are in *Tab. 3*, and to reduce inflammation are in *Tab. 4*. We did not identify significant differences by sex for any supplements in any categories that were evaluated.

***Table 4*. Supplements College Athletes Report an Interest to Reduce Inflammation**

Variable	Frequency "yes" response (%)	χ^2	p (by sex)
	Flax seed	0.15	.69
Males[a]	9%		
Females[b]	7%		
Methyl-sulfonyl-methane (MSM)		0.41	.52
Males[a]	12%		
Females[b]	9%		
	Omega-3 fatty acids	< 0.01	.99
Males[a]	9%		
Females[b]	9%		
	White willow bark	0.23	.64
Males[a]	2%		
Females[b]	4%		

Note: χ^2 = (1, N=145). [a]n=89; [b]n=56

Finally, regarding the fourth research question, both males and females solicited supplement information most frequently from athletic trainers (73% of males, 70% of females), coaches (62%, 57%), and physicians (40%, 43%). Males (37%) were more likely than females (20%) to rely on strength coaches for supplement information, χ^2 (1, N=145)=4.94, p=.03. The most popular sources of media for supplement information included the internet (84%, 75%), magazines (70%, 67%), and television (50%, 53%). Females (23%) were more likely than males (9%) to rely on texts for supplement information, χ^2 (1, N=145)=5.62, p=.02.

Discussion

As the interest in sports nutrition has increased, so have the sales of supplements to improve performance and promote recovery [11]. We found that the majority of athletes had experienced sport-related injuries, and similar to others [6-7], that use of a variety of supplements is a popular practice among college athletes. Burns [7] reported that among NCAA Division I athletes, 73% used vitamins and minerals, 22% used herbs, 40% used protein supplements, and 31% used creatine. Krumbach and colleagues [6] reported a vitamin and/or mineral supplement use range of 20% to 86% among college athletes. The most popular research regarding supplement use among athletes focus on nutrients that may be lacking in the diet (calcium and iron among females), to meet the demands of exercise (vitamins, minerals), and those that promote muscle anabolism (protein and creatine). This is the first study to investigate supplements that are marketed to treat injury among college athletes. We found that 3% to 17% of college athletes were interested in supplements that are marketed to improve circulation, 3% to 25% for supplements that repair joints or soft tissues, and 2% to 12% for supplements that reduce inflammation. It is of interest that some supplements, such as glucosamine, chondroiton, MSM, and joint support supplements, have a moderate interest among college athletes, considering the finding that college athletes have low perceived benefits for use of supplements to promote healing [7]. Further research should investigate the motivation for use of supplements for injury among competitive, young adult athletes. More specifically, if supplement use is more prevalent among athletes who are frequently injured, have injuries that require an extended recovery time, and feel pressure or desperation to recover quickly or prevent future injury.

Of the three categories that we evaluated, joint and soft tissue repair was the most popular category that both sexes had an interest to supplement. In contrast to Froiland and colleagues [12], we did not identify significantly different sex differences for supplements of interest to improve circulation, repair joint or soft tissue, or reduce inflammation. These findings suggest that sports professionals should refrain from stereotyping supplement use by sex. Additionally, sport professionals should be aware that the supplements promoted to treat injury are of at least moderate interest among college student-athletes. Therefore, efforts should be directed toward educating athletes about legal supplements that may promote injury treatment.

Of concern with the growing interest of supplement use among athletes is that many supplements contain NCAA banned substances [14]. The NCAA reported that the primary substances in positive drug tests have been over-the-counter nutritional supplements that contain ephedrine and androstendione [14]. Bents and Marsh [15] reported that 52% of American college hockey athletes from a single conference reported using stimulants before games or practice sessions, and 49% reported using the NCAA banned drug ephedra on at least one occasion to improve performance. The NCAA banned drug classes include substances generally reported to be performance enhancing and potentially harmful to the health and safety of the student-athlete [16]. Further, the US Food and Drug Administration does not strictly regulate the supplement industry, thus the purity of supplements on the market is not guaranteed [13]. Student-athletes who use impure supplements may present with a positive drug test. Thus, the student-athlete should educate themselves about the supplements they choose to take, as ultimately, it is the individual student-athletes responsibility to have a clean drug test, no matter the complexity of the supplement label they have taken [16].

Burns and colleagues [7] reported that 40% of NCAA Division I athletes use athletic trainers, 24% use strength coaches, and 14% use dietitians as primary sources of nutrition information. Krumbach and colleagues [6] reported that 25% of males and 29% of females reported taking supplements due to recommendations of coaches or trainers. Froiland and colleagues [12] reported family members (used by 32%) and fellow athletes (32%) were the most popular sources of nutrition information in their study, and identified sex differences; females were more likely to obtain nutrition information from family members, whereas males relied on store nutritionists, fellow athletes, friends, and coaches. We reviewed sources of people as well as media, and found that males were more likely to rely on their strength coach, whereas females to use texts for supplement information. Both sexes used a variety of sources for supplement information. The most popular people, in addition to strength coaches, included athletic trainers, coaches, physicians, friends and relatives, and nutrition store personnel. Because supplements pose both benefits and risks to athletes [2], and because many athletes rely on the recommendations of coaches and athletic trainers [6], it is important that sports professionals are fully informed of when taking a supplement may pose an advantage or would be contraindicated for athletes whom they work, particularly among those athletes who are most susceptible to injury. Shifflett, Timm, and Kahanov [17] surveyed athletes, coaches, and athletic trainers at NCAA Division I, II, and III programs and found that athletic trainers scored highest on the knowledge test than any other group. Athletes may benefit from scientifically sound supplement information from professionals who are knowledgeable in this area. Furthermore, the most popular media sources used for supplement information by the college athletes included the internet, magazines, the television, texts, and journals. Further research is needed to identify if student athletes recognize legitimate and scientifically sound sources of nutrition information, and how susceptible they are to use supplements that impair health and/or contain NCAA banned drugs [13].

Acknowledgments

This research was supported in part by an undergraduate research assistantship, East Carolina University Honors Program. The researchers would like to thank Maria Montesano and Lisa Schumaker for their assistance with data acquisition.

References

1. Burke ER. Better Nutrition 2000 Sports Supplement Guide. Better Nutrition, 2000; 62: 52-7.

2. Grandjean AC, Ruud JS. Dietary supplements and athletics. Current Opinion in Orthopedics, 2002; 13: 122-7.

3. Juhn MS. Popular sports supplements and ergogenic aids. Sports Medicine, 2003; 33: 921-39.

4. United States Food and Drug Administration. Retrieved July 29, 2006 from http://www.cfsan.fda.gov/~dms/ds-oview.html#what

5. Kaufman DW, Kelly JP, Rosenberg L, Anderson TE, Mitchell AA. Recent patterns of medication use in the ambulatory adult population of the United States: the Slone study. Journal of the American Medical Association, 2002; 287: 337-44.

6. Krumbach CJ, Ellis DR, Driskell JA. A report of vitamin and mineral supplement use among university athletes in a Division I institution. International Journal of Sport Nutrition, 1999; 9: 416-25.

7. Burns RD, Schiller MR, Merrick MA, Wolf KN. Intercollegiate student athlete use of nutritional supplements and the role of athletic trainers and dietitians in nutrition counseling. Journal of the American Dietetic Association, 2004; 104: 246-9.

8. Kujala UM, Taimela S, Antti-Poika I, Orava S, Tuominen R, Myllynen P. Acute injuries in soccer, ice hockey, volleyball, basketball, judo, and karate: analysis of national registry data. British Medical Journal, 1995; 311: 1465-8.

9. Sperryn PN. Overuse injury in sport. British Medical Journal, 1994; 308: 1430-5.

10. Sall J, Creighton L, Lehman A. JMP® Start Statistics. 3rd ed. Southbank, Australia: Thomson Brooks/Cole; 2005.

11. Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine. Nutrition and athletic performance. Journal of the American Dietetic Association, 2000; 100: 1543-56.

12. Froiland K, Koszewski W, Hingst J, Kopecky L. Nutritional supplement use among college athletes and their sources of information. International Journal of Sport Nutrition and Exercise Metabolism, 2004; 14: 104-21.

13. NCAA banned drug-classes. Retrieved March 16, 2007, from http://www1.ncaa.org/membership/ed_outreach/health-safety/drug_testing/banned_drug_classes.pdf

14. Carlon P. Mystery over supplements exposes users to risk. Ignorance of banned substances no excuse. NCAA News, 15 April 2002: A1-A2.

15. Bents RT, Marsh E. Patterns of ephedra and other stimulant use in collegiate hockey athletes. International Journal of Sport Nutrition and Exercise Metabolism, 2006; 16: 636-43.

16. Johnson G. Understand banned. NCAA News, 29 August 2005; 5, 12.

17. Shifflett B, Timm C, Kahanov L. Understanding of athletes' nutritional needs among, athletes, coaches, and athletic trainers. Research Quarterly for Exercise and Sport, 2002; 73: 357-62.