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Sports Nutrition Knowledge of Certified Athletic Trainers

Original Research

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Abstract

Introduction: The purpose of this study was to determine the sports nutrition knowledge of certified athletic trainers (ATs) using the Sports Nutrition Knowledge Survey (SNKS).

Methods: One hundred fifty-five college students, 30 ATs and 14 credentialed sports nutrition experts all completed the SNKS.

Results: The SNKS demonstrated very high test-retest reliability ($r = 0.91$, $p < 0.01$). There was no significant difference between the average scores of the ATs and post-nutrition course group (60.8 vs. 59.2; $p = 0.78$; Hedges' $g = 2.15$), while they were significantly greater than the average score for the elementary education group ($p < 0.01$; Hedges' $g = 2.10$). Nutrition experts scores were significantly greater than elementary education ($p < 0.01$; Hedges' $g = 3.80$), ATs ($p < .01$; Hedges' $g = 1.17$) and post-nutrition course ($p < 0.01$; Hedges' $g = 1.54$) groups.

Conclusions: Results indicated ATs demonstrated sports nutrition knowledge consistent with the required competencies for licensure, yet their knowledge does not exceed that of undergraduate kinesiology students. However, with the shift in the athletic training degree level to a master's degree from a bachelor's degree this may be an opportunity to place more emphasis on nutrition when creating degree requirements.

Key Words: Education, Survey Development, Performance Nutrition

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Introduction

Over the past two decades researchers have documented the benefits of nutrition as it relates to optimal athletic performance. Further, the American College of Sports Medicine (ACSM), the Dieticians of Canada (DC), and the American Dietetic Association (ADA) in a joint position statement reported that physical activity, athletic performance, and recovery from exercise are improved by optimal nutrition.[1,2] Moreover, it's important to consider that if athletes had greater access to nutritional knowledge, and put this into practice, they could improve dietary intake and potentially enhance performance. A concern, however, is how sports nutritional knowledge is assessed and whether or not those who administer nutrition advice to athletes are knowledgeable enough to do so.

Much research has been conducted in the area of general nutrition knowledge[3-13], but few studies have focused on *sports* nutrition knowledge.[14-15] Further, prior research has determined coaches and certified ATs lack appropriate *general* nutritional knowledge yet these groups have been listed as the top two sources of nutritional information in many studies.[8-10,16-18] However, few studies have been conducted on the *sports* nutrition knowledge of ATs. There are 18 competencies in the National Athletic Trainers' Association (NATA) guidelines that relate to nutrition for athletes. These include categories such as general nutrition, weight management and body composition, disordered eating, and performance enhancing substances. Also, ATs are a group of professionals who are routinely sought after as a source of nutrition information and they spend much of their day working with athletes.[8-10,13-18] Therefore, the purpose of our study was to determine the sports nutrition knowledge of ATs using the Sports Nutrition Knowledge Survey (SNKS).

Methods

Participants

Permission to conduct this study was granted by the University of South Alabama Institutional Review Board. One hundred ninety-nine participants completed the study (129 kinesiology students, 26 elementary education students, 30 ATs and 14 sports nutrition experts). Student participants completed the survey in person and were informed that participation was voluntary, and results would remain confidential. Nutrition experts (persons having a registered dietitian credential, sports nutrition certification, or a graduate degree in a sports nutrition-related field) and ATs completed the survey online through Qualtrics. Researchers asked nutrition experts and ATs to complete the survey without using the aid of any outside sources including: notes, textbooks, internet, search engines, other colleagues or professionals. Descriptive statistics are displayed in Tables 1-3.

Table 1. Demographic characteristics of nutrition education students.

Variable		n	%
Gender			
	Male	61	47.3
	Female	64	49.6
	Missing	4	3.3
Race			
	African American	46	35.7
	White	75	58.1
	Other	8	6.2
GPA range			
	1.0-1.9	2	1.6
	2.0-2.9	60	46.5
	3.0-4.0	66	51.2
	Missing	1	0.8

Note. n= 129

Table 2. Demographic characteristics of the elementary education students.

Variable		n	%
Gender			
	Male	2	7.7
	Female	24	92.3
Race			
	African American	10	38.5
	White	15	57.5
	Hispanic	1	3.8
College Nutrition course taken			
	Yes	12	46.2
	No	14	53.8
GPA range			
	2.0-2.9	9	34.6
	3.0-4.0	17	65.4

Note. n = 26

Table 3. Demographic characteristics of the athletic trainers.

Variable		n	%
Race			
	African American	1	3.3
	White	29	96.7
Highest degree obtained			
	Bachelor of Science	22	73.3
	Master's Degree	6	20
	Doctoral	2	6.7
Number of college nutrition courses taken			
	0	2	6.7
	1	11	36.7
	2	9	30
	≥3	8	26.7

Note. n = 30

Protocol

This study utilized a cross-sectional design to compare sports nutrition knowledge between ATs, college students, and nutrition experts. Researchers also implemented an educational intervention to determine if the SNKS could detect change in sports nutrition knowledge. First, researchers examined measures of both *general* and *sports* nutrition knowledge in order to develop the SNKS instrument. Parmenter and Wardle[3] developed a general knowledge questionnaire that has been used many times in research studies for athletes and non-athletes. This is important because sports nutrition has become a specialty area in the field of nutrition. Sports nutrition is defined as the application of nutritional knowledge to daily food consumption focused on providing energy for physical activity and facilitating the repair and rebuilding processes while promoting overall wellness and optimizing athletic performance.[21]

Previously Developed Sports Nutrition Knowledge Instruments

Zinn[20] is one of the few researchers to develop a questionnaire to specifically measure sports nutrition knowledge. This questionnaire was developed in New Zealand and the aim of the questionnaire was to measure nutrition concepts as they related to sports performance.[14] The questionnaire contained five sections (general nutrition concepts, fluid, recovery, weight control, and supplements) and was scored out of a possible score of 84. More recently, Torres-McGehee et al.[15] developed an instrument to assess sports nutrition knowledge among collegiate athletes, coaches, ATs, and strength and conditioning specialists. The instrument was a 20 question multiple choice sports nutrition questionnaire categorized into four domains of sport: micronutrients and macronutrients, supplements and performance, weight management, and eating disorders. Researchers noted that, "All domains were weighted equally during scoring and percentages were determined by the number of incorrect answers divided by 20".[15(p.206)] It was determined participants who scored 75% or higher on the instrument had "adequate" sport nutrition knowledge while those with a score lower than 75% had "inadequate" nutrition knowledge.[15] However, only construct validity was established by 12 professionals in the field for the instrument used but no reliability results were reported.[15]

Many of these general and sports nutrition knowledge surveys or questionnaires were developed outside of the United States which poses problems that can fall to semantics. The vernacular is different in the United Kingdom and New Zealand so most Americans may not necessarily understand wording used on these instruments. Further, many of the nutrition knowledge surveys or questionnaires vary

considerably in length. That is, some surveys contained as many as 100 questions where others had only 20 questions.

Researchers in this study examined the types of knowledge measured on these questionnaires. Knowledge is often described based on two components. First, *declarative* knowledge is defined as facts about things. Second, *procedural* knowledge is knowledge about the way actions are performed.[19] An example of declarative knowledge is the number of kilocalories per gram of fats, carbohydrates, and proteins while an example of procedural knowledge is knowing how to choose healthier carbohydrates for the pre-competition meal. Some of the questionnaires developed to measure nutritional knowledge have only addressed declarative knowledge [4] while others have addressed both knowledge components.[3,5-7,21]

Moreover, Trakman, Forsyth, Devlin, and Belski[16] conducted a systematic review of the literature and examined studies that sought to determine the nutritional knowledge of athletes. They searched for quality instruments to assess nutrition knowledge. After searching MEDLINE, CINAHL, SCOPUS, SPORTDiscus, and Web of Science, searching through articles by hand, and removing duplicate and irrelevant records researchers had 36 studies that provided a quantitative measure of nutrition knowledge (general and sports nutrition knowledge). After a detailed review of these studies including reliability, validity, and comprehensiveness of the instrument used, researchers concluded a new and more up-to-date measure of sports nutrition knowledge is greatly needed.[16]

Current researchers developed a sports nutrition knowledge survey based on current nutritional guidelines created by leading organizations in the field of nutrition to measure the nutritional knowledge of athletes, ATs, coaches, and other professionals in the field. This was needed because of the current emphasis being placed on evidence-based studies rather than anecdotal observations or experiences in the field of sports nutrition.[21]

Sports Nutrition Knowledge Survey (SNKS) Development

Researchers developed a question pool that represented five areas of nutrition including general nutrition, hydration, competition nutrition (pre, during, and post), dietary supplements, and weight control (See Appendix A). These content areas were selected based upon prior research studies.[14-16,20] Further, questions were designed to test the knowledge of all areas of nutrition related to sports nutrition and were based on nutritional information from the Dietary Guidelines for Americans[22], the ISSN Guidelines,[23-24] and the ACSM position stands on "Nutrition and Athletic Performance"[2] and "Exercise and Fluid Replacement".[25] The general nutrition questions focused on micronutrients, macronutrients, and alcohol. Hydration questions focused on dehydration, rehydration and electrolytes while competition nutrition focused on pre-competition, during competition, and post competition nutrition in terms of timing of meals, snacks, and beverages as well as predominant macronutrient intake in each of the areas (pre, during, and post). Dietary supplement questions focused on creatine, caffeine, and protein which are common supplements used by many athletes. Weight control questions focused on healthy weight gain and weight loss strategies as well as distinguishing between nutrient- and calorie-dense foods.

This original question pool was 90 questions and was narrowed to the final question pool of 60 questions after content and face validity analysis (See Figure 1). The maximum score on the SNKS is 85 since some questions had a subset of related questions. Scores on the instrument were determined by participants receiving +1 for questions answered correctly while incorrect responses and questions answered "unsure" were given a score of 0. Maximum scores on each of the sections of the survey were: General Nutrition (41), Hydration (9), Competition (pre, during and post) Nutrition (17), Supplements (8), and Weight Control (10). Based on prior research studies, researchers determined an "adequate" score on the SNKS was 70% or higher while scores below 70% was "inadequate".[15,20]

Statistical Analysis

The original question pool on the SNKS was sent to five professionals in the fields of healthcare and nutrition [an NATA certified AT, a certified strength and conditioning specialist (National Strength and Conditioning) with a second certification as a certified sports nutritionist (ISSN), a licensed sports medicine physician, and two professors with doctoral degrees in the field of kinesiology and nutrition].

Four of the five professionals had at least seven years of experience in working in their field (M=12.6 years). Professionals reviewed all questions on the survey for clarity, relevance, and factuality. The AT was chosen specifically to evaluate the clarity of questions because of the known target audience for the study. This process was used to determine face and content validity for the instrument[26] and led to changes in the survey questions. Once questions were changed, omitted, or re-worded, the final instrument of 60 questions was developed.

To determine test-retest reliability of the SNKS, the SNKS was administered to a group of 44 college students on two separate occasions separated by one week. Data from each of the two tests were analyzed for test-retest reliability using an intraclass correlation. As a measure of construct validity, the SNKS was administered to a sample of 85 college students before and after a *general* and *sports*-related nutrition course and paired-samples *t* tests comparing pre- and post-scores were utilized to determine if the participants performed better on the SNKS after receiving formal nutrition education. Additionally, researchers administered the SNKS to a group of 26 undergraduate college students majoring in elementary education in order to confirm the SNKS' ability to discriminate varying degrees of sports nutrition knowledge. The SNKS was also taken by 30 ATs, and 14 sports nutrition experts. A discriminant analysis between the elementary education majors, the ATs, the college students who received nutrition education (post-test scores from the construct validity assessment above), and the sports nutrition experts was performed utilizing a one-way ANOVA with Tukey post-hoc analysis. All data were analyzed using IBM SPSS Statistics for Windows version 23.0.

Results

Of the 155 college students surveyed, 87.1% (n=135) indicated they were not currently on a college athletic team, 12.3% (n=19) indicated they were currently a student-athlete at their college, and one participant failed to answer this question. Moreover, the age range of the college students who completed the SNKS was 19-47 years (M= 21.5). Table 2 displays the descriptive statistics for the 26 students majoring in elementary education that were used in the discriminate analysis; Table 3 includes the descriptive stats for ATs. Sports nutrition experts were asked where they obtained their highest degree and 12 (85.7%) indicated they received it from a college in the United States while two received their highest degree from outside of the United States (Ireland and Switzerland). In terms of SNKS scores, the range of scores for sports nutrition experts was 53-84 out of a maximum score of 85 (M=71.3, 83.9%).

The SNKS demonstrated very high test-retest reliability (r = 0.91, $p < 0.01$). The nutrition course intervention also resulted in significantly higher test scores for the post-test in comparison to the pre-test ($p < 0.01$; Cohen's d = 1.18), demonstrating the ability of the instrument to detect changes in sport nutrition knowledge. On average, these students improved from a pre-test score of "inadequate" (59%) to a passing score of 70% after taking the nutrition course. Discriminant analysis using one-way ANOVA revealed a significant difference between the nutrition expert, ATs, elementary education, and nutrition education post-intervention groups ($F(3, 131) = 43.37$, $p < 0.01$, partial $\eta^2 = 0.50$). Post-hoc analyses determined the average score for the nutrition expert group to be significantly greater than the average scores for the elementary education ($p < 0.01$; Hedges' g = 3.80), ATs ($p <.01$; Hedges' g = 1.17) and post-intervention ($p < 0.01$; Hedges' g = 1.54) groups. There was no significant difference between the average scores of the ATs and post-intervention group (60.8 vs. 59.2; p = .78; Hedges' g = 2.15), while they were significantly greater than the average score for the elementary education group ($p < .01$; Hedges' g = 2.10). Among the different domains of the survey, the sports nutrition experts scored significantly higher than all other groups with the exception of the hydration and weight control sections (two of the smaller question pools). In every domain, the elementary education majors scored significantly lower than all three of the other groups, with the exception of weight control where their scores were not significantly different than those of the nutrition education students. A summary of the domain analysis scores is included in Table 4.

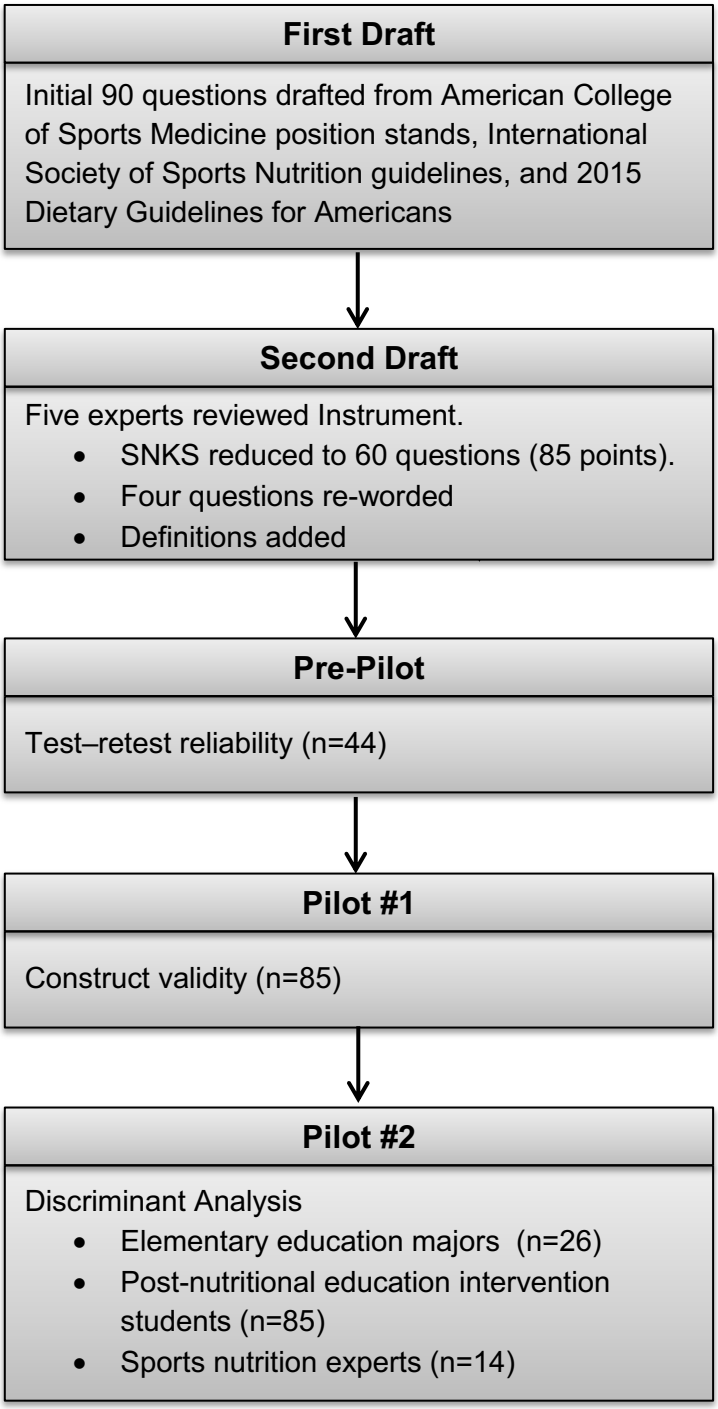

Figure 1. Summary of steps for development of the Sports Nutrition Knowledge Survey

Table 4. Survey results of specific survey domains.

Domain	Elementary Education (n=26)	Nutrition Education (n=85)	Athletic Trainers (n=30)	Sports Nutrition Experts (n=14)
General Nutrition	21.2±3.1	28.5±4.6[a]	28.1±5.4[a]	33.7±5.0[a,b,c]
Hydration	4.7±1.5	6.5±1.3[a]	6.5±1.5[a]	7.3±1.5[a]
Training Nutrition	7.9±2.5	12.0±2.4[a]	13.0±2.3[a]	15.2±1.4[a,b,c]
Dietary Supplements	3.7±1.6	5.2±1.3[a]	6.0±1.2[a,b]	7.2±0.8[a,b,c]
Weight Control	6.0±1.8	7.0±1.6	7.3±1.5[a]	7.9±1.8[a]
Total Scores	43.6±6.6	59.2±7.7[a]	60.8±9.1[a]	71.3±8.5[a,b,c]

Notes: Data presented are Means ± SD; [a]Scores significantly greater than elementary education ($p < 0.05$); [b]Scores significantly greater than nutrition education students ($p < 0.05$); [c]Scores significantly greater than ATs ($p < 0.05$)

Discussion

Results of the current study indicate these ATs did not demonstrate more sports nutrition knowledge than undergraduate kinesiology students. This is concerning since ATs have been identified as a top source of nutrition information for athletes throughout the literature.[8-10,16-18] However, with the shift in the athletic training degree level to a master's degree from bachelor 's degree researchers believe this is an opportunity to place more emphasis on sports nutrition when creating degree requirements. Nutrition could be emphasized as a single course or in multiple courses in the program of study. Not only could the master's programs in athletic training include declarative nutrition knowledge, but they should incorporate procedural sports nutrition knowledge in order to help ATs apply the information to their specific sports and athletes.

Since program directors overseeing the master's programs perceive students at the master's level possess greater maturity and commitment to the profession[24], this may also translate into a deeper appreciation and understanding of nutrition's impact on athletic performance, recovery, and overall health. Further, adding more nutrition (*general* and *sports*) content to the program could also make ATs more marketable to schools that do not have a certified sports nutritionist on staff. While their sports nutrition education knowledge may have been sufficient to pass the competencies associated with their licensure exam, the results of this study indicate that continuing education in sports nutrition may be necessary. Since continuing education requirements are meant to ensure, "ATs continue stay on the cutting edge in the field of athletic training",[27] then greater knowledge of the essential nutrients and their impact on training and injury prevention would certainly place ATs at the forefront of knowledge in their field.

Prior research has determined the lack of nutrition knowledge and the lack of appropriate nutritional guidance and information sources for coaches and athletes.[11-13,28] Further, Trakman, Forsyth, Devlin, and Belski[13] review of the literature on the quality of nutrition knowledge instruments and indicated a new, more up-to-date- instrument was needed in the measurement of nutritional knowledge. Therefore, special attention was paid by researchers to develop and utilize a nutrition knowledge survey focused specifically on sports nutrition knowledge. Further, a main criticism of prior instruments was that they were outdated in terms of "consensus recommendations".[16] The SNKS was developed using current nutritional guidelines created based upon information and recommendations from leading organizations in the field of nutrition (Dietary Guidelines for Americans, ACSM Position Stands, and the ISSN). Therefore, the development of this 60-item sport nutrition knowledge survey has many potential applications such as to measure the sport nutrition knowledge of athletes, coaches, ATs, registered dieticians (RDs) and any other individuals who require this type of knowledge. Moreover, this instrument could be used with athletes at many levels of competition such as recreational, collegiate, elite, and masters level athletes. Interestingly, Trakman, Forsyth, Devlin, and Belski[16] in their systematic

review noted they did not find a study that measured the sport nutrition knowledge of elite North American athletes. Therefore, this would be certainly an area of future research using the SNKS.

Media-Friendly Summary

The sports nutrition knowledge of certified athletic trainers (ATs) was determined using the Sports Nutrition Knowledge Survey (SNKS) developed by researchers. The survey measures knowledge in the following areas of sports nutrition: general nutrition, hydration, competition (pre, during and post) nutrition, supplements, and weight control. Results indicated ATs demonstrated sports nutrition knowledge consistent with the required competencies for licensure, yet their knowledge does not exceed that of undergraduate kinesiology students. With the current shift in the athletic training degree level to a master's degree from a bachelor's degree, this may be an opportunity to place more emphasis on nutrition when creating degree requirements.

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Appendix A. Sports Nutrition Knowledge Survey (SNKS)

General

1. Do you think the following foods are high or low in saturated fats?

Food	High	Low	Unsure
Boneless, skinless chicken breast			
Coconut Oil			
Canola Oil			
Pork			
Cheese			

2. Do you think the following are high or low in cholesterol?

Food	High	Low	Unsure
Vegetable Oil			
Peanut Butter			
Chicken, dark meat with skin			
Turkey			
Potato Chips			

3. Do you think the following are high or low in carbohydrates?

Food	High	Low	Unsure
Whole Grain Products			
Fruit			
Chicken and Fish			
Brown Rice			
Pork			

4. Do you think the following are high or low in protein?

Foods	High	Low	Unsure
Legumes (e.g. kidney beans, black beans, white beans, lentils)			
Soy Products			
Eggs			
Bananas			
Carrots			

5. Do you think the following foods are nutrient dense?

Nutrient dense is defined as a characteristic of food and beverages that provides vitamins, minerals and other substances that contribute to adequate nutrient intakes or may have positive health benefits with little or no solid fats and added sugars, refined starches and sodium.

Food	Yes	NO	Unsure
Fruits			
Vegetables			
Eggs			
Beans and Peas			
Unsalted Nuts and Seeds			
Whole Grains			

6. Do you think the following contain or are considered natural or added sugars?

Source	Natural Sugar	Added Sugar	Unsure
Flavored Water (Vitamin Waters)			
Fruit			
Milk			
Corn Sweetener			
High Fructose Corn Syrup			

7. Fats yield _____ kilocalories per gram.
    a. 4
    b. 5
    c. 7
    d. 9

8. Carbohydrates yield _____ kilocalories per gram.
    a. 4
    b. 5
    c. 7
    d. 9

9. Proteins yield _____ kilocalories per gram.
    a. 4
    b. 5
    c. 7
    d. 9

10. Alcohol yields _____ kilocalories per gram.
    a. 4
    b. 5
    c. 7
    d. 9

11. Moderate alcohol consumption is defined as up to _____ per day in women and up to _____ for males.
    a. 0; 1
    b. 1;2
    c. 2;3
    d. 3;4

12. High risk (binge) drinking is _____ or more drinks on any day or _____ or more drinks consumed per week for **women**.
    a. 4;6
    b. 4;8
    c. 6;8
    d. 5;15

13. High risk (binge) drinking is _____ or more drinks on any day or _____ or more drinks consumed per week for **men**.
    a. 4;6
    b. 4;8
    c. 6;8
    d. 5;15

14. It is recommended that Americans consume less than _____percent of kilocalories per day from added sugars (sugars that do not naturally occur in the food item and are added during food preparation.
    a. 5
    b. 10
    c. 15
    d. 20

15. It is recommended that Americans consume less than _____percent of kilocalories per day from saturated fats.
    a. 5
    b. 10

c. 15
d. 20

16. It is recommended that Americans consume less than _____ milligrams (mg) of sodium per day.
    a. 1700
    b. 2000
    c. 2300
    d. 2600

Hydration

17. The percentage of carbohydrate in a sports drink should be?
    a. 2-4%
    b. 4-8%
    c. 8-10%
    d. > 10%

18. Fluid deficits of _____ % and higher of body weight can affect athletic performance.
    a. 2
    b. 4
    c. 6
    d. 8

19. Every pound lost during exercise should be replaced with ____ to _____ cups of fluid for rehydration.
    a. 0-1
    b. 2-3
    c. 4-5
    d. 6-7

20. Which is the most appropriate fluid to consume **during** a two-hour training session?
    a. Water
    b. Sports drink (i.e Gatorade or Powerade)
    c. 100% fruit juice
    d. Monster energy drink

21. Rehydration strategies should **mainly** involve the consumption of water and sodium at a modest rate.
    a. Agree
    b. Disagree
    c. Unsure

22. Weighing athletes before and after training and competition would be good way to determine rehydration needs?
    a. Agree
    b. Disagree
    c. Unsure

23. Urine of a pale yellow color is a sign the athlete is dehydrated.
    a. Agree
    b. Disagree
    c. Unsure

24. The key electrolytes include sodium, potassium and chloride.
    a. Agree
    b. Disagree
    c. Unsure

25. The primary beverages that should be consumed daily are water, fat-free and low fat milk, and 100% juices.
    a. Agree
    b. Disagree
    c. Unsure

Training and Competition (Pre, During, Post)

PRE

26. The pre-competition meal should be filled with quality carbohydrates (foods and beverages).
    a. Agree
    b. Disagree
    c. Unsure

27. The pre-competition meal that includes foods high in fiber/fat/and protein may need to be avoided to reduce the risk of gastrointestinal issues during the event.
    a. Agree
    b. Disagree
    c. Unsure

28. Foods that are low glycemic index foods may provide a more sustained source of energy for training and competition situations where carbohydrates cannot be consumed during exercise.
    a. Agree
    b. Disagree
    c. Unsure
29. Carbohydrate loading involves consuming quality carbohydrates such as whole wheat grains, brown rice, etc. the 12-16 hours prior to competition.
    a. Agree
    b. Disagree
    c. Unsure

30. Carbohydrate loading provides to the **greatest** benefit to athletes who are competing continuously for 60 to 90 minutes or longer.
    a. Agree
    b. Disagree
    c. Unsure

DURING

31. Sports drinks and diluted 100% juices (i.e. ½ water and ½ juice) are good choices during training and competitions that last longer than 60 minutes.
    a. Agree
    b. Disagree
    c. Unsure

32. Opportunities to consume beverages and foods vary according to the rules and nature of each sport.
    a. Agree
    b. Disagree
    c. Unsure

33. Liquid and solid forms of carbohydrate can be consumed during training and competition.
    a. Agree
    b. Disagree
    c. Unsure

34. Ingestion of cold beverages of 33 degrees Fahrenheit may help reduce core temperature and therefore improve performance in the heat.
    a. Agree
    b. Disagree
    c. Unsure

35. Overdrinking fluids in excess of sweat and urinary losses is the main cause of hyponatremia (water intoxication).
    a. Agree
    b. Disagree
    c. Unsure

36. Individual differences are seen in fluid consumption and sweat rates during sport, and result in a range in fluid status (dehydration to over-hydration).
    a. Agree
    b. Disagree
    c. Unsure

37. Competition nutrition should target specific strategies that reduce or delay factors that would otherwise cause fatigue in sport and these factors are specific to the sport or event, the environment in which the competition is taking place, and the individual athlete.
    a. Agree
    b. Disagree
    c. Unsure

POST

38. Glycogen stores can be normalized with _____ hours of adequate fuel intake and reduced training.
    a. 6
    b. 12
    c. 16
    d. 24

39. The most important nutrient to replace after a one hour aerobic training session is:
    a. Carbohydrate
    b. Fat
    c. Protein
    d. Vitamins

40. Consumption of milk-based protein after resistance exercise is effective in increasing muscle strength and favorable changes in body composition.
    a. Agree
    b. Disagree
    c. Unsure

41. Protein consumption post training and competition leads to accelerated recovery in athletes.
    a. Agree
    b. Disagree
    c. Unsure

42. Binge drinking may indirectly affect recovery goals of an athlete such as rehydration.
    a. Agree
    b. Disagree
    c. Unsure

Supplements

43. If a manufacturer of a supplement claims their supplement is "100% pure", "pharmaceutical grade", "free of banned substances" or a "Natural Health Product" then it is safe for an

NCAA athlete to consume because the supplement does not contain any substance banned by the NCAA.

a. Agree
b. Disagree
c. Unsure

44. Caffeine is not a nutrient; rather it is a dietary component that functions in the body as a stimulant.
    a. Agree
    b. Disagree
    c. Unsure

45. People who mix alcohol with caffeinated drinks may drink more alcohol and become more intoxicated thus increasing their risk of adverse alcohol-related events.
    a. Agree
    b. Disagree
    c. Unsure

46. Protein supplement recommendations should be conservative and primarily focused on optimizing recovery and adaption to training.
    a. Agree
    b. Disagree
    c. Unsure

47. Chronic use of creatine monohydrate has detrimental effects (i.e. dehydration and kidney distress) on otherwise healthy individuals.
    a. Agree
    b. Disagree
    c. Unsure

48. Research suggests that creatine monohydrate is an effective nutritional supplement for increasing high-intensity exercise capacity and lean body mass during training.
    a. Agree
    b. Disagree
    c. Unsure

49. Creatine and caffeine are considered ergogenic aids (ie. substances that can enhance athletic performance).
    a. Agree
    b. Disagree
    c. Unsure

50. Which if the following energy drink ingredients contains caffeine?
    a. Guarana
    b. Vinpocetine
    c. L-Tyrosine
    d. Gingko Biloba

Weight Control

If an athlete was trying to **gain weight** and had the options below to choose from for a mid-morning snack, which of the two choices should they choose for each of the 5 questions below? **(Circle one of the two)**

51. ½ cup Strawberries **OR** 1 tbsp Peanut butter

52. 8 Baby Carrots **OR** 1 oz Roasted Almonds

53. 8 oz Orange Juice (100%) **OR** 8 oz Skim Milk

54. 3 Fig Bars **OR** 1 slice 100% Whole Wheat Toast

55. 8 oz Plain Yogurt **OR** 8 oz Strawberry Yogurt

56. Purposeful dehydration to "make weight" is a safe way to lose weight.
    a. Agree
    b. Disagree
    c. Unsure

57. Managing calorie intake is fundamental to achieving and maintaining calorie balance (which is the balance between the kilocalories taken in and the kilocalories expended from metabolic processes and physical activity).
    a. Agree
    b. Disagree
    c. Unsure

58. Replacing sugars with high-intensity sweeteners may reduce calorie intake in the short term yet, they may not be a long-term weight management solution.
    a. Agree
    b. Disagree
    c. Unsure

59. Increased meal frequency results in greater resting metabolic rate.
    a. Agree
    b. Disagree
    c. Unsure

60. Considerable evidence suggests that a healthy diet and regular physical activity can help improve health and reduce the risk of certain chronic diseases.
    a. Agreed
    b. Disagree
    c. Unsure