NUTRITION COMPETENCY OF CERTIFIED ATHLETIC TRAINERS

A Thesis

Presented to

The Graduate Faculty of The University of Akron

In Partial Fulfillment

of the Requirements for the Degree

Master of Science, Nutrition and Dietetics

Laura M. Marinaro

August, 2008
NUTRITION COMPETENCY OF CERTIFIED ATHLETIC TRAINERS

Laura M. Marinaro

Thesis

Approved:  
Advisor  
Dr. Lonnie M. Lowery

Accepted:  
Dean of the College  
Dr. James M. Lynn

Committee Member  
Dr. Deborah D. Marino

Dean of the Graduate School  
Dr. George R. Newkome

Committee Member  
Dr. Ronald Otterstetter

Date

School Director  
Dr. Richard S. Glotzer
ABSTRACT

Since certified athletic trainers have been shown to be a key source of nutrition information for athletes, it is essential that they have an adequate amount of nutrition competency in order to appropriately answer questions and make referrals. The purpose of this study was to assess the nutrition competency of certified athletic trainers. Secondary purposes were to determine if differences in nutrition competency existed based on demographics or self-rated level of nutrition competency. An instrument consisting of 9 demographic and 24 nutrition competency questions was developed and reviewed by a panel of experts for face and content validity. After pilot testing, a random sample of 1000 certified athletic trainers working in the high school and collegiate settings were emailed requesting their anonymous participation in the online survey. Descriptive statistics described general competency while ANOVAs and t tests explored potential group differences based on demographics and self-rated level of nutrition competency. All statistics were run using SPSS 15.0 for Mac; tests were considered significant at the p < 0.05 level. For the 280 participants, the average score on the nutrition competency questions was 76.2 ± 12.8. Although the overall competency was good, pre-event meals and eating disorders were revealed as areas of weakness. Limited differences based on demographics were found. Participants holding a terminal degree (84.2 ± 13.8) achieved higher scores than those holding a bachelor’s degree (74.0 ± 12.6), p = 0.014. Also, those with an athletic performance related certification (81.3 ± 9.2)
scored higher than those without (74.9 ± 13.2), p = 0.001. Differences in scores were also revealed between groups of athletic trainers based on their self-rated level of nutrition competency. The scores of those who rated their competency as very low, low, moderate, high, and very high scored 61.7 ± 9.9, 69.7 ± 16.1, 75.8 ± 11.7, 82.1 ± 11.3, and 87.5 ± 9.5, respectively. The findings of this investigation have positive implications for athletes who bring their nutrition concerns to athletic trainers. Minor limitations identified may be addressed through athletic training education programs as well as continuing education opportunities.
ACKNOWLEDGEMENTS

Thank you to my thesis advisor, Dr. Lonnie Lowery for your insight and support from project conceptualization to completion. Your understanding of the goal and appreciation for research were essential to the successful completion of this thesis. I would also like to thank my committee members, Dr. Deborah Marino and Dr. Ronald Otterstetter for their guidance and feedback with regards to the project. Finally, thanks to Kelly for your research design and survey methodology expertise, not to mention your patience, understanding, and encouragement throughout the process. I could not have done it without you.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>LIST OF TABLES</th>
<th>ix</th>
</tr>
</thead>
</table>

## CHAPTER

### I. THE PROBLEM

| Introduction | 1 |
| Statement of the Problem | 1 |
| Research Questions | 2 |
| Summary | 4 |
| Definitions | 4 |

### II. REVIEW OF LITERATURE

| Introduction | 7 |
| Athletic Performance | 7 |
| The Sports Medicine Team | 8 |
| The Certified Athletic Trainer | 9 |
| Roles and Functions of a Certified Athletic Trainer | 9 |
| Becoming a Certified Athletic Trainer | 10 |
| Education Process | 10 |
| Examination Process | 13 |
| Maintaining Certification | 16 |
| Nutrition Knowledge Review | 17 |
Implications ........................................................................................................... 62
Possibilities for Future Research ........................................................................ 63
REFERENCES ........................................................................................................ 64
APPENDICES ........................................................................................................ 68
  APPENDIX A. NUTRITIONAL COMPETENCIES ............................................. 69
  APPENDIX B. SURVEY INSTRUMENT .............................................................. 72
  APPENDIX C. SCREENSHOTS OF WEB-HOSTED INSTRUMENT .................. 78
  APPENDIX D. INITIAL CONTACT LETTER ....................................................... 80
  APPENDIX E. FOLLOW-UP CONTACT LETTER ............................................. 81
  APPENDIX F. HUMAN SUBJECTS APPROVAL .............................................. 82
LIST OF TABLES

Table                  Page

2.1 Overlap of the content areas and domains of athletic training ....................... 15
2.2 Distribution of exam content across domains .......................................................... 16
3.1 Ethnicity of certified athletic trainers ................................................................. 25
3.2 Employment settings of certified athletic trainers .................................................... 26
3.3 Gender of certified athletic trainers ........................................................................ 27
3.4 Topics covered on instrument and number of questions related to each topic .... 29
3.5 Pilot test results – macronutrients ........................................................................... 31
3.6 Pilot test results – micronutrients ............................................................................ 31
3.7 Pilot test results – other athletic training related .................................................... 32
3.8 Data analysis for each research question .................................................................... 36
4.1 General demographics of respondents and instrument completers ....................... 41
4.2 Education-related demographics of respondents and instrument completers ..... 42
4.3 Average score on each subset of the nutrition instrument ........................................ 44
4.4 Macronutrient item responses ................................................................................... 46
4.5 Micronutrient item responses .................................................................................... 46
4.6 Other athletic training related item responses ......................................................... 47
4.7 Age and score on instrument ...................................................................................... 48
4.8 Gender and score on instrument ................................................................. 49
4.9 Ethnicity and score on instrument ............................................................ 50
4.10 Route to certification and score on instrument .......................................... 50
4.11 Highest degree obtained and score on instrument .................................... 51
4.12 Additional allied health certifications and score on instrument .................. 52
4.13 Additional athletic performance certifications and score on instrument ....... 52
4.14 Years practicing as an athletic trainer and score on instrument .................. 53
4.15 Scores of athletic trainers who rated their competency as “High” .............. 58
4.16 Self-rated level of nutrition competency and score on the instrument ......... 59
4.17 Results of the Tukey follow-up test on self-rated level of competency ......... 59
CHAPTER I
THE PROBLEM

INTRODUCTION

Sports nutrition is a growing field of interest. As athletes become more skilled, stronger, and better conditioned, nutrition is increasingly being recognized as a factor that can be the difference between winning and losing.\(^1\) Athletes often have a number of nutrition-related concerns, including weight gain and loss, supplement use, proper hydration, pre- and post-event nutrition, recovery from injuries, and eating disorders. They tend to seek guidance about these issues from sources with whom they have regular contact, including their athletic team coaches, peers, popular magazines, parents, and certified athletic trainers.

STATEMENT OF THE PROBLEM

Since certified athletic trainers have been shown to be a key source of nutrition information for athletes, it is essential that these professionals have an adequate amount of nutrition competency in order to appropriately answer their questions and make referrals when necessary.\(^2,3\) The primary purpose of this study was to assess the nutrition competency (as defined by the National Athletic Trainers’ Association Education Council) of a random sample of certified athletic trainers. A secondary purpose was to determine if any differences in nutrition competency exist based on demographic
groupings. The final purpose was to determine if certified athletic trainers have realistic perspectives on their actual nutrition competency level.

The results of this investigation could be used to guide athletic training professors in the development of their education programs. If shortcomings in nutrition competency are found, more emphasis may be placed on nutrition in the education setting so that future athletes can benefit from their skills. The findings may also open the door to more nutrition-related continuing education opportunities for certified athletic trainers. If current certified athletic trainers recognize that they have deficiencies in their nutrition competency, they may be apt to pursue continuing education opportunities that could rectify these areas.

RESEARCH QUESTIONS

Research Question #1: Are certified athletic trainers competent in their knowledge regarding sports nutrition?

Research Question 1a: What percent of certified athletic trainers will demonstrate a minimum of 70% (at least 17 out 24 correct responses) competency on the nutrition questionnaire?

Research Question 2b: What is the average score of certified athletic trainers on the nutrition questionnaire?

Research Question #2: What differences in nutrition competency exist based on demographic information provided?

Research Question #2a: Are there nutrition competency differences among certified athletic trainers based on age?
Research Question #2b: Are there nutrition competency differences among certified athletic trainers based on gender?

Research Question #2c: Are there nutrition competency differences among certified athletic trainers based on ethnicity?

Research Question #2d: Are there nutrition competency differences among certified athletic trainers based on route to certification?

Research Question #2e: Are there nutrition competency differences among certified athletic trainers based on highest degree obtained?

Research Question #2f: Are there nutrition competency differences among certified athletic trainers based on additional professional certifications held?

Research Question #2g: Are there nutrition competency differences among certified athletic trainers based on the number of years practicing?

Research Question #2h: Are there nutrition competency differences among certified athletic trainers based on the number of nutrition courses taken?

Research Questions #3: Do certified athletic trainers have a realistic understanding of what their nutrition competency is?

Research Question #3a: What percentage of certified athletic trainers that rate their nutrition competency as “High” or “Very High” will demonstrate a minimum of 85% (at least 21 out of 24 correct responses) competency on the nutrition questionnaire?

Research Question #3b: Are there nutrition competency differences among certified athletic trainers based on self-reported nutrition competency?
SUMMARY

While proper nutrition is important for everybody, nutritional shortcomings are magnified when they occur in the athletic population. For this reason, it is essential that athletes have access to adequate guidance regarding nutrition so seemingly minor concerns do not escalate to serious problems. While there are nutritional competencies established by the National Athletic Trainers’ Association Education Council, it is unknown whether the knowledge is maintained by certified athletic trainers following graduation or even if the topic is adequately addressed during education. This research will assess the general and sports specific nutrition competency of a random sample of certified athletic trainers.

DEFINITIONS

The terminology utilized in this study is defined as follows:

Application: the third level in Bloom’s Taxonomy (Cognitive domain); involves the use of acquired knowledge to solve new problems

Athletic training: encompasses the prevention, diagnosis, and intervention of emergency, acute, and chronic medical conditions involving impairment, functional limitations, and disabilities.

Bloom’s Taxonomy of Educational Objectives: a classification system for learning objectives; includes three domains: Affective, Cognitive, and Psychomotor, although the Cognitive domain is most frequently cited.

Board of Certification (BOC): the body that sets the standards for the practice of athletic training; the only accredited certifying body for Athletic Trainers in the United States.
Certified athletic trainer: a health care professional that specializes in preventing, recognizing, managing and rehabilitating injuries that result from physical activity.\(^8\)

Clinical Proficiency: a behavioral classification of Competency involving decision-making and skill integration.\(^4\)

Cognitive Competency: a behavioral classification of Competency involving knowledge and intellectual skills.\(^4\)

Commission on Accreditation of Athletic Training Education (CAATE): the agency responsible for the accreditation of 357 professional (entry-level) Athletic Training educational programs.\(^9\)

Comprehension: the second level in Bloom’s Taxonomy (Cognitive domain); the ability to demonstrate understanding of facts and ideas.\(^5\)

Knowledge: the lowest level in Bloom’s Taxonomy (Cognitive domain); the ability to exhibit memory of previously-learned materials.\(^5\)

National Athletic Trainers’ Association (NATA): the professional membership association for Certified athletic trainers and others who support the athletic training profession.\(^10\)

NATA Educational Competencies: delineate the standardized educational content required by an entry-level Athletic Trainer.\(^4\)

NATA Education Council: serves as the NATA’s voice in matters related to athletic training education; responsible for facilitating continuous quality improvement in entry-level, graduate and continuing athletic training education.\(^11\)

Psychomotor Competency: a behavioral classification of Competency involving manipulative and motor skills.\(^4\)
Registered dietitian: a food and nutrition professional who has met the minimum academic and professional requirements to qualify for the credential “RD.”

Role Delineation Study (RDS): identifies essential knowledge and skills for the athletic training profession and serves as a blueprint for certification exam development; integral to ensuring that the BOC exam is content valid, meaning the aspects of athletic training covered on the exam reflect the range of practice settings throughout the United States.
CHAPTER II
REVIEW OF LITERATURE

The review of literature was conducted using PubMed as well as various internet search engines (Google Scholar, CINAHL, and EBSCOhost). Once a bibliography was developed, relevant journal articles were either downloaded directly from the online journal archives or ordered via interlibrary loan.

The review of literature consists of (a) introduction (including athletic performance and the sports medicine team), (b) the certified athletic trainer (including roles and functions, becoming a certified athletic trainer, and maintaining certification), (c) nutrition knowledge review (including athletes, coaches, and certified athletic trainers), and (d) summary.

INTRODUCTION

Athletes constantly seek ways to better their performance. While they gather information regarding training and nutritional strategies from their peers, parents, and popular magazines, they also look to members of the sports medicine team for guidance on these issues.

Athletic Performance

Athletes are always looking for ways to improve their performance and gain an edge over their competitors. They seek to better their performance by correcting
biomechanical errors, strength and conditioning deficits, and nutritional shortfalls. When conditioning and natural ability are more or less equal, proper nutrition can be the deciding factor in a competitive environment. Furthermore, the harder and longer an athlete trains, the more essential proper nutrition becomes.\textsuperscript{1,14,15} Athletes have a variety of nutritional concerns, including weight gain and loss, supplement use, proper hydration, pre- and post-event nutrition, recovery from injuries, and eating disorders. Even without a specific nutrition-related concern, athletes are often interested in tailoring their diet so that it is well-balanced and complete, which has an impact on performance and adequate recovery.

The Sports Medicine Team

The sports medicine team is a group of professionals responsible for dealing with physically active or athletic populations. The chief roles of the sports medicine team are performance enhancement and injury prevention and treatment. Members of the sports medicine team can include athletic coaches, certified strength and conditioning specialists, exercise physiologists, orthopedic physicians, registered dietitians, certified athletic trainers, and sports psychologists. These professionals work together with the best interests of athletes in mind.\textsuperscript{16} One of the considerations for both performance enhancement and injury prevention and treatment is nutrition.\textsuperscript{17,18} Although many individuals have a role in athletic health care, the focus of this paper is certified athletic trainers. Certified athletic trainers are responsible for recognizing when adverse nutritional situations arise and for handling the situation by offering guidance or referring the athlete as necessary.
THE CERTIFIED ATHLETIC TRAINER

The focus of this investigation is certified athletic trainers. A certified athletic trainer is a health care professional that specializes in preventing, recognizing, managing and rehabilitating injuries that result from physical activity. The following sections will outline the roles and functions of a certified athletic trainer, as well as the education and examination process necessary to become a certified athletic trainer.

Roles and Functions of a Certified Athletic Trainer

A certified athletic trainer is an allied health care professional who specializes in injury prevention, clinical evaluation and diagnosis, immediate care, and treatment, rehabilitation, and reconditioning. Injury prevention may be considered the most important area of athletic training, since if an injury never occurs, there is no need for immediate care, evaluation, or rehabilitation. The prevention of injuries is also known as risk management, and can include activities such as conducting pre-participation exams, developing conditioning programs, fitting protective equipment, and explaining the importance of proper nutritional habits. Because certified athletic trainers are often the first person an injured athlete sees, they are responsible for providing first aid, evaluating the injury, and referring the athlete for medical care if necessary. After determining the nature of the injury, certified athletic trainers provide the appropriate treatment and develop a rehabilitation program so that the injured athlete can experience a safe and timely return to activity. Certified athletic trainers also have responsibilities including organization and administration and professional responsibility. Organization and administration includes medical record keeping and ordering supplies, as well as other tasks related to the successful administration of an athletic training program. Finally, the
certified athletic trainer has professional responsibilities including completing continuing education requirements. Although athletic training was first recognized by the American Medical Association as an allied health profession in 1990, athletic trainers have been practicing since the early 1900’s. Historically, having a full-time athletic trainer was reserved for professional teams alone. Now, professional and collegiate athletic teams have an entire staff of sports medicine professionals, including certified athletic trainers, and even middle schools are beginning to employ certified athletic trainers. In addition, certified athletic trainers can be found in non-traditional settings, such as hospitals, clinics, physician’s offices, branches of the military, industrial settings, and in the performing arts.

Becoming a Certified Athletic Trainer

Athletic trainers must earn a degree from an accredited athletic training education program. Accredited programs include formal instruction in areas such as injury and illness prevention, emergency care, assessment of injury and illness, human anatomy and physiology, therapeutic modalities, and nutrition. The educational experience includes both classroom and clinical experiences.

Education process

In the past, there were two routes to certification: an internship route and a curriculum route. The internship route required students interested in athletic training to complete 1500 hours of athletic training experience under the supervision of a certified athletic trainer and take a core of classes related to athletic training. In 1998, the NATA eliminated the internship route and required that, beginning January 1, 2004, all students...
wishing to become certified athletic trainers obtain a degree from a Commission on the Accreditation Athletic Training Education (CAATE) approved program.

Every accredited athletic training education program is centered around educational competencies, which identify the knowledge and skills that must be mastered by the entry-level certified athletic trainer. The educational competencies are developed by the NATA Education Council. The NATA Education Council is responsible for facilitating continuous quality improvement in entry-level, graduate and continuing athletic training education. They are also responsible for developing the athletic training educational competencies which serve as the framework for athletic training education. They are enforced by CAATE, who use their Standards for Accreditation of Entry-Level Athletic Training Education Programs as a guide. The mission of the CAATE is to provide comprehensive accreditation services to institutions that offer Athletic Training degree programs and verify that all CAATE-accredited programs meet the acceptable educational standards for professional (entry-level) athletic training education. The educational competencies encompass the twelve content areas of athletic training, which are risk management and injury prevention, pathology of injuries and illnesses, orthopedic clinical examination and diagnosis, medical conditions and disabilities, acute care of injuries and illnesses, therapeutic modalities, conditioning and rehabilitative exercises, pharmacology, psychosocial intervention and referral, nutritional aspects of injuries and illnesses (these competencies are available as Appendix A), healthcare administration, and professional development and responsibility.

While CAATE does not mandate that certain courses be included in a curriculum in order for the program to be accredited, they do require that certain topics associated
with the educational competencies and standards (related to the twelve content areas of athletic training) be addressed. Athletic training program administrators choose courses that are available at their institutions or develop new courses in order to ensure that all of the required competencies are addressed throughout their students’ educational careers. CAATE does mandate the assessment of students on the Educational Competencies, which include Cognitive Competencies, Psychomotor Competencies, and Clinical Proficiencies. The Cognitive Competencies include knowledge and intellectual skills, while the Psychomotor Competencies include manipulative and motor skills. Both of these Competencies are classified at the knowledge, comprehension, and application levels of Bloom’s Taxonomy of Educational Objectives and are assessed as such. Knowledge was defined by Bloom as the ability to remember learned materials, whereas comprehension involves the ability to grasp the meaning of material, not simply to recite memorized material. Application involves solving new problems using acquired information. The Clinical Proficiencies integrate clinical skills and decision-making. When evaluating Proficiencies, students are expected to perform at the analysis level of Bloom’s Taxonomy.

In addition to completing coursework, students participating in an accredited athletic training program work closely with Approved Clinical Instructors (ACIs) in clinical rotations, where they get practical experience working in typical athletic training settings. ACIs are certified athletic trainers that undergo mandatory training and re-training seminars related to supervising students. While there is no longer a set number of clinical hours that athletic training students have to obtain, students are required to have experience with a number of sports types, including equipment intensive sports (i.e.
football, ice hockey), lower body intensive (i.e. cross country, soccer) and upper body intensive (i.e. baseball, softball). While the bulk to the athletic training student’s clinical experiences may take place in a collegiate sports environment, many athletic training education programs afford their students the opportunity to gain experience in a number of related settings, including clinics, high schools, and physician’s offices.

Examination process

Before an athletic training student becomes a certified athletic trainer, they must pass a board certification exam. The content covered on the certification exam revolves around the athletic training Role Delineation Study (RDS). The RDS is developed and revised by the Board of Certification, which sets the standards for the practice of athletic training. It outlines essential knowledge and skills for the entry-level athletic trainer. The RDS covers the six domains of athletic training: prevention, clinical evaluation and diagnosis, immediate care, treatment, rehabilitation, and reconditioning, organization and administration, and professional responsibility, as described earlier under “Roles and Functions of the Certified Athletic Trainer”. This document is developed by surveying a large sample of certified athletic trainers and determining their practice setting and typical responsibilities.

While the documents (NATA Education Council – Educational Competencies (NATA Education Council) and Role Delineation Study (BOC)) developed with respect to athletic training education and standards are different, the governing bodies of athletic training education all communicate openly in order to ensure that there is consistency between the requirements for accredited education programs and entry-level practice for certified athletic trainers. The overlap between the twelve content areas of athletic
training (Educational Competencies) and the six domains of athletic training (RDS) is available as Table 2.1. CAATE’s role is to ensure that their Standards for Entry-Level Athletic Training Educational Programs are being met. One aspect of the Standards is making sure that the Educational Competencies are both taught and assessed within the course of the education program.

Before an athletic training student is allowed to sit for the national certification exam, their athletic training education program director must sign a verification statement that attests that they have completed all the requirements of their program and are therefore eligible for certification.22
<table>
<thead>
<tr>
<th>Twelve Content Areas</th>
<th>Six Domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Management and Injury Prevention</td>
<td>Prevention</td>
</tr>
<tr>
<td>Nutritional Aspects of Injuries and Illnesses</td>
<td></td>
</tr>
<tr>
<td>Pathology of Injuries and Illnesses</td>
<td></td>
</tr>
<tr>
<td>Orthopedic Clinical Examination and Diagnosis</td>
<td>Clinical Evaluation and Diagnosis</td>
</tr>
<tr>
<td>Medical Conditions and Disabilities</td>
<td></td>
</tr>
<tr>
<td>Acute Care of Injuries and Illnesses</td>
<td>Immediate Care</td>
</tr>
<tr>
<td>Therapeutic Modalities</td>
<td></td>
</tr>
<tr>
<td>Conditioning and Rehabilitative Exercises</td>
<td>Treatment, Rehabilitation and Reconditioning</td>
</tr>
<tr>
<td>Pharmacology</td>
<td></td>
</tr>
<tr>
<td>Psychosocial Intervention and Referral</td>
<td></td>
</tr>
<tr>
<td>Healthcare Administration</td>
<td>Organization and Administration</td>
</tr>
<tr>
<td>Professional Development and Responsibility</td>
<td>Professional Responsibility</td>
</tr>
</tbody>
</table>

CASTLE Worldwide is a professional testing company with expertise in the development and scoring of certification exams, and is responsible for the administration of the athletic training certification exam. This organization works with a committee of Certified athletic trainers who are responsible for developing the questions that appear on the certification exam and ensuring that they are within the required knowledge for an entry-level certified athletic trainer, as outlined by the RDS. The percent representation of each domain on the exam are available in Table 2.2. In addition, the psychometricians
from CASTLE review the questions after they have been written for clarity and content validity.22

Table 2.2 Distribution of exam content across domains22

<table>
<thead>
<tr>
<th>Domain of Athletic Training</th>
<th>Percentage of Questions on Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention*</td>
<td>15.72</td>
</tr>
<tr>
<td>Clinical Evaluation and Diagnosis</td>
<td>22.91</td>
</tr>
<tr>
<td>Immediate Care</td>
<td>17.50</td>
</tr>
<tr>
<td>Treatment, Rehabilitation, and Reconditioning</td>
<td>23.31</td>
</tr>
<tr>
<td>Organization and Administration</td>
<td>11.29</td>
</tr>
<tr>
<td>Professional Responsibility</td>
<td>9.27</td>
</tr>
</tbody>
</table>

* Domain includes nutrition competencies

At present, the certification exam is completely computer-based and consists of approximately 125 multiple-choice questions as well as four hybrid problems. The hybrid problems assess the candidate’s clinical judgment ability, as well as their ability to complete other athletic training related tasks, such as taking an injury-related medical history, identifying pertinent anatomical landmarks, and administering an appropriate course of treatment.24 Scores on the exam range from 200 to 800; candidates must pass the exam with a score of 500 or better in order to become certified athletic trainers.22

Maintaining Certification

In order to maintain their certification, athletic trainers must adhere to the BOC’s Standards of Professional Practice, submit an annual certification fee to the BOC, and maintain their certification in Emergency Cardiac Care. In addition, they must complete
Continuing Education Units (CEUs) every 3 years. These CEUs can be completed in four categories, which include BOC Approved Provider programs (workshops, conferences, etc), Professional Development (speaking at a conference, authoring an article in a refereed journal), Post-Certification College/University Coursework, and Individualized Options (activities/programs by non-BOC Approved Providers). The activities used and content covered while fulfilling CEU requirements must fall within the six domains of athletic training as defined by the Role Delineation Study. This allows athletic trainers to tailor their continuing education to their particular interests. For that reason, some athletic trainers may choose to further their knowledge in the area of nutrition, while others choose to study other areas of athletic training.

In addition to maintaining certification status, certified athletic trainers may choose to participate in their national organization. The National Athletic Trainers’ Association (NATA) is the professional association for certified athletic trainers and others who support the profession. Being a member of the NATA has several benefits. Each year, the NATA holds a clinical symposium, which affords athletic trainers the opportunity to network with other professionals, further their clinical knowledge and skills, and earn CEUs. NATA dues also cover the annual BOC recertification fee for athletic trainers and the district membership dues for members. Although membership in the NATA is voluntary, over 90% of certified athletic trainers choose to participate.

NUTRITION KNOWLEDGE REVIEW

While few studies have investigated the nutrition knowledge of athletes, even fewer have attempted to assess the nutrition knowledge of two of the more commonly
Proper nutrition is essential for the average individual but it is even more important for athletes performing at high competitive levels. Athletes have concerns ranging from pre-event nutrition and proper hydration to disordered eating and the use of ergogenic aids. As the importance of nutrition becomes increasingly recognized, athletes are constantly bombarded with messages about nutrition from their peers, popular media, and coaches. While some information they get is based in fact, there are many common misconceptions that persist to which athletes can fall prey.

A number of studies have investigated the level of nutrition knowledge that athletes possess. Overall, they show that athletes, although in need of nutrition knowledge, rarely exhibit a “passing” (by academic standards) level of knowledge. When a twenty-five item nutrition questionnaire, over information commonly taught in basic nutrition courses, was administered to 75 male college athletes, their average score was below 50%. When male hockey players 10 to 21 years of age were asked a series of basic nutrition knowledge questions while at a camp, they averaged a score of 45%. Interestingly, the scores did not increase significantly with age. In a study done at a Division I University, 328 male and female athletes were asked to indicate whether they agreed or disagreed with 11 statements about nutrition (i.e. “Vitamin and mineral supplements increase energy levels”). The athletes only agreed or disagreed correctly with 53% of the statements.
To put this lack of knowledge into perspective, it is imperative to see examples of the misconceptions that athletes hold with respect to nutrition. In a study done by Jacobson and Aldana in 1991, 77% of athletes (n = 812) surveyed believed that vitamins were a major contributor of energy and 23% believed that they could increase muscular strength. Sixty-seven percent did not know that carbohydrates are the best source of fuel for exercise and 78% believed that 40% of the daily caloric intake should come from protein.\textsuperscript{18} When the authors did a follow-up study ten years later, there were no major differences in nutrition knowledge; the percentage of athletes believing the misconceptions were lower, but still high enough to be concerning.\textsuperscript{17} In another study done by Shoaf, McClellan, and Birskovich, 37% of athletes (n = 76) participating were unable to identify a quality recommendation for a pre-game meal.\textsuperscript{3}

In the older studies that were done, athletes most commonly cited their parents, high school health and physical education classes, and friends as their sources of nutrition information.\textsuperscript{18} As certified athletic trainers become more widespread and athletes have more access to them, they are gaining in popularity as a quality source of nutrition information. When college athletes were asked where most of their nutrition information came from in more recent studies, between 17 and 40% of athletes cited certified athletic trainers as a primary source.\textsuperscript{2,17,29-32}

Certified athletic trainers are often “out-ranked” by popular magazines, television, and the athlete’s parents and friends, all of whom are most likely not as reputable sources.\textsuperscript{17,29-31} Magazines, not scientific journals, are typically rated as the primary source of nutrition information. Much of the information found in magazines does not have strong scientific support, is not subject to peer review, and is likely to be misleading.
Because of the misinformation found in the sources, athletes may have a skewed perception of proper nutrition. It is important to note that athletes do perceive certified athletic trainers as being knowledgeable about nutrition.\textsuperscript{32} However, they are often not utilized appropriately by athletes.

Partly because only few college and almost no high school athletic programs employ registered dietitians for their athletes to access, they are very rarely cited as a common source of nutrition information, despite obviously being knowledgeable in this area.\textsuperscript{17,28} Because certified athletic trainers are very accessible to the majority of athletes, it is important that they be competent in nutrition so that they can supply information to athletes and refer to outside sources (like registered dietitians) when necessary.

Coaches

Studies have also investigated the nutrition knowledge of high school and college level athletic coaches. Coaches commonly dispense nutrition information and supplements to athletes (whether solicited or not).\textsuperscript{33,34} The results of these investigations have been similar to those looking at the nutrition knowledge of athletes.\textsuperscript{34-36} This is not surprising for a number of reasons. First of all, coaches are not regulated by any sort of certifying body and, as such, they are not required to have any sort of nutritional training prior to obtaining their positions. Additionally, many coaches are former athletes. As it has already been demonstrated that the majority of athletes lack high levels of nutrition knowledge, there is no reason to believe that as individuals transition from athletes to coaches they undergo a mandatory increase in nutrition knowledge.
Athletic trainers

As integral members of the sports medicine team, certified athletic trainers are involved in all areas of a student athlete’s performance. Certified athletic trainers report functioning as counselors, nutritionists, injury prevention and rehabilitation specialists, and educators. Because of their unique position and interaction with athletes, they are often called upon to serve in a number of capacities. Because proper nutrition is vital for both the prevention of problems and to assist with the healing of injuries, certified athletic trainers must be prepared to handle any issues that arise. However, they also need to recognize their limitations and understand when a referral is warranted.

When compared to athletes and coaches, athletic trainers typically score the highest on nutrition knowledge questionnaires. According to various instruments, athletic trainers typically answer between 66 and 74% of the questions correctly. In 2002, Shifflett, Timm, and Kahaov utilized an instrument that included questions about macronutrients, micronutrients, hydration, and weight gain and loss. Athletic trainers (n = 97) averaged a score of 14.02/19 (73.8%). Athletic trainers (n = 18) participating in a study using a questionnaire over similar topics averaged a score of 66%. One caveat to the results of previous investigations is that they often included both athletic trainers (who have no formal education requirements) and certified athletic trainers (who must complete the requirements for certification as outlined in “Becoming a Certified Athletic Trainer”). If a distinction were to be made between the two groups, certified athletic trainers outperformed athletic trainers by about 10%.

Certified athletic trainers report that they frequently give athletes guidance regarding nutrition. In fact, the only areas certified athletic trainers reported counseling
athletes about more frequently were injury prevention and rehabilitation. Additionally, they report feeling well-prepared to undertake this responsibility, but still believe that more emphasis should be placed on nutrition during their academic education.\textsuperscript{40} Interestingly, 71% of athletic trainers surveyed (n = 78) believed that athletic trainers should be the primary source of nutrition guidance for athletes. Additionally, 55% of coaches (n = 348) surveyed believe that it is the athletic trainer’s responsibility to provide nutrition information to athletes.\textsuperscript{31} The increasing recognition of nutrition as an important area is further evidenced by the fact that 74% of certified athletic trainers surveyed (n = 90) have participated in continuing education coursework, seminars, or workshops about nutrition, and 91% would participate in continuing education on the subject if it was available.\textsuperscript{40}

SUMMARY

Very few studies have been done using certified athletic trainers as the target population, therefore the purpose of this study will be to assess the level of nutrition competency among a random sample of certified athletic trainers. The current investigation will be the first of its type. As mentioned earlier, there have been areas defined as important by the RDS for competency. If areas of shortcoming are identified, athletic training education program administrators may choose to re-examine the emphasis that they place on the Competencies pertaining to the Nutritional Aspects of Injury and Illness. In addition, certified athletic trainers may decide to participate in continuing education opportunities related to nutrition in an attempt to correct any deficiencies they may have.
“Athletic trainers are active in both the prevention and healing of injuries, therefore, the role of the athletic trainer should include educating athletes on the importance of nutrition to performance and healing. The athletic trainer should be aware of areas of decreased nutritional knowledge in collegiate runners [and other athletes] and be qualified to formulate a plan of intervention through preseason seminars, handouts, posters, and individual counseling.” 30
CHAPTER III
RESEARCH DESIGN AND METHODS

This chapter includes a description of the procedures used in this investigation. The following sections are included in this chapter: (a) introduction, (b) sampling process, (c) instrument development, (d) instrument validation and pilot study, (e) survey mode and electronic formatting, (f) data collection, (g) data analysis, (h) limitations and (i) summary.

INTRODUCTION

Since certified athletic trainers have been shown to be a primary source of nutrition information for athletes, it is essential that these professionals have an adequate amount of knowledge in order to appropriately answer their questions and make referrals when necessary.\textsuperscript{2,17,18} The primary purpose of this study was to assess the nutrition competency of a random sample of certified athletic trainers. A secondary purpose was to determine if any differences in nutrition competency exist based on demographic groupings. The final purpose was to determine if certified athletic trainers have realistic perspectives on what their actual nutrition competency level is.

This study was approved by the University of Akron’s Institutional Review Board. Because it was survey research related to topics that are not sensitive, it involved adult participants, and participants remained anonymous, it was eligible for an exempt
review. The survey was granted approval under Exemption #2: research involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior.

SAMPLING PROCESS

The primary source used to obtain a sample frame for studies using certified athletic trainers as the population of interest is the membership of the NATA. Ninety-two percent of all certified athletic trainers are members of the NATA. The ethnicity, gender, and employment settings of certified NATA members as of December 31, 2006 are available as Tables 3.1, 3.2, and 3.3. The use of this sample frame eliminated 8% of certified athletic trainers, as they are not active in their professional organization. Currently, more than 31,000 individuals hold the ATC® credential.

Table 3.1 Ethnicity of certified athletic trainers

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian/ Alaskan Native</td>
<td>111</td>
<td>0.4%</td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>816</td>
<td>3.2%</td>
</tr>
<tr>
<td>Black (not Hispanic origin)</td>
<td>455</td>
<td>1.8%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>645</td>
<td>2.5%</td>
</tr>
<tr>
<td>Caucasian</td>
<td>21955</td>
<td>86.6%</td>
</tr>
<tr>
<td>Other</td>
<td>304</td>
<td>1.2%</td>
</tr>
<tr>
<td>Unspecified</td>
<td>1067</td>
<td>4.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>25353</td>
<td>99.9%</td>
</tr>
</tbody>
</table>
Table 3.2 Employment settings of certified athletic trainers

<table>
<thead>
<tr>
<th>Employment Setting</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Student</td>
<td>2266</td>
<td>9.0%</td>
</tr>
<tr>
<td>University &amp; College</td>
<td>4858</td>
<td>19.2%</td>
</tr>
<tr>
<td>Clinic</td>
<td>4704</td>
<td>18.6%</td>
</tr>
<tr>
<td>High School</td>
<td>4135</td>
<td>16.3%</td>
</tr>
<tr>
<td>High School/Clinic</td>
<td>1836</td>
<td>7.2%</td>
</tr>
<tr>
<td>Other Professional</td>
<td>1803</td>
<td>7.1%</td>
</tr>
<tr>
<td>Hospital</td>
<td>868</td>
<td>3.4%</td>
</tr>
<tr>
<td>Professional Sports</td>
<td>1079</td>
<td>4.3%</td>
</tr>
<tr>
<td>Industrial</td>
<td>172</td>
<td>0.7%</td>
</tr>
<tr>
<td>Corporate</td>
<td>150</td>
<td>0.6%</td>
</tr>
<tr>
<td>Clinic/Industrial</td>
<td>1023</td>
<td>4.0%</td>
</tr>
<tr>
<td>Junior College</td>
<td>381</td>
<td>1.5%</td>
</tr>
<tr>
<td>Health/Fitness</td>
<td>323</td>
<td>1.3%</td>
</tr>
<tr>
<td>Middle School/Junior High</td>
<td>122</td>
<td>0.5%</td>
</tr>
<tr>
<td>Sales/Marketing</td>
<td>173</td>
<td>0.7%</td>
</tr>
<tr>
<td>Other</td>
<td>378</td>
<td>1.5%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>696</td>
<td>2.8%</td>
</tr>
<tr>
<td>Unspecified</td>
<td>67</td>
<td>0.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>25353</td>
<td>99.0%</td>
</tr>
</tbody>
</table>
Table 3.3 Gender of certified athletic trainers

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>12079</td>
<td>47.6%</td>
</tr>
<tr>
<td>Male</td>
<td>13274</td>
<td>52.4%</td>
</tr>
<tr>
<td>Total</td>
<td>25353</td>
<td>100%</td>
</tr>
</tbody>
</table>

While the NATA is a national organization with international membership, this study only explored certified athletic trainers who are currently living in the United States. In addition, the population was delimited to certified athletic trainers currently employed in a high school or collegiate setting as they are more likely to be approached by an athlete requesting nutrition information. This study used a sample drawn from those members of the NATA who have opted-in to email surveys. Of the approximately 35,143 members, about 19,767 choose not to be included in surveys. The NATA membership office generated a random sample of certified athletic trainers using the random function in Microsoft Access (Microsoft Corporation, Redmond, 1999). The sample included 1000 certified athletic trainers with active membership status who provided email addresses and opted-in to participation in surveys meeting the criteria specified above.

INSTRUMENT DEVELOPMENT

A survey instrument, consisting of twenty-four multiple-choice items and eight demographic items was developed. Demographic data collected included age, gender, ethnicity, years practicing as a certified athletic trainer, route to certification, highest level of education completed and other certifications held with categories offered as
response options. Participants were also asked the number of nutrition courses taken with an open-ended response option, which allowed them to provide an exact number. In addition, participants were asked to indicate their perceived level of nutrition knowledge on a 5-point Likert scale (very low, low, moderate, high, very high).

The multiple-choice items assessed the participant’s knowledge and comprehension of nutrition information. The items were developed based on the Nutrition Competencies that were established by the NATA’s Educational Council and the expected knowledge for an entry-level certified athletic trainer as defined by the BOC’s Role Delineation Study. The items covered general nutrition topics as well as those relevant to athletic nutrition, including macronutrient sources, nutritional concerns related to injury and illness, micronutrient functions, pre-event nutrition, hydration, disordered eating, ergogenic aids, and body composition. Each topic had a minimum of two items related to it on the instrument. The number of questions related to each topic is available as Table 3.4.

In addition to being content-specific to athletic trainers, items were developed to comply with the guidelines set forth by CASTLE Worldwide, a psychometric consulting company. This company is also responsible in part for the development and administration of the athletic training certification exam. Item stems were developed to be free of irrelevant material. All responses were grammatically consistent with the stem and the distractor responses were all plausible with the item stem. Because the terms “always” and “never” are frequently used by test takers to eliminate distractors, they were not used in any responses. Furthermore, the responses “all of the above” and “none of the above” were not used in any item. Each item had only one correct answer.
Table 3.4 Topics covered on instrument and number of questions related to each topic

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Related Questions</th>
<th>Knowledge questions</th>
<th>Comprehension questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macronutrients</td>
<td>6</td>
<td>11, 17, 23</td>
<td>1, 7, 13</td>
</tr>
<tr>
<td>Micronutrients</td>
<td>6</td>
<td>5, 19, 21</td>
<td>3, 9, 15</td>
</tr>
<tr>
<td>Nutritional concerns related to injury</td>
<td>2</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Pre-event nutrition</td>
<td>2</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Hydration</td>
<td>2</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Eating disorders</td>
<td>2</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Ergogenic aids</td>
<td>2</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>Body composition</td>
<td>2</td>
<td>12</td>
<td>24</td>
</tr>
</tbody>
</table>

The three basic types of multiple-choice items are direct multiple-choice questions, incomplete sentences, and best answer format items. Direct multiple-choice questions state the problem in the form of a question, while incomplete sentence items pose a problem and allow the test taker to complete the sentence with the correct response. Finally, items written in the best answer format include responses that are all correct to some degree. The test taker must then choose the response that is the most correct. In this questionnaire, the item stems were formatted as either direct multiple choice questions or incomplete sentences. Because of the risk of ambiguity, items in best answer format were not used for this project.

Questions in the instrument assessed the individual’s knowledge as well as their comprehension of the material. The items will addressed basic knowledge (“knowledge”), as well as practical applications (“comprehension”). The higher levels of
thinking (application, analysis, synthesis, and evaluation) are too complex to be evaluated in a simple, multiple-choice, web-based format.

The text of the instrument is available as Appendix B.

INSTRUMENT VALIDATION AND PILOT TESTING

The instrument was reviewed by a panel of registered dietitians and certified athletic trainers for face and content validity. Initially, a bank of over thirty possible items was developed. During the evaluation process, items that were ambiguous, redundant, or otherwise superfluous were eliminated. Following review, the multiple-choice questions from the modified instrument were administered to a small convenience sample of undergraduate athletic training students. This pilot test was performed to ensure that there were no questions regarding item interpretation. Overall, students averaged a score of 76.2% on the twenty-four questions. The responses to each question, as well as the number of students who answered the question correctly, are available as Tables 3.5, 3.6, and 3.7. The instrument was then finalized, put into electronic format, and hosted online.
### Table 3.5 Pilot test results – macronutrients; n = 14

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct Answer</th>
<th>Incorrect Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best source of CHO</td>
<td>Sweet potato (86%, 12)</td>
<td>Cheese (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carrots (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diet soda (0%, 0)</td>
</tr>
<tr>
<td>Least amount of protein</td>
<td>Orange (93%, 13)</td>
<td>Milk (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chicken (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Baked beans (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WW bread (0%, 0)</td>
</tr>
<tr>
<td>Nutrient with 9 kcal/g</td>
<td>Fat (57%, 8)</td>
<td>Carbohydrate (36%, 5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alcohol (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Protein (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vitamins (0%, 0)</td>
</tr>
<tr>
<td>Not high in fiber</td>
<td>Milk (71%, 10)</td>
<td>Starch (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fruit (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Legumes (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegetable (7%, 1)</td>
</tr>
<tr>
<td>Protein calories</td>
<td>4 kcal/g (71%, 10)</td>
<td>9 kcal/g (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 kcal/g (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 kcal/g (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 kcal/g (7%, 1)</td>
</tr>
<tr>
<td>Calories in pound of fat</td>
<td>3500 kcal (71%, 10)</td>
<td>2500 kcal (14%, 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3000 kcal (14%, 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000 kcal (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4000 kcal (0%, 0)</td>
</tr>
</tbody>
</table>

### Table 3.6 Pilot test results – micronutrients; n = 14

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct Answer</th>
<th>Incorrect Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteoporosis nutrient</td>
<td>Calcium (100%, 14)</td>
<td>Retinol (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tocopherol (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Iron (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ascorbic acid (0%, 0)</td>
</tr>
<tr>
<td>Fat soluble vitamins</td>
<td>A, D, E, K (79%, 11)</td>
<td>Folate, E, B1, K (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B, C, D, Niacin (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B1, B2, B6, C (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E, niacin, thiamin, riboflavin (0%, 0)</td>
</tr>
<tr>
<td>Nutrient not in meat</td>
<td>Vitamin C (93%, 13)</td>
<td>Thiamin (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Protein (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Niacin (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Iron (0%, 0)</td>
</tr>
<tr>
<td>Iron deficiency</td>
<td>Anemia (86%, 12)</td>
<td>Restlessness (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liver failure (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gingivitis (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension (0%, 0)</td>
</tr>
<tr>
<td>Not a role of minerals</td>
<td>Provide energy (57%, 8)</td>
<td>Soft tissue component (28%, 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bone rigidity (14%, 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acid-base balance (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regulate body processes (0%, 0)</td>
</tr>
<tr>
<td>Vitamin E function</td>
<td>Antioxidant (64%, 9)</td>
<td>Free radical (21%, 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energy source (14%, 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hormone (0%, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Superoxide (0%, 0)</td>
</tr>
<tr>
<td>Question</td>
<td>Correct Answer</td>
<td>Incorrect Answers</td>
</tr>
<tr>
<td>----------</td>
<td>---------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Concern with injury</td>
<td>Weight gain (86%, 12)</td>
<td>Weight loss (0%, 0)</td>
</tr>
<tr>
<td>Nutrients for muscle</td>
<td>Amino acids (79%, 11)</td>
<td>Minerals (14% 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in pre-event meal</td>
<td>&gt; 1000 kcal (93%, 13)</td>
<td>Low fat (7%, 1)</td>
</tr>
<tr>
<td>Pre-event meal timing</td>
<td>Comp. level (43%, 6)</td>
<td>Preference (50%, 7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excessive water</td>
<td>Hyponatremia (100%, 14)</td>
<td>Hypotension (0%, 0)</td>
</tr>
<tr>
<td>Not for rehydration</td>
<td>Caffeine (64%, 9)*</td>
<td>Thirst driven (36%, 5)*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not sign of anorexia</td>
<td>Tachycardia (14%, 2)</td>
<td>Lanugo (79%, 11)</td>
</tr>
<tr>
<td>Bulimia found in</td>
<td>All weights (93%, 13)</td>
<td>Only UW (7%, 1)</td>
</tr>
<tr>
<td>Body comp standard</td>
<td>Hydrostatic (57%, 8)</td>
<td>BMI (21%, 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skinfold error</td>
<td>±3% (93%, 13)</td>
<td>±1% (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not effect of caffeine</td>
<td>↓ BMR (57%, 8)</td>
<td>↑ force (43%, 6)</td>
</tr>
<tr>
<td>AAS mimic what</td>
<td>Testosterone (86%, 12)</td>
<td>HGH (7%, 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Ideal rehydration beverage had two correct answers that were revealed during pilot testing.
SURVEY MODE AND ELECTRONIC FORMATTING

A web-based format was chosen for this project because of the availability of a no cost, random sample of the target population. Web-based surveys have an advantage over traditional postal methods in that they are typically low cost, allow for access to a larger sample, and permit easy uploading of data into a database for analysis. In addition, investigations using the Internet can garner acceptable response rates, particularly when a follow-up to the initial contact is utilized. The instrument was put online using SelectSurveyASP (ClassApps, Overland Park, 2005), a web-based survey application. The demographic questions were divided over two pages and the multiple-choice questions were divided over four pages. This prevented each page from appearing too overwhelming to the participant. Dropdown menus were utilized for the demographic questions with categorical responses. Answer choices for age and years practicing as an ATC were grouped into five (years practicing) or ten (age) year ranges to facilitate ease of answering. Participants were asked to indicate what other professional certifications they hold (if any) using a “Check all that apply” format. The question “how many nutrition courses have you taken at the college level” was open-ended, with the participant able to enter an exact number. Finally, participants were asked to rate their perceived level of nutrition competency using a drop-down menu with the responses “very high”, “high”, “moderate”, “low”, and “very low”. The multiple-choice items were presented with all possible answers displayed. Participants selected their answer choice by clicking the radio button to the left of their desired answer. The order of the answers was randomized each time the instrument was accessed to diminish the effect of bias that could be introduced by a set order.
A progress bar appeared in the upper right hand corner of each page to indicate what percent of the instrument the participant had finished. Participants were able to change their answers on a given page as many times as they chose, however once they moved on to the next page, they were not allowed to return to the previous one.

Participants moved from page to page by clicking a button reading “Next” in the lower right hand corner. The final page had a button that read, “Finish.” When participants clicked this button, they were directed to a page thanking them for their participation. At that time, they were given the investigator’s contact information so that they could follow up with any questions and get a summary of the results when data collection was finished, if they were interested. Screenshots of the instrument as it appeared online are available as Appendix C.

DATA COLLECTION

Potential participants received an email inviting them to take part in the study. The email explained the potential risks and benefits of participation. In compliance with Institutional Review Board standards, completion of the instrument served as evidence of their informed consent. The text of the participant email invitation is available as Appendix D. Participants followed a link contained in the email to the website hosting the instrument, SelectSurveyASP (ClassApps, Overland Park, 2005). They provided their demographic information before going on to complete the nutrition knowledge and comprehension items.

One week following the initial contact, potential participants were contacted again. The purpose of this contact was to thank those who had already responded and
encourage those who had not yet completed to instrument to do so. The text of the follow-up email is available as Appendix E.

There was no login or password needed to access the survey webpage. Individual users’ IP addresses were logged as they completed the survey. When identical IP addresses were detected, and the responses to both the demographic and the survey questions were identical, one response was deleted. When identical IP addresses were detected and the responses to the demographic questions are different, both responses were included in the analysis. Incomplete responses were not included in the primary data analysis.

DATA ANALYSIS

Data was exported to Excel (Excel for Mac, Microsoft Corporation, Remond, 2003) before being imported into SPSS (Statistical Package for the Social Sciences, v13.0 for Mac, Chicago, 2007) for analysis. Answers to the nutrition knowledge and comprehension items were coded as correct = 1 and incorrect = 0. Scores were determined by the total number of correct answers out of twenty-four. Descriptive and inferential statistics were used to answer each of the research questions (Table 3.8). Descriptive statistics utilized included frequencies, percentages, means, and standard deviations. Inferential statistics included correlations, independent t tests, and Analysis of Variance with Tukey’s Post Hoc when necessary. All inferential statistics were considered significant at the p < 0.05 level.
<table>
<thead>
<tr>
<th>Research Question</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are certified athletic trainers competent in their knowledge regarding sports nutrition?</td>
<td>Frequency &amp; Percentage</td>
</tr>
<tr>
<td>1a. What percent of certified athletic trainers will demonstrate a minimum of 70% (at least 17 out 24 correct responses) competency on the nutrition questionnaire?</td>
<td></td>
</tr>
<tr>
<td>1b. What is the average score of certified athletic trainers on the nutrition questionnaire?</td>
<td>Mean ± Standard Deviation</td>
</tr>
<tr>
<td>2. What differences in nutrition competency exist based on demographic information provided?</td>
<td></td>
</tr>
<tr>
<td>2a. Are there nutrition competency differences among certified athletic trainers based on age?</td>
<td>Analysis of Variance (Tukey’s Post Hoc)</td>
</tr>
<tr>
<td>2b. Are there nutrition competency differences among certified athletic trainers based on gender?</td>
<td>Independent T-test</td>
</tr>
<tr>
<td>2c. Are there nutrition competency differences among certified athletic trainers based on ethnicity?</td>
<td>Analysis of Variance (Tukey’s Post Hoc)</td>
</tr>
<tr>
<td>2d. Are there nutrition competency differences among certified athletic trainers based on route to certification?</td>
<td>Independent T-test</td>
</tr>
<tr>
<td>2e. Are there nutrition competency differences among certified athletic trainers based on highest degree obtained?</td>
<td>Analysis of Variance (Tukey’s Post Hoc)</td>
</tr>
<tr>
<td>2f. Are there nutrition competency differences among certified athletic trainers based on additional professional certifications held?</td>
<td>Analysis of Variance (Tukey’s Post Hoc)</td>
</tr>
<tr>
<td>2g. Are there nutrition competency differences among certified athletic trainers based on the number of years practicing?</td>
<td>Analysis of Variance (Tukey’s Post Hoc)</td>
</tr>
<tr>
<td>2h. Are there nutrition competency differences among certified athletic trainers based on the number of nutrition courses taken?</td>
<td>Correlation</td>
</tr>
<tr>
<td>3. Do certified athletic trainers have a realistic understanding of what their nutrition competency is?</td>
<td></td>
</tr>
<tr>
<td>3a. What percentage of certified athletic trainers that rate their nutrition competency as “High” or “Very High” will demonstrate a minimum of 85% (at least 21 out 24 correct responses) competency on the nutrition questionnaire?</td>
<td>Frequency &amp; Percentage</td>
</tr>
<tr>
<td>3b. Are there nutrition competency differences among certified athletic trainers based on self-reported nutrition competency?</td>
<td>Analysis of Variance (Tukey’s Post Hoc)</td>
</tr>
</tbody>
</table>

LIMITATIONS OF THE STUDY

The limitations of this study were the sample frame and response rate. Recall, not all certified athletic trainers are members of the NATA and not all those that are provide their email addresses. Furthermore, those that do provide their email addresses have the
opportunity to “opt-out” of inclusion in survey samples. In addition, web-based surveys do not typically garner the same response rate as mail-based surveys. These two limitations could potentially restrict the extent to which it is possible to generalize the results of this study to the target population.

Another consideration is the quality of the responses provided by the participants. With self-reported data, there is no guarantee that participants will not use resources when providing answers to the multiple-choice questions. To help control for this possibility, the time to completion for each survey response was calculated. In addition, if a potential participant chooses to respond to the survey, they may purposely or accidentally navigate away from the instrument page prior to completion.

A final limitation may lie in the instrument itself. Because there were a number of different topics addressed in the instrument, six of the sub-topics had only two questions each related to them. This may be too small a number of questions to adequately address a participant's knowledge about the category (i.e. hydration), however including more questions for each category would have resulted in a much longer instrument and could have potentially decreased the response and/or completion rate.

SUMMARY

The primary purpose of this study was to assess the level of nutrition competency among a random sample of certified athletic trainers. If areas of shortcoming pertaining to nutrition knowledge were identified, the emphasis placed on nutrition-related competencies could be re-examined. Additionally, certified athletic trainers may decide to participate in continuing education opportunities related to nutrition in an attempt to correct any deficiencies they may have.
CHAPTER IV
RESULTS & DISCUSSION

This chapter contains the results and the discussion of those results. The sections include (a) introduction, (b) sample demographics, (c) overall nutrition competency, (d) demographic differences in nutrition competency, and (e) self-reported levels of nutrition competency.

INTRODUCTION

An email broadcast was sent to 1000 randomly selected certified athletic trainers who were currently employed at high schools, colleges, and universities across the United States and who had opted-in to participation in email surveys. Of the 1000 emails sent with the first contact, 15 were returned as undeliverable, 2 contacts auto-replied requesting sender verification, and 5 contacts auto-replied with out-of-office notices. When the second message was sent, 21 were returned as undeliverable (13 of the previous 15), 1 contact auto-replied requesting sender verification (the same as one from the previous week), and 3 contacts auto-replied with out-of-office notices (none of the previous 5). With each broadcast, one person responded indicating that he or she could not follow the link in the email. The link was re-issued to these potential respondents and both reported success with the link that was sent. Finally, 23 participants wrote to the investigator requesting the results of the survey once data collection had concluded.
SAMPLE DEMOGRAPHICS

Three-hundred six of the 987 potential participants who received at least one email contact began the survey (31.0% response rate). Of the 306, 280 completed the entire instrument (91.5% completion rate, 28.4% response rate). When answering the research questions, only complete responses were included in the analysis. The demographic characteristics of the respondents and instrument completers are available in Tables 4.1 and 4.2. Note that the characteristics of instrument completers are similar to those of respondents, as well as similar to the population of interest. The exception is the slight discrepancy in the ratio of male to females who responded. Recall that membership statistics are reported for the NATA population as a whole, but this sample was delimited to include only those certified athletic trainers that are employed at a college/university or high school. While the NATA does not report statistics on demographic characteristics of different work settings, it is possible that a higher proportion of females are employed in these types of environments. Another possibility may be that females in general respond to surveys at higher rates than males. While this investigation used a web-based format, Howes and Mailloux demonstrated that females responded at higher rates to mail-based surveys. Finally, females may have more interest in the topic than males, which could have resulted in their over-representation.

Overall, the vast majority of participants \( (n = 253, 90.0\%) \) completed the survey in under twenty minutes. When participants took over twenty minutes to complete the instrument, a concern arose that they may have been utilizing resources to look up the answers to the questions which could artificially inflate their scores and skew the results of the investigation. None of the people who took over twenty minutes to complete the
instrument \((n = 27)\) achieved a perfect score. In fact, the average for the group that took over 20 minutes to complete the instrument was 77.8\%, just 1.5\% different than the average score for the entire sample.
Table 4.1 General demographics of respondents and instrument completers

<table>
<thead>
<tr>
<th>Category</th>
<th>Responses</th>
<th>Respondents (n = 306)</th>
<th>Instrument Completers (n = 280)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>60.1% (184)</td>
<td>60.4% (169)</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>39.9% (122)</td>
<td>39.6% (111)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 and under</td>
<td></td>
<td>14.1% (43)</td>
<td>13.6% (38)</td>
</tr>
<tr>
<td>26-35</td>
<td></td>
<td>49.0% (150)</td>
<td>50.4% (141)</td>
</tr>
<tr>
<td>36-45</td>
<td></td>
<td>22.2% (68)</td>
<td>20.7% (58)</td>
</tr>
<tr>
<td>46-55</td>
<td></td>
<td>12.1% (37)</td>
<td>12.5% (35)</td>
</tr>
<tr>
<td>56 and over</td>
<td></td>
<td>2.6% (8)</td>
<td>2.9% (8)</td>
</tr>
<tr>
<td>Ethnic background</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td></td>
<td>0.7% (2)</td>
<td>0.7% (2)</td>
</tr>
<tr>
<td>Asian</td>
<td></td>
<td>1.0% (3)</td>
<td>1.1% (3)</td>
</tr>
<tr>
<td>Black or African American</td>
<td></td>
<td>1.6% (5)</td>
<td>1.4% (4)</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td></td>
<td>2.3% (7)</td>
<td>2.5% (7)</td>
</tr>
<tr>
<td>Native Hawaiian or Pacific Islander</td>
<td></td>
<td>0.3% (1)</td>
<td>0.0% (0)</td>
</tr>
<tr>
<td>White or Caucasian</td>
<td></td>
<td>94.1% (288)</td>
<td>94.3% (264)</td>
</tr>
<tr>
<td>Years as an athletic trainer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 6 years</td>
<td></td>
<td>31.4% (96)</td>
<td>32.1% (90)</td>
</tr>
<tr>
<td>6-10 years</td>
<td></td>
<td>27.1% (83)</td>
<td>27.9% (78)</td>
</tr>
<tr>
<td>11-15 years</td>
<td></td>
<td>16.3% (50)</td>
<td>15.4% (43)</td>
</tr>
<tr>
<td>16-20 years</td>
<td></td>
<td>10.8% (33)</td>
<td>10.4% (29)</td>
</tr>
<tr>
<td>21-25 years</td>
<td></td>
<td>7.5% (23)</td>
<td>8.2% (23)</td>
</tr>
<tr>
<td>More than 25 years</td>
<td></td>
<td>6.2% (19)</td>
<td>6.1% (17)</td>
</tr>
<tr>
<td>No Answer Entered</td>
<td></td>
<td>0.7% (2)</td>
<td>0.0% (0)</td>
</tr>
</tbody>
</table>
Table 4.2 Education-related demographics of respondents and instrument completers

<table>
<thead>
<tr>
<th>Category</th>
<th>Responses</th>
<th>Respondents (n = 306)</th>
<th>Completers (n = 280)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route to Certification</td>
<td>Curriculum</td>
<td>58.8% (180)</td>
<td>58.9% (165)</td>
</tr>
<tr>
<td></td>
<td>Internship</td>
<td>41.2% (126)</td>
<td>41.1% (115)</td>
</tr>
<tr>
<td>Highest level of education completed</td>
<td>Bachelor’s degree</td>
<td>27.1% (83)</td>
<td>26.4% (74)</td>
</tr>
<tr>
<td></td>
<td>Master’s degree</td>
<td>67.0% (205)</td>
<td>68.2% (191)</td>
</tr>
<tr>
<td></td>
<td>Terminal degree</td>
<td>5.9% (18)</td>
<td>5.4% (15)</td>
</tr>
<tr>
<td>Other Allied Health Certifications Held</td>
<td>Allied Health (i.e. PA, PT, RN)</td>
<td>8.5% (26)</td>
<td>8.9% (25)</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>90.5% (277)</td>
<td>91.1% (255)</td>
</tr>
<tr>
<td></td>
<td>No Answer Entered</td>
<td>1.0% (3)</td>
<td>0.0% (0)</td>
</tr>
<tr>
<td>Athletic Performance Certifications Held</td>
<td>Athletic Performance (i.e. CSCS, CPT, PES)</td>
<td>19.0% (58)</td>
<td>19.3% (54)</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>80.1% (245)</td>
<td>80.7% (222)</td>
</tr>
<tr>
<td></td>
<td>No Answer Entered</td>
<td>1.0% (3)</td>
<td>0.0% (0)</td>
</tr>
<tr>
<td>Number of nutrition courses taken</td>
<td></td>
<td>2.13 ± 3.060 (n = 304)</td>
<td>2.11 ± 3.164</td>
</tr>
</tbody>
</table>

OVERALL NUTRITION COMPETENCY

Research Question #1: Are certified athletic trainers competent in their knowledge regarding sports nutrition?

    Research Question 1a: What percent of Certified Athletic Trainers will demonstrate a minimum of 70% (at least 17 out 24 correct responses) competency on the nutrition questionnaire?

    Research Question 1b: What is the average score of Certified Athletic Trainers on the nutrition questionnaire?
Of the 280 certified athletic trainers who completed the instrument, 210 (75.0%) had scores above 70%. The average score on the instrument was 76.2%, with a standard deviation of 12.8%. The lowest score was 25% and the highest was 100%. This level of competency is slightly above the 70% benchmark for academic passing. It is also on the high end of the range of scores reported in the literature for athletic trainers’ scores on nutrition knowledge instruments. In previous studies reported in the literature, athletic trainers typically answered between 66 and 74% of nutrition knowledge questions correctly.\textsuperscript{29,31,38,39} On an instrument used by Shifflett and associates (2002) over nutrition topics similar to those covered on the instrument used in this investigation, athletic trainers (n = 97) averaged a score of 14.02/19 (74.0%).\textsuperscript{29} The athletic trainers surveyed in that investigation were all from California and were not randomly selected, which limits the generalizability of those results. However, those athletic trainers were all certified. On another questionnaire over similar topics, athletic trainers (n = 18) averaged a score of just 66%.\textsuperscript{39} The “athletic trainer” category in that investigation included both staff and students at one Division I university. Recall that previous investigations included both athletic trainers (who have no formal education requirements) and certified athletic trainers (who must complete the requirements for certification as outlined in “Becoming a Certified Athletic Trainer”).\textsuperscript{17,21} When a distinction was made between the two groups, certified athletic trainers outperformed athletic trainers by about 10%.\textsuperscript{29} The current investigation revealed an average score that was 5 – 10% higher than previous investigations could have resulted from the fact that only certified athletic trainers were included in the sample population. In addition, the most recent investigation was published in 2002; the increase in score could also reflect a growing interest in and
recognition of the importance of proper nutrition for athletes. Finally, this investigation was the first to use a random sample drawn from a national population of certified athletic trainers.

Overall, participants performed best on the items related to micronutrients, nutrition related to injuries, and hydration. The other topics that participants performed at a 70% or higher level were related to macronutrients, ergogenic aids, and body composition. The average score on each of the question subsets is available as Table 4.3.

Table 4.3 Average score on each subset of the nutrition instrument; n = 280

<table>
<thead>
<tr>
<th>Subset</th>
<th>Average score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macronutrients</td>
<td>74.1 ± 22.6</td>
</tr>
<tr>
<td>Micronutrients</td>
<td>86.0 ± 15.2</td>
</tr>
<tr>
<td>Nutrition related to injury</td>
<td>86.4 ± 24.6</td>
</tr>
<tr>
<td>Pre-event nutrition</td>
<td>56.6 ± 39.3</td>
</tr>
<tr>
<td>Hydration</td>
<td>83.4 ± 27.8</td>
</tr>
<tr>
<td>Eating disorders</td>
<td>60.5 ± 21.7</td>
</tr>
<tr>
<td>Body composition</td>
<td>76.3 ± 29.9</td>
</tr>
<tr>
<td>Ergogenic aids</td>
<td>70.5 ± 32.2</td>
</tr>
</tbody>
</table>

Participants scored lower on the questions related to eating disorders and pre-event nutrition. While both of these topics are things that athletic trainers encounter regularly, there may be underlying reasons that the performance was poor on these categories. The two eating disorder questions were related to the population that bulimia
can occur in (answered correctly by 98.6% of participants) and the signs of anorexia (answered correctly by 22.5% of participants). The wrong answer about signs of anorexia that was chosen most frequently by participants was lanugo (chosen by 46.8% of participants). While this is a sign of anorexia nervosa, the word may have been unfamiliar to many participants, which may have resulted in them choosing it. The more concerning of the two areas of weakness was that of pre-event meals. While the majority of certified athletic trainers would refer suspected eating disorder cases to more experienced resources because of the potential serious and life-threatening implications for the athlete, they are not as likely to refer an athlete seeking guidance on pre-event nutrition. The two pre-event nutrition questions were related to meal contents (answered correctly by 56.4% of participants) and timing (answered correctly by 56.8% of participants). Each of the distractor responses for the pre-event meal contents question were chosen by over 5% of participants. Over 30% of participants believed that athlete preference was not a factor in the timing of the pre-event meal. Because participants performed most poorly on questions related to these two categories, these may be areas which need to be addressed better during undergraduate education. In addition, athletic trainers who recognize that these topics are areas of weakness for them may choose to further their knowledge by attending continuing education seminars that focus on these topics.

The number of instrument completers who answered each question correctly is available as Table 4.4, 4.5, and 4.6.
Table 4.4 Macronutrient item responses; n = 280

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct Answer</th>
<th>Incorrect Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best source of CHO</td>
<td>Sweet potato</td>
<td>Baby carrots</td>
</tr>
<tr>
<td></td>
<td>(87.9%, 246)</td>
<td>(7.5%, 21)</td>
</tr>
<tr>
<td>Least amount of protein</td>
<td>Orange</td>
<td>WW bread</td>
</tr>
<tr>
<td></td>
<td>(82.5%, 231)</td>
<td>(12.5%, 35)</td>
</tr>
<tr>
<td>Nutrient with 9 kcal/g</td>
<td>Fat</td>
<td>Carbohydrate</td>
</tr>
<tr>
<td></td>
<td>(71.8%, 201)</td>
<td>(12.1%, 34)</td>
</tr>
<tr>
<td>Least amount of protein</td>
<td>Orange</td>
<td>WW bread</td>
</tr>
<tr>
<td></td>
<td>(82.5%, 231)</td>
<td>(12.5%, 35)</td>
</tr>
<tr>
<td>Not high in fiber</td>
<td>Milk</td>
<td>Starch/bread</td>
</tr>
<tr>
<td></td>
<td>(80.0%, 224)</td>
<td>(11.4%, 32)</td>
</tr>
<tr>
<td>Protein calories</td>
<td>4 kcal/g</td>
<td>7 kcal/g</td>
</tr>
<tr>
<td></td>
<td>(62.1%, 174)</td>
<td>(16.8%, 47)</td>
</tr>
<tr>
<td>Calories in pound of fat</td>
<td>3500 kcal</td>
<td>2500 kcal</td>
</tr>
<tr>
<td></td>
<td>(60.4%, 169)</td>
<td>(13.9%, 39)</td>
</tr>
</tbody>
</table>

Table 4.5 Micronutrient item responses; n = 280

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct Answer</th>
<th>Incorrect Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteoporosis nutrient</td>
<td>Calcium</td>
<td>Iron</td>
</tr>
<tr>
<td></td>
<td>(99.3%, 278)</td>
<td>(0.7%, 2)</td>
</tr>
<tr>
<td>Fat soluble vitamins</td>
<td>A, D, E, K</td>
<td>B1, B2, B6, C</td>
</tr>
<tr>
<td></td>
<td>(80.7%, 226)</td>
<td>(7.5%, 21)</td>
</tr>
<tr>
<td>Nutrient not in meat</td>
<td>Vitamin C</td>
<td>Niacin</td>
</tr>
<tr>
<td></td>
<td>(90.7%, 254)</td>
<td>(3.6%, 10)</td>
</tr>
<tr>
<td>Iron deficiency</td>
<td>Anemia</td>
<td>Liver failure</td>
</tr>
<tr>
<td></td>
<td>(97.1%, 272)</td>
<td>(1.8%, 5)</td>
</tr>
<tr>
<td>Not a role of minerals</td>
<td>Provide energy</td>
<td>Soft tissue</td>
</tr>
<tr>
<td></td>
<td>(72.5%, 203)</td>
<td>component</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(12.1%, 34)</td>
</tr>
<tr>
<td>Vitamin E function</td>
<td>Antioxidant</td>
<td>Free radical</td>
</tr>
<tr>
<td></td>
<td>(75.4%, 211)</td>
<td>(16.4%, 46)</td>
</tr>
</tbody>
</table>

46
Table 4.6 Other athletic training related item responses; n = 280

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct Answer</th>
<th>Incorrect Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concern with injury</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight gain</td>
<td>Weight loss</td>
<td>Malnutrition</td>
</tr>
<tr>
<td>(91.1%, 255)</td>
<td>(3.9%, 11)</td>
<td>(3.2%, 9)</td>
</tr>
<tr>
<td>Nutrients for muscle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amino acids</td>
<td>Carbohydrates</td>
<td>Vitamins</td>
</tr>
<tr>
<td>(81.8%, 229)</td>
<td>(5.7%, 16)</td>
<td>(5.0%, 14)</td>
</tr>
<tr>
<td><strong>Not in pre-event meal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 1000 kcal</td>
<td>Moderate PRO</td>
<td>Food preferred</td>
</tr>
<tr>
<td>(56.4%, 158)</td>
<td>(18.6%, 52)</td>
<td>(11.1%, 31)</td>
</tr>
<tr>
<td>Pre-event meal timing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comp. level</td>
<td>Preference</td>
<td>Gastric empty</td>
</tr>
<tr>
<td>(56.8%, 159)</td>
<td>(33.2%, 93)</td>
<td>(5.7%, 16)</td>
</tr>
<tr>
<td><strong>Excessive water</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyponatremia</td>
<td>Hypohydration</td>
<td>Hyperkalemia</td>
</tr>
<tr>
<td>(74.3%, 208)</td>
<td>(13.9%, 39)</td>
<td>(7.1%, 20)</td>
</tr>
<tr>
<td>Not for rehydration</td>
<td>Caffeine</td>
<td>Hypotension</td>
</tr>
<tr>
<td>(92.5%, 259)</td>
<td>Preference</td>
<td>(2.5%, 7)</td>
</tr>
<tr>
<td><strong>Not sign of anorexia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachycardia</td>
<td>Lanugo</td>
<td>Hypotension</td>
</tr>
<tr>
<td>(22.5%, 63)</td>
<td>(46.8%, 131)</td>
<td>(29.6%, 83)</td>
</tr>
<tr>
<td>Bulimia found in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All weights</td>
<td>Only UW</td>
<td>Only normal</td>
</tr>
<tr>
<td>(98.6%, 276)</td>
<td>(0.4%, 1)</td>
<td>(0.7%, 2)</td>
</tr>
<tr>
<td>Body comp standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrostatic</td>
<td>Skinfold</td>
<td>BMI</td>
</tr>
<tr>
<td>(85.0%, 238)</td>
<td>(7.9%, 22)</td>
<td>(6.4%, 18)</td>
</tr>
<tr>
<td>Skinfold error</td>
<td>± 3%</td>
<td>± 1%</td>
</tr>
<tr>
<td>(67.5%, 189)</td>
<td>(18.6%, 52)</td>
<td>(8.6%, 24)</td>
</tr>
<tr>
<td><strong>Not effect of caffeine</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>↓ BMR</td>
<td>↑ force</td>
<td>Increase EPI</td>
</tr>
<tr>
<td>(58.6%, 164)</td>
<td>(37.5%, 105)</td>
<td>(2.9%, 8)</td>
</tr>
<tr>
<td>AAS mimic what</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Testosterone</td>
<td>HGH</td>
<td>Androsterone</td>
</tr>
<tr>
<td>(82.5%, 231)</td>
<td>(11.4%, 32)</td>
<td>(5.7%, 16)</td>
</tr>
<tr>
<td><strong>Not sign of anorexia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachycardia</td>
<td>Lanugo</td>
<td>Hypotension</td>
</tr>
<tr>
<td>(22.5%, 63)</td>
<td>(46.8%, 131)</td>
<td>(29.6%, 83)</td>
</tr>
<tr>
<td>Bulimia found in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All weights</td>
<td>Only UW</td>
<td>Only normal</td>
</tr>
<tr>
<td>(98.6%, 276)</td>
<td>(0.4%, 1)</td>
<td>(0.7%, 2)</td>
</tr>
<tr>
<td>Body comp standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrostatic</td>
<td>Skinfold</td>
<td>BMI</td>
</tr>
<tr>
<td>(85.0%, 238)</td>
<td>(7.9%, 22)</td>
<td>(6.4%, 18)</td>
</tr>
<tr>
<td>Skinfold error</td>
<td>± 3%</td>
<td>± 1%</td>
</tr>
<tr>
<td>(67.5%, 189)</td>
<td>(18.6%, 52)</td>
<td>(8.6%, 24)</td>
</tr>
<tr>
<td><strong>Not effect of caffeine</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>↓ BMR</td>
<td>↑ force</td>
<td>Increase EPI</td>
</tr>
<tr>
<td>(58.6%, 164)</td>
<td>(37.5%, 105)</td>
<td>(2.9%, 8)</td>
</tr>
<tr>
<td>AAS mimic what</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Testosterone</td>
<td>HGH</td>
<td>Androsterone</td>
</tr>
<tr>
<td>(82.5%, 231)</td>
<td>(11.4%, 32)</td>
<td>(5.7%, 16)</td>
</tr>
</tbody>
</table>

47
DEMOGRAPHIC DIFFERENCES IN NUTRITION COMPETENCY

Research Question #2: What differences in nutrition competency exist based on demographic information provided?

Research Question #2a: Are there nutrition competency differences among certified athletic trainers based on age?

The average score of each age group on the instrument is available as Table 4.7. A one-way analysis of variance was conducted to evaluate potential differences in score on the nutrition competency instrument based on age. The independent variable, age, included five levels: 25 and under, 26 – 35, 36 – 45, 46 – 55, and 56 and over. The dependent variable was the score on the nutrition competency instrument. The ANOVA was not significant, $F(4,275) = 1.005, p = 0.405$.

Table 4.7. Age and score on instrument

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 and under (n = 38)</td>
<td>75.9 ± 11.1</td>
</tr>
<tr>
<td>26 – 35 (n = 141)</td>
<td>75.1 ± 12.9</td>
</tr>
<tr>
<td>36 – 45 (n = 58)</td>
<td>76.9 ± 13.9</td>
</tr>
<tr>
<td>46 – 55 (n = 35)</td>
<td>79.8 ± 12.2</td>
</tr>
<tr>
<td>56 and over (n = 8)</td>
<td>76.0 ± 12.7</td>
</tr>
</tbody>
</table>

Research Question #2b: Are there nutrition competency differences among certified athletic trainers based on gender?

The average score of each gender is available as Table 4.8. An independent-samples t test was conducted to evaluate the hypothesis that females would average a
different score on the nutrition instrument than males. The test was not significant, $t(278) = -0.275$, $p = 0.783$.

Table 4.8 Gender and score on instrument

<table>
<thead>
<tr>
<th>Gender</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (n = 111)</td>
<td>75.9 ± 12.0</td>
</tr>
<tr>
<td>Female (n = 169)</td>
<td>76.3 ± 13.3</td>
</tr>
</tbody>
</table>

Research Question #2c: Are there nutrition competency differences among Certified Athletic Trainers based on ethnicity?

The average score of each ethnicity on the instrument is available as Table 4.9. A one-way analysis of variance was conducted to evaluate potential differences in score on the nutrition competency instrument based on ethnicity. The independent variable, ethnicity, included five levels: American Indian or Alaska Native, Asian, Black or African American, Hispanic or Latino, and White or Caucasian. The dependent variable was the score on the nutrition competency instrument. The ANOVA was not significant, $F(4,275) = 1.324$, $p = 0.261$. 
Table 4.9 Ethnicity and score on instrument

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian or Alaska Native (n = 2)</td>
<td>79.2 ± 5.9</td>
</tr>
<tr>
<td>Asian (n = 3)</td>
<td>86.1 ± 2.4</td>
</tr>
<tr>
<td>Black or African American (n = 4)</td>
<td>64.6 ± 12.0</td>
</tr>
<tr>
<td>Hispanic or Latino (n = 7)</td>
<td>77.4 ± 8.6</td>
</tr>
<tr>
<td>White or Caucasian (n = 264)</td>
<td>76.2 ± 12.9</td>
</tr>
</tbody>
</table>

Research Question #2d: Are there nutrition competency differences among certified athletic trainers based on route to certification?

The average score of each certification route is available as Table 4.10. An independent samples $t$ test was conducted to evaluate the hypothesis that graduates from a curriculum program would average a different score on the nutrition instrument than graduates from an internship program. The test was not significant, $t(278) = -1.108$, $p = 0.269$.

Table 4.10 Route to certification and score on instrument

<table>
<thead>
<tr>
<th>Route to Certification</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum (n = 165)</td>
<td>75.5 ± 12.1</td>
</tr>
<tr>
<td>Internship (n = 114)</td>
<td>77.2 ± 13.6</td>
</tr>
</tbody>
</table>

Research Question #2e: Are there nutrition competency differences among certified athletic trainers based on highest degree obtained?
The average score of each group on the instrument is available as Table 4.11. A one-way analysis of variance was conducted to evaluate potential differences in score on the nutrition competency instrument based on highest degree earned. The independent variable, highest degree obtained, included three levels: Bachelor’s degree, Master’s degree, and terminal degree. The dependent variable was the score on the nutrition competency instrument. The ANOVA was significant, $F(2,277) = 4.063, p = 0.018$.

Follow-up tests were conducted to evaluate pairwise differences among the means. Because the variances among the three groups ranged from 12.6 to 13.8, we chose to assume equal variances and use the Tukey’s test. Follow-up testing revealed one significant pairwise difference ($p < 0.05$) between participants with a bachelor’s degree and those holding terminal degrees.

Table 4.11 Highest degree obtained and score on instrument

<table>
<thead>
<tr>
<th>Highest Degree Obtained</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor’s degree (n = 73)</td>
<td>74.0 ± 12.6</td>
</tr>
<tr>
<td>Master’s degree (n = 192)</td>
<td>76.4 ± 12.6</td>
</tr>
<tr>
<td>Terminal degree (n = 15)</td>
<td>84.2 ± 13.8</td>
</tr>
</tbody>
</table>

Research Question #2f: Are there nutrition competency differences among certified athletic trainers based on additional professional certifications held?

The average score of those who hold additional allied health related certification and those who do not is available as Table 4.12. An independent samples $t$ test was conducted to evaluate the hypothesis that those with additional allied health related
certifications would average a different score on the nutrition instrument than those without. The test was not significant, \( t(278) = 0.134, p = 0.894 \).

Table 4.12 Additional allied health certifications and score on instrument

<table>
<thead>
<tr>
<th>Additional Allied Health Certifications?</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (n = 25)</td>
<td>75.8 ± 12.6</td>
</tr>
<tr>
<td>No (n = 255)</td>
<td>76.2 ± 12.8</td>
</tr>
</tbody>
</table>

The average score of those who hold additional athletic performance related certifications and those who do not is available as Table 4.13. An independent samples \( t \) test was conducted to evaluate the hypothesis that those with additional athletic performance related certifications would average a different score on the nutrition instrument than those without. The test was significant, \( t(278) = -3.366, p = 0.001 \).

Table 4.13 Additional athletic performance certifications and score on instrument

<table>
<thead>
<tr>
<th>Additional Athletic Performance Certifications?</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (n = 54)</td>
<td>81.3 ± 9.2</td>
</tr>
<tr>
<td>No (n = 226)</td>
<td>75.0 ± 13.2</td>
</tr>
</tbody>
</table>

Research Question #2g: Are there nutrition competency differences among certified athletic trainers based on the number of years practicing?

The average score of each “years practicing” group on the instrument is available as Table 4.14. A one-way analysis of variance was conducted to evaluate potential differences in score on the nutrition competency instrument based on years practicing.
The independent variable, years practicing, included six levels: less than 6 years, 6 – 10 years, 11 – 15 years, 16 – 20 years, 21 – 25 years, and more than 25 years. The dependent variable was the score on the nutrition competency instrument. The ANOVA was not significant, F(5,274) = 1.920, p = 0.091.

Table 4.14 Years practicing as an athletic trainer and score on instrument

<table>
<thead>
<tr>
<th>Years practicing as an athletic trainer</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 6 years (n = 90)</td>
<td>74.7 ± 12.4</td>
</tr>
<tr>
<td>6 – 10 years (n = 78)</td>
<td>75.0 ± 13.3</td>
</tr>
<tr>
<td>11 – 15 years (n = 43)</td>
<td>78.0 ± 12.7</td>
</tr>
<tr>
<td>16 – 20 years (n = 29)</td>
<td>74.6 ± 13.7</td>
</tr>
<tr>
<td>21 – 25 years (n = 23)</td>
<td>79.5 ± 12.9</td>
</tr>
<tr>
<td>More than 25 years (n = 17)</td>
<td>82.8 ± 8.1</td>
</tr>
</tbody>
</table>

Research Question #2h: Are there nutrition competency differences among certified athletic trainers based on the number of nutrition courses taken?

Correlation coefficients were computed between number of nutrition courses taken at the college level and score on the nutrition competency instrument. The results of the correlational analysis were not statistically significant (r(278) = 0.040, p = 0.500).

Researchers have not reported on the effect of age or gender on nutrition knowledge in previous investigations using coaches and athletic trainers as the population of interest. There is slightly more information in the literature regarding the effects of these demographic characteristics on nutrition knowledge in athletes. One study which
evaluated the nutrition knowledge of male hockey players from (10-21) years old found that increasing age was not correlated to an increase in nutrition knowledge.\textsuperscript{27} Most investigations on athletes use the collegiate or high school population, where there is not much variability in age in the sample. For this reason, it is unsurprising that differences based on age have not been reported. Previous studies have reported both that females score higher on nutrition knowledge instruments and that both genders perform about equally.\textsuperscript{18,45,46}

The effect of ethnicity on nutrition knowledge scores has not been reported in any population researched for this investigation. The major contributing factor to the ANOVA not revealing a significant difference between different ethnic groups’ scores in this investigation is the fact that all ethnic groups, with the exception of Caucasians, had fewer than 10 participants.

As the $t$ test indicated, both internship and curriculum program graduates performed about equally on the nutrition competency instrument. This was unexpected because the instrument was based on the competencies that were established by the NATA Education Council. Because students graduating from CAATE accredited programs are required to have met these competency standards, they might have had an advantage over students who graduated from an internship program, where specific competencies pertaining to nutrition may not have been addressed.

Previous research has not evaluated knowledge differences based on highest degree obtained. In this investigation, the scores increased with increasing education. This difference was not expected, because the instrument was designed to assess a basic (entry-level) level of nutrition competency. Taking more nutrition classes may not have
resulted in a higher score since the instrument was not made to test advanced nutrition knowledge. In addition, completing a master’s or even a terminal degree does not guarantee that a person would have increased nutrition knowledge; he or she still may only have taken one nutrition course.

One factor that could have contributed to the significant difference between bachelor’s level educated participants and those with terminal degrees may lie in their occupation. Since fewer than 2% of the population of certified athletic trainers hold terminal degrees, they are in high demand in the education setting. The majority of certified athletic trainers holding terminal degrees function in the capacity of athletic training education program directors. Program directors have the responsibility of ensuring that students graduating from their programs have met all of the competencies established by the Education Council. Because of this, they may have been more familiar with the material covered on the instrument.

Previous research on nutrition knowledge has not evaluated whether holding additional certifications has an impact on knowledge. This investigation compared the nutrition competency of athletic trainers who hold additional allied health certifications to that of those who do not. There was no significant difference between the two groups. This is not surprising, as the other allied health professions may or may not have nutrition-related aspects. There was a significant difference found between the scores of athletic trainers who hold certifications related to athletic performance enhancement (i.e. the NSCA’s Certified Strength and Conditioning Specialist (CSCS) or the ACSM’s Performance Enhancement Specialist (PES)) and those who do not. The understanding of athletic nutrition is a significant component of these professionals’ job duties and is
addressed on their credentialing examinations; therefore it is not unexpected that people who have these additional certifications would earn higher scores than those who do not. In the literature reviewed, the only group of people who scored higher than athletic trainers on a nutrition knowledge questionnaire were strength and conditioning coaches, who typically hold the CSCS credential. Finally, certified strength and conditioning coaches, along with certified athletic trainers, are recognized as prime sources of nutrition information for athletes.

To the knowledge of this researcher, the relationship between years practicing as an athletic trainer and nutrition knowledge has not been evaluated previously in the literature. In this study, scores on the instrument did not increase with the length of time the participant had been working as an athletic trainer. This was expected, because the instrument was designed to assess entry-level nutrition competency. Having more time in the field may lead to increased nutrition knowledge for athletic trainers, but this would not necessarily be reflected in the participant’s score.

The major contributing factor to the lack of statistical significance in the correlation between score on the instrument and quantity of nutrition courses taken is the low number of nutrition classes taken by the participants, resulting in a lack of variability. The majority of participants (n = 252, 91.6%) had taken three or fewer nutrition classes, so it was not possible to draw a meaningful correlation between the two variables. In addition, the instrument was designed to assess the type of basic nutrition knowledge that an entry-level certified athletic trainer would be expected to possess. For this reason, having more advanced nutrition knowledge would not necessarily result in a higher score on the instrument.
SELF-REPORTED LEVELS OF NUTRITION COMPETENCY

Research Question #3: Do Certified Athletic Trainers have a realistic understanding of what their nutrition competency is?

    Research Question #3a: What percentage of Certified Athletic Trainers that rate their nutrition competency as “High” or “Very High” will demonstrate a minimum of 85% (at least 21 out 24 correct responses) competency on the nutrition questionnaire?

    Research Question #3b: Are there nutrition competency differences among Certified Athletic Trainers based on self-reported nutrition competency?

    Of the 53 participants who rated their nutrition competency as “Very High” or “High”, 50.9% (n = 27) scored above an eighty-five percent. The scores of all the participants who rated their nutrition competency as “High” or “Very High” is available as Table 4.15.

    The average score of each self-rated level of nutrition competency group on the instrument is available as Table 4.16. A one-way analysis of variance was conducted to evaluate the relationship between self-reported level of nutrition competency and score on the nutrition competency instrument. The independent variable, self-reported level of nutrition competency, included five levels: very low, low, moderate, high, and very high. The dependent variable was the score on the nutrition competency instrument. The ANOVA was significant, F(4,275) = 8.229, p < 0.001.

    Follow-up tests were conducted to evaluate pairwise differences among the means. Because the variances among the six groups ranged from 9.5 to 16.1, we chose to assume equal variances and used the Tukey’s test. Follow-up testing revealed several
significant pairwise differences (p < 0.05). These differences are summarized in Table 4.17.

Table 4.15 Scores of athletic trainers who rated their competency as “High” or “Very High”

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.0</td>
<td>2</td>
<td>3.8</td>
<td>3.8</td>
</tr>
<tr>
<td>95.8</td>
<td>5</td>
<td>9.4</td>
<td>13.2</td>
</tr>
<tr>
<td>91.7</td>
<td>6</td>
<td>11.3</td>
<td>24.5</td>
</tr>
<tr>
<td>87.5</td>
<td>14</td>
<td>26.4</td>
<td>50.9</td>
</tr>
<tr>
<td>83.3</td>
<td>9</td>
<td>17.0</td>
<td>67.9</td>
</tr>
<tr>
<td>79.2</td>
<td>3</td>
<td>5.7</td>
<td>73.6</td>
</tr>
<tr>
<td>75.0</td>
<td>4</td>
<td>7.5</td>
<td>81.1</td>
</tr>
<tr>
<td>70.8</td>
<td>3</td>
<td>5.7</td>
<td>86.8</td>
</tr>
<tr>
<td>66.7</td>
<td>3</td>
<td>5.7</td>
<td>92.5</td>
</tr>
<tr>
<td>62.5</td>
<td>2</td>
<td>3.8</td>
<td>96.2</td>
</tr>
<tr>
<td>54.2</td>
<td>1</td>
<td>1.9</td>
<td>98.1</td>
</tr>
<tr>
<td>50.0</td>
<td>1</td>
<td>1.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
4.16 Self-rated level of nutrition competency and score on the instrument

<table>
<thead>
<tr>
<th>Self-rated level of nutrition competency</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low (n = 5)</td>
<td>61.7 ± 9.9</td>
</tr>
<tr>
<td>Low (n = 33)</td>
<td>69.7 ± 16.1</td>
</tr>
<tr>
<td>Moderate (n = 189)</td>
<td>75.8 ± 11.7</td>
</tr>
<tr>
<td>High (n = 47)</td>
<td>82.1 ± 11.3</td>
</tr>
<tr>
<td>Very high (n = 6)</td>
<td>87.5 ± 9.5</td>
</tr>
</tbody>
</table>

4.17 Results of the Tukey follow-up test on self-rated level of competency and score

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Mean difference</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>Low</td>
<td>-8.0</td>
<td>0.644</td>
</tr>
<tr>
<td>Very low</td>
<td>Moderate</td>
<td>-14.2</td>
<td>0.079</td>
</tr>
<tr>
<td>Very low</td>
<td>High</td>
<td>-20.4*</td>
<td>0.004</td>
</tr>
<tr>
<td>Very low</td>
<td>Very high</td>
<td>-25.8*</td>
<td>0.005</td>
</tr>
<tr>
<td>Low</td>
<td>Moderate</td>
<td>-6.1</td>
<td>0.060</td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>-12.4*</td>
<td>&gt; 0.001</td>
</tr>
<tr>
<td>Low</td>
<td>Very high</td>
<td>-17.8*</td>
<td>0.010</td>
</tr>
<tr>
<td>Moderate</td>
<td>High</td>
<td>-6.3*</td>
<td>0.015</td>
</tr>
<tr>
<td>Moderate</td>
<td>Very high</td>
<td>-11.7</td>
<td>0.144</td>
</tr>
<tr>
<td>High</td>
<td>Very high</td>
<td>-5.4</td>
<td>0.844</td>
</tr>
</tbody>
</table>

*Indicates that difference between Level 1 and Level 2 is significant at the p < 0.05 level
These results indicate that certified athletic trainers have a relatively good idea of where they stand with respect to their nutrition competency. This is reassuring because with a good understanding of their limitations, athletic trainers would hopefully look up answers when faced with questions that they feel unsure about the answers of and they know when to refer athletes to outside sources such as registered dietitians. In a previous study where participants were asked to assess their nutrition knowledge before completing a questionnaire, coaches underestimated their knowledge while athletes over-estimated their knowledge. Athletic trainers were found to have an accurate perception of their nutrition knowledge.²⁹
CHAPTER V
SUMMARY

STATEMENT OF THE PROBLEM

Since certified athletic trainers have been shown to be a key source of nutrition information for athletes, it is essential that these professionals have an adequate amount of nutrition competency in order to appropriately answer their questions and make referrals when necessary.²,³ The primary purpose of this study was to assess the nutrition competency (as defined by the National Athletic Trainers’ Association Education Council) of a random sample of certified athletic trainers. A secondary purpose was to determine if any differences in nutrition competency exist based on demographic groupings. The final purpose was to determine if certified athletic trainers have realistic perspectives on their actual nutrition competency level.

SUMMARY OF RESEARCH QUESTIONS

The research questions of this study focused on evaluating the nutrition competency of certified athletic trainers, determining if there were differences in scores based on the demographic characteristics, and to assess whether certified athletic trainers had a realistic idea of what their level of nutrition competency was.

Overall, athletic trainers averaged a score of 76.3 ± 12.7, above the standard academic passing point of 70%. The only demographic characteristics that had a
statistically significant impact on scores on the nutrition instrument were the highest degree earned and holding additional certifications related to athletic performance. Finally, athletic trainers’ scores on the nutrition competency instrument increased with their self-rated level of nutrition competency.

IMPLICATIONS

The results of this investigation have positive implications for athletic trainers and the population that they serve. It is important that athletic trainers have a sound level of nutrition knowledge because athletes often come to them seeking advice on the topic. Athletic trainers averaged a score above 75% on the instrument used in this study. This results in a quality standard of care for the athletes who have access to certified athletic trainers. Moreover, because the athletic trainers in this investigation were able to accurately self-identify their level of nutrition competency, they should be confident in their ability to answer questions that arise and their knowledge of when a referral to another resource is necessary.

Furthermore, the results of this investigation could be used to guide athletic training professors in the development of their education programs. Two areas of shortcoming identified in this investigation were pre-participation meals and eating disorders. In future, program directors may choose to place more emphasis on nutrition, particularly on those two topics, in the education setting so that future athletes can benefit from the knowledge of the next generation of athletic trainers.

These findings may also open the door to more nutrition-related continuing education opportunities for certified athletic trainers. If current certified athletic trainers
recognize that they have deficiencies in their nutrition competency, they may be apt to pursue continuing education opportunities that could rectify these areas.

POSSIBILITIES FOR FUTURE RESEARCH

Based on the findings of this investigation, future research may seek to further analyze the nutrition competency of certified athletic trainers in more specific areas. For example, the areas in this study that participants performed worst in were related to pre-participation meals and eating disorders. A future study may look further into whether certified athletic trainers can identify the signs and symptoms of eating disorders and situations in which a referral to a specialist is warranted. Because many of the topic subsets had only two questions related to them on the instrument, a more in-depth questionnaire could further investigate the competency of athletic trainers in these areas individually and determine if true deficiencies exist. A new instrument could utilize a variety of question types in order to test levels of understanding beyond knowledge and comprehension, including application or analysis.
REFERENCES


APPENDIX A

NUTRITIONAL COMPETENCIES

Nutritional Aspects of injuries and Illnesses (NU)

In order to demonstrate knowledge of the practice of athletic training, to think critically about the practices involved in athletic training, including the ability to integrate knowledge, skill and behavior, and to assume professional responsibility, the entry-level certified athletic trainer must possess an understanding of the nutritional aspects of injuries and illnesses. The use of learning objectives and outcomes in the nutritional aspects of injuries and illnesses ensures that the student is able to:

Cognitive Competencies

1. Describe personal health habits and their role in enhancing performance, preventing injury or illness, and maintaining a healthy lifestyle.

2. Describe the USDA's “My Pyramid" and explain how this can be used in performing a basic dietary analysis and creating a dietary plan for a patient.

3. Identify and describe primary national organizations responsible for public and professional nutritional information.

4. Identify nutritional considerations in rehabilitation, including nutrients involved in healing and nutritional risk factors (e.g., reduced activity with the same dietary regimen and others).

5. Describe common illnesses and injuries that are attributed to poor nutrition (e.g., effects of poor dietary habits on bone loss, on injury, on long-term health, and on other factors).

6. Explain energy and nutritional demands of specific activities and the nutritional demands placed on the patient.

7. Explain principles of nutrition as they relate to the dietary and nutritional needs of the patient (e.g., role of fluids, electrolytes, vitamins, minerals, carbohydrates, protein, fat, and others).
8. Explain the physiological processes and time factors involved in the digestion, absorption, and assimilation of food, fluids, and nutritional supplements. Further, relate these processes and time factors to the design and planning of pre-activity and post-activity meals, menu content, scheduling, and the effect of other non-exercise stresses before activity.

9. Describe the principles, advantages, and disadvantages of cryogenic aids and dietary supplements used in an effort to improve physical performance.


11. Identify and interpret pertinent scientific nutritional comments or position papers (e.g., healthy weight loss, fluid replacement, pre-event meals, and others).

12. Explain principles of weight control for safe weight loss and weight gain, and explain common misconceptions regarding the use of food, fluids, and nutritional supplements in weight control.


14. Describe disordered eating and eating disorders (i.e., signs, symptoms, physical and psychological consequences, referral systems).

15. Identify effects of macronutrients (e.g., saturated fats, incomplete proteins, and complex carbohydrates) on performance, health, and disease.

16. Describe signs, symptoms, and physiological effects of mineral deficiency (e.g., iron, and calcium), and identify foods high in specific mineral content.

17. Identify and explain food label Daily Value recommendations and common food sources of essential vitamins and minerals in using current USDA Dietary Guidelines.

18. Describe the principles and methods of body composition assessment (e.g., skinfold calipers, bioelectric impedance, body mass index (BMI) to assess a patient's health status and to monitor progress in a weight loss or weight gain program for patients of all ages and in a variety of settings.

19. Explain the relationship between basal metabolic rate, caloric intake, and energy expenditure in the use of the Food Pyramid Guidelines.

20. Identify the nutritional benefits and costs of popular dietary regimen for weight gain, weight loss, and performance enhancement.
Psychomotor Competencies

1. Assess body composition by validated technique (e.g., skinfold calipers, bioelectric impedance, BMI, etc.) to assess a patient's health status and to monitor progress during a weight loss or weight gain program.

2. Calculate energy expenditure, caloric intake, and BMR.

3. Provide educational information about basic nutritional concepts, facts, needs, and food labels for settings associated with physically active individuals of a wide range of ages and needs.

Clinical Proficiency #1

Demonstrate the ability to counsel a patient in proper nutrition. This may include providing basic nutritional information and/or an exercise and nutrition program for weight gain or weight loss. The student will demonstrate the ability to take measurements and figure calculations for a weight control plan (e.g., measurement of body composition and BMI, calculation of energy expenditure, caloric intake, and BMR). Armed with basic nutritional data, the student will demonstrate the ability to develop and implement a pre-participation meal and an appropriate exercise and nutritional plan for an active individual. The student will develop an active listening relationship to effectively communicate with the patient and, as appropriate, refer the patient to other medical professionals (physician, nutritionist, counselor or psychologist) as needed.

Clinical Proficiency #2

Demonstrate the ability to recognize disordered eating and eating disorders, establish a professional helping relationship with the patient, interact through support and education, and encourage vocal discussion and other support through referral to the appropriate medical professionals.
APPENDIX B

SURVEY INSTRUMENT

1. Gender
   Male
   Female

2. Age
   25 and under
   26 – 35
   36 – 45
   46 – 55
   56 and over

3. Ethnic Background
   American Indian or Alaska Native
   Asian
   Black or African American
   Hispanic or Latino
   Native Hawaiian or Other Pacific Islander
   White or Caucasian

4. Route to Certification
   Internship
   Curriculum

5. What is the highest level of education you have completed?
   Bachelor's degree
   Started Master's coursework, no degree
   Master's degree
   Started terminal degree coursework, no degree
   Terminal degree (i.e. PhD, EdD)
   MD / DO
   Other, please specify
6. What other professional certifications (if any) do you hold?
   RN
   RD
   PT
   PTA
   NSCA-CPT
   NSCA-CSCS
   EMT
   PA
   RNP
   None
   Other, please specify

7. How many years have you practiced as an athletic trainer?
   Less than 6 years
   6 – 10 years
   11 – 15 years
   16 – 20 years
   21 – 25 years
   More than 25 years

8. How many nutrition courses have you taken at the college level?

9. What would you consider your level of nutrition competency to be?
   Very high
   High
   Moderate
   Low
   Very low

10. Which of the following foods is the best source of carbohydrate?
    One half cup of green beans
    One can (12oz) diet soda
    One ounce of mozzarella cheese
    One sweet potato
    Twelve baby carrots

11. When an athlete is injured and can no longer participate in practices and games, which of the following is a nutritional concern?
    Weight loss
    Loss of essential body fat
    Weight gain
    Malnutrition
    Dehydration
12. In order to help prevent the development of osteoporosis later in life, females should consume adequate quantities of which nutrient during the years in which they are developing peak bone mass?
   - Thiamin
   - Tocopherol
   - Iron
   - Ascorbic acid
   - Calcium

13. The contents of a quality pre-event meal should include all of the following except:
   A. A minimum of 1000 calories
   B. A food that the athlete prefers
   C. A low amount of fat
   D. A moderate amount of protein
   E. A high amount of carbohydrate

14. Which of the following are fat soluble vitamins?
   - A, D, E, K
   - E, niacin, thiamin, riboflavin
   - Folate, E, B1, K
   - B, C, D, niacin
   - B1, B2, B6, C

15. During prolonged endurance exercise in the heat, excessive intake of water and inadequate intake of salt may lead to a dangerous health condition known as:
   - Hypotension
   - Hyperkalemia
   - Hypohydration
   - Hypercalcemia
   - Hyponatremia

16. Which of the following has the least amount of dietary protein?
   - One orange
   - One 8 oz glass of 2% milk
   - One 4 oz chicken breast
   - One half cup of baked beans
   - One slice of whole wheat bread

17. An athlete struggling with anorexia nervosa may display all of the following signs except:
   - Amenorrhea
   - Tachycardia
   - Low body weight
   - Hypotension
   - Lanugo
18. Which key nutrient is not usually found in substantial amounts in the meat group?  
   Protein  
   Vitamin C  
   Niacin  
   Thiamin  
   Iron

19. Anabolic/androgenic steroids (AAS) are designed to mimic mainly the anabolic effects of which natural hormone in the body?  
   Human growth hormone  
   Estrogen  
   Testosterone  
   Androsterone  
   Insulin

20. Which of the following nutrients has 9 calories per gram?  
   Carbohydrate  
   Protein  
   Fat  
   Alcohol  
   Vitamins

21. Which of the following methods for assessing body composition is commonly referred to as the "gold standard"?  
   Hand-held bioelectrical impedance analysis  
   Skinfold thickness assessment  
   Waist to hip ratio  
   Hydrostatic weighing  
   Body Mass Index (BMI)

22. Which of the following food groups is least likely to be high in dietary fiber?  
   Starch/bread  
   Legumes  
   Vegetable  
   Fruit  
   Milk

23. Which macronutrient is especially important when considering healing from a muscle or tendon injury?  
   Minerals  
   Lipids  
   Vitamins  
   Carbohydrates  
   Amino acids
24. An iron deficiency can lead to
   Restlessness
   Liver failure
   Anemia
   Gingivitis
   Hypertension

25. Which is not a consideration for the timing of the pre-event meal?
   Athlete preference
   Intensity of activity
   Duration of activity
   Level of competition
   Gastric emptying

26. Protein contains ____ calories per gram.
   9
   4
   7
   8
   5

27. All of the following are characteristics of the ideal rehydration beverage except:
   The beverage consists of 6-8% carbohydrate
   The beverage is served at a temperature of 10-15°C (50-59°F)
   The beverage contains NaCl for electrolyte replenishment
   The beverage is consumed only when the athlete is thirsty
   The beverage is flavored to athlete's preference

28. Which statement does NOT describe the role of major minerals in the body?*
   They help maintain acid-base balance
   They provide energy
   They are constituents of soft tissues
   They give teeth and bone their rigidity and strength
   They regulate body processes

29. The disorder of bulimia, which is often characterized by the binge-purge syndrome, is found
   Only in normal weight individuals
   In individuals across the body weight spectrum
   Only in those with anorexia
   Only in moderately or morbidly obese individuals
   Only in extremely underweight individuals
30. The main function of vitamin E in the body is to act as a(n)
   Antioxidant
   Hormone
   Source of energy
   Superoxide
   Free radical

31. Which of the following is not a physiological effect of caffeine?
   Decreases metabolic rate
   Stimulates central nervous system
   Increases force of skeletal muscle contractility
   Increases epinephrine secretion
   Increases heart rate

32. How many calories are in one pound of fat?
   3500 kcal
   2000 kcal
   2500 kcal
   3000 kcal
   4000 kcal

33. What is the commonly accepted margin of error when a skilled technician performs a
    skinfold body composition assessment?
    ± 5%
    ± 1%
    ± 8%
    ± 10%
    ± 3%
APPENDIX C

SCREENSHOTS OF WEB-HOSTED INSTRUMENT
Certified Athletic Trainers' Nutrition Competency

10. Which of the following foods is the best source of carbohydrate?
   - One can (12oz) diet soda
   - One sweet potato
   - One ounce of mozzarella cheese
   - One half cup of green beans
   - Twelve baby carrots

11. When an athlete is injured and can no longer participate in practices and games, which of the following is a nutritional concern?
   - Weight loss
   - Loss of essential body fat
   - Weight gain
   - Malnutrition
   - Dehydration

12. In order to help prevent the development of osteoporosis later in life, females should consume adequate quantities of which nutrient during the years in which they are developing peak bone mass?
   - Calcium
   - Retinol
   - Tocopherol
   - Iron

Certified Athletic Trainers' Nutrition Competency

Survey Completed

Thank you for completing the survey. If you would like a summary of the results once data collection is completed, please send an email to imm61@uel.edu
APPENDIX D

INITIAL CONTACT LETTER

Dear Fellow Certified Athletic Trainer:

I am a master’s degree candidate at the University of Akron, requesting your help to complete part of my degree requirements. Please follow the link at the end of this letter to an online survey titled: Nutrition Competency of Certified Athletic Trainers.

The questionnaire consists of 9 background questions and 24 multiple-choice questions, and should take less than 15 minutes to complete.

As a fellow certified athletic trainer, your knowledge and opinions regarding this topic makes your input invaluable. Please take a few minutes to fill out the anonymous questionnaire you will find by clicking on this link and submit it by June 2, 2008

Nutrition Competency of Certified Athletic Trainers

One thousand randomly selected certified NATA members in the United States with a listed email address are being asked to submit this questionnaire, but you have the right to choose not to participate. This is a completely anonymous questionnaire and upon submission, neither your name nor email address will be attached to your answers. Your information will be kept strictly confidential. Completion of this questionnaire will serve as evidence of your consent. The University of Akron Institutional Review Board has approved this study for the Protection of Human Subjects.

If you would like to receive a summary of the results following this investigation, please reply to LMM81@uakron.edu with your contact information.

Thank you for your time and consideration!

Sincerely,

Laura Marinaro, ATC, CSCS
The University of Akron
Akron, OH 44325
LMM81@uakron.edu

Participants for this survey were selected at random from the NATA membership database according to the selection criteria provided by the student doing the survey. This student survey is not approved or endorsed by NATA. It is being sent to you because of NATA’s commitment to athletic training education and research.
Dear Fellow Certified Athletic Trainer:

About a week ago I contacted you requesting your help with the completion of a short survey of nutrition knowledge. If you have already completed this survey, thank you! If not, please take a few moments now to follow the link at the end of this letter to the online survey. It consists of 9 background questions and 24 multiple-choice questions, and should take less than 15 minutes to complete.

As a certified athletic trainer, your knowledge and opinions regarding this topic make your input invaluable. Please take a few minutes to fill out the anonymous questionnaire you will find by clicking on this link and submit it by June 2, 2008

Nutrition Competency of Certified Athletic Trainers

One thousand randomly selected certified NATA members in the United States with a listed email address were asked to submit this questionnaire, but you have the right to choose not to participate. This is a completely anonymous questionnaire and upon submission, neither your name nor email address will be attached to your answers. Your information will be kept strictly confidential. Completion of this questionnaire will serve as evidence of your consent. The University of Akron Institutional Review Board has approved this study for the Protection of Human Subjects.

If you would like to receive a summary of the results following this investigation, please reply to LMM81@uakron.edu with your contact information.

Thank you for your time and consideration!

Sincerely,

Laura Marinaro, ATC, CSCS
The University of Akron
Akron, OH 44325
LMM81@uakron.edu

Participants for this survey were selected at random from the NATA membership database according to the selection criteria provided by the student doing the survey. This student survey is not approved or endorsed by NATA. It is being sent to you because of NATA’s commitment to athletic training education and research.
APPENDIX F

HUMAN SUBJECTS APPROVAL

November 28, 2007
Laura Marinaro
7485 Branch Road
Medina, Ohio 44256

Ms. Marinaro:

Your request for exemption for the protocol entitled “Nutrition Knowledge of Certified Athletic Trainers” was approved on November 27, 2007. The IRB application number assigned to this project is 20071129. The protocol represents minimal risk to subjects and matches the following federal category for exemption:

☐ Exemption 1 - Research conducted in established or commonly accepted educational settings, involving normal educational practices.
☐ Exemption 2 - Research involving the use of educational tests, survey procedures, or observation of public behavior.
☐ Exemption 3 - Research involving the use of educational tests, survey procedures, or observation of public behavior not exempt under category 2, but subjects are elected or appointed public officials or candidates for public office.
☐ Exemption 4 - Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens.
☐ Exemption 5 - Research and demonstration projects conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine public programs or benefits.
☐ Exemption 6 - Taste and food quality evaluation and consumer acceptance studies.

Annual continuation applications are not required for exempt projects. If you make changes to the study’s design or procedures that increase the risk to subjects or include activities that do not fall within the approved exemption category, please contact the IRB to discuss whether or not a new application must be submitted. Any such changes or modifications must be reviewed and approved by the IRB prior to implementation.

Please retain this letter for your files. If the research is being conducted for a master’s thesis or doctoral dissertation, the student must file a copy of this letter with the thesis or dissertation.

Sincerely,

Sharon McWhorter
Associate Director

Approved consent form attached

Cc: Lonnie Lowery, Advisor
    Rosalie Hall, IRB Chair

Office of Research Services and Sponsored Programs
Akron, OH 44325-0102
330-972-7666 x 330-972-5281 Fax

The University of Akron is an Equal Education and Employment Institution