

DIETARY HABITS AND NUTRITIONAL KNOWLEDGE OF COLLEGE
ATHLETES

THESIS

Submitted to the Faculty of the School of
Graduate Studies and Research
of
California University of Pennsylvania
in partial fulfillment of the requirements for
the degree of Master of Science

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California, Pennsylvania
2005

CALIFORNIA UNIVERSITY OF PENNSYLVANIA
California, Pennsylvania

THESIS APPROVAL

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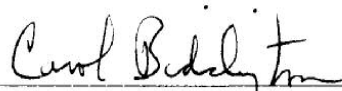
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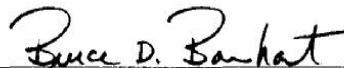
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ACKNOWLEDGEMENTS

I would like to take this opportunity to thank the many people who played an important role in the completion of this thesis. First, I would like to thank my advisor Dr. Carol Biddington and members of my committee: Dr. Bruce Barnhart and Dr. Joni Roh. Their extensive help, patience and experience were much appreciated and the final product was a success because of them.

I would also like to thank the coaches and athletes from California University of Pennsylvania and Alderson-Broadbush College for their cooperation and willingness to participate in this study.

Finally, I would like to thank the members of my family for always supporting me and showing me guidance when times became difficult. You always say that you are proud of me, but your love and support help make me who and what I am. I love you with all of my heart. To my fiancé Jody Weaver, for his love, support and computer knowledge will always be remembered, as well as those times when I just needed to vent. I will always love you and look forward to spending my life with you.

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INTRODUCTION

Too often, student athletes are left with very little time to meet their nutrition needs. These athletes tend to grab the easiest on the go food for their meal. Little do they know that this lack of nutritious food can affect their performance. Student athletes need regular well-balanced meals and snacks to maintain the high energy demands of training, competition, and the rigor of an academic program.¹ A study completed by Ziegler et al² showed how the increased competitiveness of the sport raises concerns about the health of these athletes. For example, nutrient intake was found to possibly be influenced by factors such as lack of time, hectic training schedule and increased emphasis on physical features, such as leanness and body image.²

Assessment of meal patterns not only can facilitate the development of health promotion and prevention, but also provide information about desirable dietary behaviors. In turn, serve as an aid for nutritional counseling and applied in the assessment for an eating disorder.

Anorexia nervosa and bulimia nervosa are the two most common types of eating disorders. Both males and females are affected with these disorders accounting for 2% males

and 4-5% females.²⁸ With the rising number of people diagnosed with an eating disorder it is important to educate and identify those who may have signs and symptoms of an eating disorder.

An increased interest and availability of nutritional information seems to be on the rise, however, it is unclear if athletes are more knowledgeable about the role of nutrition on athletic performance. Professionals can help athletes recognize the role of nutrition in sports and help them choose the most appropriate foods and fluids to attain peak performance.³ Athletes can obtain nutritional knowledge from a variety of sources; such as magazines, parents, coaches and teammates. Athletic trainers, who are medical professionals can also be a source of information for the athlete.⁴ The athlete, who has control over what to eat, must make decisions and become aware of his/her nutritional habits. The proper decisions can be obtained with the proper nutrition education.

Athletes can understand the key concepts behind the food that they are eating with proper education and good decisions when it comes to their food choices. The ideal diet for an athlete is 40% carbohydrates, 30% protein and 30% fat.⁵ Carbohydrates are not only the favored fuel but also the body's most efficient source of energy.^{6,7} A low

intake of carbohydrates will not meet the energy demands on an athlete who requires long durations of activity.

Carbohydrates should also be included in the pre-game meal, which should be eaten three to four hours ahead of competition along with plenty of fluids.⁸ Knowing what to eat after competition can be beneficial too. Restore the nutrients that were lost in competition and enhance readiness for the next game. Glycogens and fluids are the key components of the post game meal.⁹

An athlete who is well nourished is not only healthy but typically capable of training more intensely and competing quite successfully, as well as being less susceptible to injury and fatigue.¹⁰ If an athlete knows what and when to eat then he or she can benefit from eating the proper foods. Small frequent meals that are energy and nutrient dense will assist athletes with meeting their energy and nutrient needs while at the same time prevent overeating, and can safeguard against fatigue.² Overall, proper nutrition education and changing unhealthy dietary habits can not only work for the athlete but also for the team as well.

This study attempted to answer the following questions regarding dietary habits and nutritional knowledge: 1) What is the relationship between dietary habits and knowledge of

nutrition? 2) What is the difference between gender for dietary habits and knowledge of nutrition?

METHODS

The methods section explains the procedures used to perform this research study. This section includes the following subsections: Research Design, Subjects, Pilot Study, Instruments, Procedures, Hypotheses, and Data Analysis.

Research Design

The research design used for this study was descriptive. The dependent variables were dietary habits and nutritional knowledge. The independent variable was gender. The strengths of this study are that more than one state was surveyed and the study used a reliable instrument. A limitation was only using NCAA Division II athletes.

Subjects

The subjects ($n = 117$) in this study consisted of college athletes from mens' and womens' basketball, mens' and womens' cross country, softball, and baseball. A reliable survey was administered to these athletes in a sample of convenience. Questionnaires were given to 188 NCAA

Division II athletes from two different institutions. The institutions were Alderson-Broadus College and California University of Pennsylvania. An Informed Consent Form (Appendix C1) was distributed before the participants completed the questionnaire.

Pilot Study

A draft questionnaire was administered to 31 students from California University of Pennsylvania. There were 29 questions regarding nutrition knowledge. A Kuder Richardson test was used to measure reliability. The results of the pilot study showed a reliability of .645 or moderate internal consistency. As a result the final questionnaire consisted of 29 knowledge questions.

Instruments

The Dietary Habits and Nutritional Knowledge Questionnaire (Appendix C2) examined dietary habits and nutritional knowledge. The reliability coefficients for this questionnaire were .66¹¹ and .645 for dietary habits and nutritional knowledge, respectively. The questionnaire is divided into three sections: demographics, dietary habits, and nutritional knowledge. The demographic section requires the subjects to answer questions about

gender, age, year in college, sport, height and weight.

The dietary habits section asks subjects to identify how often he/she ate a particular food item. This section consisted of 18 questions. These questions included how often the subject consumed foods from each portion of the food pyramid, as well as consumption of beverages, and vitamin and mineral supplements. Food intake, dieting, and skipping meals was also examined. For this section, answers ranged from always (4) to never (1). Question numbers 2-4, 8-9, 14-15, and 17 were reversed scored. Meaning that if the subject answered the question with a 1, then he/she was awarded 4 points. All other questions were scored according to their value. The higher the scores for this section the better the eating habits. The scores possible range was from 18-72.

For the nutritional knowledge section, the intent was to test the level of knowledge about nutrition for each athlete. This section contained 29 questions. The subject was asked to indicate to what degree he/she agreed with each statement. The range was from strongly agree (4) to strongly disagree (1). Question numbers 2,6,8,20, and 29 were reverse scoring while all others were scored based on the subject's response. The higher scores for this section indicated better level of nutritional knowledge. The range

of scores possible were 29-116. A scoring key is provided (Appendix C3).

Procedures

The researcher applied for approval by the Institutional Review Board (Appendix C4) at California University of Pennsylvania before conducting any of the research. The researcher conducted the research at Alderson Broaddus College (A-B) and California University of Pennsylvania. The researcher distributed the questionnaire to the given teams as a whole at a team meeting. The individuals were voluntarily asked to work independently and answer each question to the best of their knowledge. Once each person was finished, the questionnaire was given to the researcher and placed into a sealed envelope.

At California University of Pennsylvania, the researcher sent a cover letter (Appendix C5) to the respective head coaches asking for a time to distribute the questionnaire to the athletes. The athletes volunteered, signed an Informed Consent Form (Appendix C1), and completed the survey to the best of their ability without any help from any sources. The questionnaires took

approximately 15 minutes to complete. Once the questionnaire was completed the athlete handed back the questionnaire to the researcher; then the researcher placed them into a sealed envelope.

Hypotheses

The following hypotheses were based on the literature reviewed when developing this research study and insight of the reader.

1. There will be a positive relationship between diet habits and knowledge of nutrition.
2. Males will score higher on the dietary habits than females and conversely, females will score higher on knowledge about nutrition than males.

Data Analysis

The level of significance was set at .05 to test the acceptability of the stated hypotheses.

Hypothesis 1: A Pearson Product Moment Correlation was used to determine if there was a positive correlation between diet habits and knowledge of nutrition.

Hypotheses 2: A MANOVA test was used to determine if

there was a difference between gender for diet habits and nutritional knowledge.

RESULTS

Demographic Data

The sample consisted of college athletes that were enrolled at Alderson-Broaddus College (n = 49) and California University of Pennsylvania (n = 68). This sample consisted of 117 athletes, 74 male and 43 female (Table 1). The age range of the athlete within this sample ranged from 18 to 27 years of age (20.32 ± 1.69).

Table 1. Frequency Table of Gender

Gender	Frequency	Percent
Male	74	63.2
Female	43	36.8

Table 2 reports the findings for sport.

Table 2. Frequency Table of Sport

Sport	Frequency	Percent
Mens' Basketball	22	18.8
Womens' Basketball	10	8.5
Softball	29	24.8
Baseball	43	36.8
Mens' Cross Country	9	7.7
Womens' Cross Country	4	3.4

Table 3 reports the findings for year in college.

Table 3. Frequency Table of Year in College

Year	Frequency	Percent
Freshman	33	29.1
Sophomore	23	19.7
Junior	29	24.8
Senior	31	26.5

Table 4 reports the findings for major.

Table 4. Frequency Table for Major

Major	Frequency	Percent
Sports Management	19	16.2
Criminal Justice	6	5.1
Philosophy	1	.9
Business	25	21.4
Education	14	12.0
Graphic Communication	1	.9
Athletic Training	6	5.1
Undecided	5	4.3
PTA	2	1.7
Psychology	4	3.4
Graphic Design	2	1.7
Pre-Med	4	3.4
Political Science	2	1.7
Liberal Studies	2	1.7
Meteorology	1	.9
Biology	1	.9
Nursing	5	4.3
Recreation Leadership	8	6.8
History	1	.9
Mathematics	3	2.6
Communications	1	.9
Environmental Science	1	.9
Pre-PA	2	1.7
Music	1	.9

Table 5 reports the finding for where the athletes received information about nutrition.

Table 5. Frequency Table for Information about Nutrition

Info	Frequency	Percent
1. Coach	13	11.1
2. Magazine	29	24.9
3. TV	15	12.8
4. Athletic Trainer	3	2.6
5. Parents	22	18.8
6. Myself	2	1.7
7. Class	6	5.1
8. Professor	3	2.6
9. Communication	1	.9
10. Peers	1	.9
11. Internet	1	.9

Table 6 reports the findings for previous nutritional courses.

Table 6. Frequency Table of Previous Nutrition Course

Previous	Frequency	Percent
0. No	72	61.5
1. Yes	44	37.6

Table 7 reports the findings for age. The age ranged from 18 to 27 (20.32 ± 1.69).

Table 7. Frequency Table for Age

Age	Frequency	Percent
18	18	15.4
19	22	18.8
20	23	19.7
21	23	19.7
22	20	17.1
23	3	2.6
24	4	3.4
27	1	.9

Height was recorded in inches. The range for height was 60"- 84" (70.84 ± 4.70). The range for weight was 105lbs - 250lbs (177.17 ± 35.36). The range for BMI was 18.24 - 34.21 (24.73 ± 3.37).

Hypotheses Testing

The level of significance used for testing all hypotheses was set at an alpha level of .05.

Hypothesis 1: There will be a positive relationship between diet habits and knowledge of nutrition.

A Pearson Product Moment Correlation was used to determine if there was a positive correlation between diet habits and knowledge of nutrition. The results of the analysis are presented below in Table 8.

Table 8. Pearson-Product Moment Correlation between Total Dietary Habits and Nutritional Knowledge Scores

Variable	n	r	P
Dietary Habits & Nutritional Knowledge	117	.313	.001

* $P < .01$

Conclusion: A Pearson-Product Moment correlation coefficient was calculated for the relationship between dietary habits and nutritional knowledge. A positive relationship was found ($r(115) = .313$, $P < .001$), indicating a significant linear relationship between the two variables. Athletes who practice better dietary habits also have a better understanding of nutrition.

Hypothesis 2: There will be a significant difference between gender for dietary habits and nutritional knowledge. A MANOVA test was used to determine if there was a difference between gender for diet habits and nutritional knowledge.

Table 9. MANOVA Test between Gender for Dietary Habits and Nutritional Knowledge

Dependant Variable	Type III sum of Squares	df	Mean Square	F	P
Gender					
K Total	1332.274	1	1332.274	12.639	.001*
H Total	274.981	1	274.981	10.583	.001*

* $P < .01$

Conclusion: A one-way MANOVA was calculated examining the effect of gender on dietary habits and nutritional knowledge. A significant effect was found ($\Lambda_{2,114} = .86$, $P < .001$). Females (46.55 ± 4.88 , 91.25 ± 9.29) were significantly greater for both dietary habits and nutritional knowledge than males (43.37 ± 5.21 , 84.25 ± 10.78).

Additional Findings

Several tests were conducted using the demographic part of the questionnaire along with the total scores from both the dietary habits and nutritional knowledge sections of the questionnaire in an attempt to discover additional findings.

A one-way MANOVA was calculated examining the effects of sport on dietary habits and nutritional knowledge. A significant effect was found for dietary habits ($\Lambda_{10,220} = .814, P < .05$). Follow-up univariate ANOVA indicated a significant difference among dietary habits ($F_{5,111} = 2.946, P < .05$). The mean score for womens' cross country (51.25 ± 5.43) was significantly higher than baseball (43.18 ± 5.22). A significant effect was found for nutritional knowledge ($\Lambda_{10,220} = .814, P < .05$). Follow-up univariate ANOVA indicated a significant difference among nutritional knowledge ($F_{5,111} = 3.057, P < .05$). The mean score for womens' cross country for nutritional knowledge (95.50 ± 6.45) was significantly higher than mens' basketball (82.27 ± 13.61).

Table 10. MANOVA Test between Sport for Dietary Habits and Nutritional Knowledge

Dependant Variable	Type III sum of Squares	df	Mean Square	F	P
Sport					
K Total	1628.523	5	76.459	2.946	.013*
H Total	382.297	5	325.705	3.057	.016*

* $P < .05$

A Pearson correlation coefficient was calculated for the relationship between subjects' BMI (body mass index) and dietary habits. A weak negative correlation was found ($r(114) = -.217$, $P < .05$), indicating a significant linear relationship between the two variables. Subjects with lower BMI scores tend to have better eating habits.

Table 11. Pearson-Product Moment Correlation between BMI and Dietary Habits

Variable	n	r	P
BMI and Dietary Habits	114	-.217	.02*

* $P < .05$

DISCUSSION

Discussion of Results

This study focused on dietary habits and nutritional knowledge of college athletes. The researcher examined many ways in which certain discriminators such as gender, age, Body Mass Index, etc. can affect the dietary habits and nutritional knowledge of athletes participating in the study.

Hypothesis 1 stated that there would be a positive relationship between dietary habits and knowledge of nutrition. The researcher postulated that a higher level of nutritional knowledge would have an increased affect on an athletes dietary habits. This statement is also supported by past research, which concludes that lack of knowledge equals poor nutrition.^{13,15,17}

A positive relationship was found, indicating a significant linear relationship between the two variables. Athletes who practice better dietary habits also have a better understanding of nutrition. Therefore, the hypothesis was supported. However, a poor level of knowledge could potentially indicate poor dietary habits. Education about nutrition is a key factor for athletes and it needs to play a continual role in their lives.

Educating the athletes is only half of the problem. Coaches, parents, and athletic trainers need to have knowledge about nutrition because athletes tend to ask people to whom they are most comfortable with. Professionals can help athletes recognize the role of nutrition in sports and help them choose the most appropriate foods and fluids to attain peak performance.¹² Research also indicates that athletes have a positive attitude toward nutrition, therefore, proper nutrition knowledge can lead to healthier life styles.¹¹

Hypothesis 2 stated there would be a significant difference between gender for dietary habits and nutritional knowledge. The researcher believed that male athletes would practice healthier dietary habits because of all of the weight issues and disordered eating that females face. The researcher also believed the females knew more about nutrition but did not apply that knowledge to their eating habits. The body weight demands of some sports and the pressure to achieve the ideal body weight causes the female athlete to become overly concerned with her body weight and develop eating disorders.²⁸

The results showed a significant effect was found. Females were significantly greater for both dietary habits and nutritional knowledge. Although, the hypothesis was

not supported, female athletes had greater knowledge and dietary habits. A peer education program is an effective method of improving the general nutrition knowledge and sports nutrition knowledge of female collegiate athletes.¹⁷ Male subjects with a high fat intake had significantly more negative attitudes towards reducing fat consumption compared with those who had lower fat intake.¹⁸ It was concluded that negative attitudes towards reducing fat consumption might be more important barriers to dietary change than level of nutritional knowledge in male students.¹⁸ Anderson et al²⁰ showed that college athletes' nutritional habits are healthier and follow more strict guidelines than the average student. This statement may apply to this study however, male athletes lack the knowledge and habits compared to their gender counterpart.

In addition to hypothesis testing, statistics were also performed on the demographic section of the questionnaire to discover additional findings. The first additional find examined the effects of sport on dietary habits and nutritional knowledge. A significant effect was found for dietary habits, and for nutritional knowledge. The diet habits mean score for womens' cross country was significantly higher than baseball indicating that once again female athletes practiced healthier dietary habits

than male athletes. In fact, all of the female sports had significantly higher mean scores than the male sports for dietary habits. The mean score for women's cross country for nutritional knowledge was significantly higher than men's basketball.

The next additional finding was for the relationship between subject's BMI (body mass index) and dietary habits. A weak negative correlation was found, indicating a significant linear relationship between the two variables. Subjects with lower BMI scores tend to have better eating habits. This goes along with hypothesis 1 in that a relationship was found between dietary habits and nutritional knowledge. The more the athlete knew about nutrition the healthier their dietary habits. An obvious conclusion can be made in that overweight athletes are more susceptible to poor dietary habits and poor health conditions.

Where the athletes received their nutritional information was another observation. In this study the majority of the athletes turned to a magazine for nutrition guidance. The specific magazine was not noted but it is safe to say the athletes feel more comfortable consulting a piece of paper rather than someone who may know more about the subject. Zawila et al¹¹ theorized that the quality of

nutrition sources is more important than the number of nutritional sources an athlete uses. Only 2.6% of the subjects turned to the athletic trainer for information. There were 11.1% of the subjects who turned to their respective coaches for information. It is safe to say that both athletic trainers and coaches need to be more aware of what they can do for an athlete to help promote better nutrition. Once they are aware of the extra help, they also need to be kept up to date on nutrition so they are prepared for situations when it comes to nutrition. Parents ranked second in this study, 18.8%. Athletes most of the time turn to their parents for advice about many topics. If parents are well educated about nutritional needs and trends then they too can guide their athlete to success.

Conclusions

The results of the study revealed the following major conclusions:

1. Athletes who practiced better dietary habits also had a better understanding of nutrition.
2. Females practiced better dietary habits than males.
3. Females had greater nutritional knowledge than males.
4. Womens' sports scored higher on dietary habits and

nutritional knowledge than mens' sports.

5. Subjects with lower BMI scores had better dietary habits.

Recommendations

Based on the results of this study, the following research recommendations were made.

1. Future studies should contain a sample from larger universities or colleges.
2. Future studies should contain a sample from a variety of different sports.
3. Future studies may want to place a survey on the internet to obtain a larger sample and to collect the data in an easier fashion.
4. Future studies may want to compare athletes with non athletes.

REFERENCES

1. National Collegiate Athletic Association. Sports Nutrition: Nutrition Health. Available at: www.drugfreesport.com/choices/nutrition/health.html. Accessed October 22, 2004.
2. Ziegler PJ, Jonnalagadda SS, Nelson JA, Lawrence C, Baciak B. Contribution of meals and snacks to nutrient intake of male and female elite figure skaters during peak competitive season. *J American College Nutrition*. 2002;21(2).
3. Mirkin G. Pre-race or pre-game meal. Available at: www.DrMirkin.com/fitness/8494.html. Accessed September 9, 2004.
4. Zawila LG, Steib CSM, Hoogenboom B. The female collegiate cross-country runner: nutritional knowledge and attitudes. *J Athletic Training*. 2003;3(8):67-74.
5. Bernard B. The importance of nutrition in sports. *Positive Health*. 2000;(50):35-38.
6. Vinci DM. The training room: developing a sports-nutrition game plan. *Athletic Therapy Today*. 2002;7(5):52-53.
7. Arnheim DD, Prentice WE. *Principles of Athletic Training*. Madison, WI: Brown & Benchmark; 1997.
8. DeMasi S. Just for athletes. *Coaching Youth Sports*. 2003.
9. Bonci, L. Refueling the tank. Available at: <http://www.monetummedia.com/articles/cm/cm0902/refuelthank.htm>. Accessed September 29, 2004.
10. Post-game nutrition. *Better Nutrition*. 2004;66(7).
11. Marino S. *The Role of Nutrition Knowledge Plays In The Eating Habits of Female Collegiate Gymnasts* [master's thesis]. California, PA: California University of Pennsylvania; 2001.

APPENDICES

APPENDIX A

Review of the Literature

Review of the Literature

This review of literature will discuss all literature pertaining to this study: Diet habits, knowledge of nutrition and basic nutrition for athletes. This review of literature is divided into three sections: 1) Basic nutrition, 2) Knowledge of nutrition, and 3) Diet habits of athletes. Under basic nutrition there are three subsections: 1) importance of nutrition, 2) pre-game meal, and 3) post-game meal. Under diet habits there are two subsections: 1) practices and goals, and 2) eating disorders.

Basic Nutrition

Importance of Nutrition

Many people think of nutrition as something that people must have in order to survive. However, not many people know what it is, about nutrition, that makes it so important. For athletes, nutrition is key not only for performance but also for injury prevention. A study, completed by Reid-St.,¹ examined eating habits and injury rates among female runners. It concluded that 55%, of the

athletes polled reported injuries and those athletes also ate approximately 200 fewer calories per day.¹ An athlete who is well nourished is not only healthy but typically capable of training more intensely and competing quite successfully, as well as being less susceptible to injury.² Although the same diet will not suit everyone, it is the basic principles that matter. For instance, the typical diet for an athlete is 40-60% carbohydrates, 20-30% protein and 15-20% fat.³

Carbohydrates are the favored fuel for exercise and are stored in the form of glycogen in the liver and muscles. Those who train several hours a day require more carbohydrates.⁴ Carbohydrates are the body's most efficient source of energy. Foods that are high in carbohydrates are breads, cereal, rice, and pasta.⁵ Now, with the new low carbohydrate diet craze, it would be hard for athletes to maintain their carbohydrate needs.

Regardless of gender or sport, athletes are always attentive to protein intake.² Athletes have higher protein needs related to protein's role in repairing muscle tissue, ligaments, and tendons.⁴

Fat is an energy-dense nutrient, which is needed in everyone's diet to help maintain the nervous system and cell membranes in the body. Fat can also be a good source

of calories for athletes with higher energy needs.⁴ However, athletic trainers should encourage athletes to choose lower fat foods or healthier sources of monounsaturated and polyunsaturated fats, such as nuts, seeds, high-fat fish, olive oil, and canola oil.⁴

Pre-game Meal

Athletes have a busy schedule, especially when it is their season. Therefore, the one main important concept that is missing, is the pre-game meal. The main goal of a pre-game meal is to have enough energy to last the entire game and to stay well hydrated.⁶

The actual pre-game meal is simply topping off muscle glycogen; otherwise athletes would not have enough energy for the entire game. The pre-game meal also helps to prevent a low blood sugar level which can interfere with an athlete's performance; if the wrong foods are consumed, it can limit the level of performance.⁶ The brain gets its energy almost exclusively from sugar in the bloodstream and muscles don't contract effectively when blood sugar runs low.⁷ Energy is acquired through the food an athlete consumes before a game. A person's metabolism dictates how much energy will be available for the person to perform some type of exercise after the body's immediate needs are

met. A person needs to consume more calories than the basal metabolic rate (BMR) requirement.⁸

Athletes should enter a game on an almost empty stomach. The pre-game meal should be eaten approximately two to three hours before the game. This meal should consist of high carbohydrate foods and lots of fluids. By consuming a proper pre-game meal before a game an athlete will notice benefits such as more energy, and the ability to concentrate better during the game helping them maintain the best performance possible.⁶

Post Game Meal

After competition or practice, athletes realize that they are hungry and thirsty. What they eat after a game also affects their body's recovery from high energy needs. The key to a post game meal is to quickly restore the important nutrients that were lost.⁹ An athlete's body can only be fully ready for the next workout or game if its glycogen and fluid stores are completely replenished.⁹

If energy is not replaced, the body becomes weak. An athlete is often unaware that he or she had reached suboptimal fluid and glycogen levels until it causes a problem: performance is adversely affected, fatigue becomes difficult to ignore, weight loss occurs, or injuries

increase.⁹ The newest guidelines suggest that athletes drink 24 ounces of fluid for every pound lost during exercise. This should be consumed within six hours after exercise to ensure the athlete is achieving optimal hydration status.⁹

While re-hydrating is a key to post game refueling, water alone may not be the best recovery fluid. Water suppress thirst and increases urine output, causing additional fluid loss. A post game beverage that contains sodium or consuming a salty food with a post game fluid, helps the body retain water, therefore decreasing urine production without decreasing thirst.

The other important component of post game refueling is replenishing glycogen stores. Restoring muscle and liver glycogen stores following strenuous training will minimize the fatigue that results from repeated days of heavy training. Research has shown that the body cannot effectively replenish muscle glycogen without carbohydrates.⁹ Adding protein to the post game meal results in a greater secretion of insulin than carbohydrate alone, and the release of insulin may stimulate muscle growth.⁹

Neglecting the post game meal could result in muscle breakdown and fatigue during subsequent workouts.¹⁰ The

most important factor is meeting the carbohydrate requirements. Smaller more frequent meals may be easier to tolerate for some athletes, but as long as he or she meets the goals in consuming the appropriate amount of carbohydrates, the number of meals is irrelevant.⁹

Knowledge of Nutrition

It has been found that athletes have a positive attitude toward nutrition.¹¹ However this doesn't mean that athletes know enough about nutrition. Zawila et al¹¹ found that 60 female collegiate cross-country runners lacked nutritional knowledge critical to preventing nutrition-related health problems. The results of this study showed that 22% of the runners completed a nutrition course in college. Those same runners scored higher than those who did not take a nutrition course.¹¹ Runners obtained nutritional knowledge from a variety of sources. The top four sources were magazines, parents, coaches and teammates. The athletic trainer was only a source to 17% of runners surveyed. Proper nutrition is the key to prevention of the female athlete triad. The athletic trainer has the opportunity to serve as the first line of defense in preventing and identifying nutrition-related

health problems.

With society's fear of fat, athletic trainers need to emphasize the roles of fat in the body. Fats are necessary form of energy and help transport lipid-soluble vitamins, regulate cholesterol metabolism and provide essential fatty acids that the body does not produce. Fats should compose 25% to 30% of daily caloric intake.¹¹ Two-thirds of adolescent runners thought little or no fat in the diet was best.¹¹ Only 18% of runners disagreed with this statement. With this confusion alone, there is need for education for runners to understand the role and necessity of fat.

Higher scores on nutrition for the athlete may suggest an increased focus on knowledge related to the athlete without a foundation of general nutritional knowledge. The athlete who has more control over what to eat, must make decisions and become aware of his/her nutritional habits. Zawila et al¹¹ theorize that the quality of nutrition sources is more important than the number of nutritional sources a runner uses, and the athletic trainer may need to assume a more active role in nutritional education. Moreover, female collegiate cross-country runners demonstrated a positive attitude toward nutrition, indicating that this population of runners may be receptive to nutritional education.¹¹

There appears to be an increased interest and availability of nutritional information, however, it is unclear if athletes are more knowledgeable about the role of nutrition on athletic performance. The goal of another study was to assess the nutrition knowledge of athletes at a Division I NCAA institution.¹² Rosenbloom et al¹² reported that out of 328 Division I student athletes, 63% of men and 54% of women knew that carbohydrate and fat are the main energy source for activity, and a high percentage of both groups knew that eating carbohydrates would not make them fat. The majority of athletes believed that sugar eaten before an event would adversely affect performance. Most of the athletes believed that vitamin and mineral supplements increased energy.

The results of this study showed that athletes could use the extra nutritional knowledge that professionals can provide. Professionals can help athletes recognize the role of nutrition in sports and help them choose the most appropriate foods and fluids to attain peak performance.¹²

An experimental study done by Abood et al¹³ showed significant improvement in nutritional knowledge. Womens' soccer and swimming team participants completed nutrition knowledge and self-efficacy questionnaires, and a three day diet record. All participants were pre and post tested to

gather the baseline data necessary for the development of an intervention.¹³ Athletes in the control group attended a regularly scheduled and supervised study hall in another building on campus at the same time as the intervention but received no treatment.¹³

Treatment participants significantly improved in nutrition knowledge, self-efficacy, and overall number of positive dietary changes. Other findings of this study support the need for and the effectiveness of nutrition education intervention to increase nutrition knowledge and self-efficacy among female athletes.¹³

Jacobson et al¹⁴ claim that those individuals who are competitively active in sports consistently have been found to be largely uneducated regarding proper nutrition. The purpose of their study was to determine nutrition knowledge and behavior of division IA college athletes and to compare such knowledge and behavior with data from a similar survey conducted in 1992. Jacobson et al¹⁴ designed and validated a survey to measure collegiate varsity athlete's knowledge and behavior regarding nutrition. Usually athletes consume greater quantities of food than others, which ultimately provide them with adequate levels of vitamins, minerals, protein, and carbohydrates.¹⁴ A large portion of nutrition information comes from magazines, coaches, peers, and

parents. Therefore, the athlete may be presented with poor advice or inaccurate and possibly damaging information. Also, individuals with greater nutrition knowledge were less likely to include supplements in their diets.¹⁴ The results showed it was apparent that athletes were not aware of some nutrition basics and some also participated in various degrees of supplementation. The result of the most recent study concluded with better scores regarding knowledge, along with how the athletes were receiving their nutrition information. Supplementation use was again a high number, and the most used supplement was creatine.¹⁴ Positive trends in nutrition knowledge and behavior were sought, but more education was also recommended.

A study conducted by Lundell¹⁴ evaluated and examined relationships between actual dietary intakes of female college athletes and their nutritional knowledge, attitudes, and practices. Results showed that several selected dietary components were found below recommended standards.¹⁵ Scores on the knowledge test averaged 50.5%. However, no correlation was found between nutritional knowledge and dietary intake or practices. Despite the level of nutrition knowledge, the athletes were aware of two basic concepts; how to maintain their weight and decrease their fat intake.¹⁵ The female varsity athletes,

in this study, benefited from nutrition intervention which addressed awareness of the importance of adequate energy intakes to ensure adequacy of proper foods.¹⁵

The purpose of another study, done by Kopp and Young,¹⁶ was to determine college students' knowledge of basic nutrition information at a mid-western university. The subjects were pre-tested to see how much they knew before taking a nutrition section of a course; followed by a post test. The results suggested that these college students need more nutrition education and greater awareness of the consequences of poor nutritional choices.¹⁶ In order to help the climbing obesity rates, health education needs to be taught in grades K-12, correlated to other subjects, and continued through the college years. If the proper education is taught at an early age and then re-taught every so often, then better results might show athletes knowing about basic nutrition and using better dietary practices.

Kunkel et al¹⁷ claim that the diets of many athletes are inadequate due in part to overly restrictive eating habits and nutrition misinformation. In addition, athletes also have a limited knowledge of general nutrition concepts. Athletes may benefit from nutrition education; however insufficient nutrition education resources are in

place at most colleges.¹⁷ The purpose of this study was to improve the nutrition knowledge of collegiate athletes through the use of peer educators. The use of peer educators has been advocated as a way to improve nutrition education services for college students. Peer educators may be effective in encouraging behavioral changes.¹⁷ The results concluded that a peer nutrition education program is an effective method of improving the general nutrition knowledge and sports nutrition knowledge of female collegiate athletes. Peer educators reported being able to tailor nutrition information to specific needs of an athlete during one-on-one meetings. The athletes appeared to be more interested in the nutrition education program and attended more meetings than the athletes who met in groups with peer educators.¹⁷ This program can be used as a model for peer nutrition education programs that tailor meetings to the specific needs of each athlete.¹⁷

The main findings of another study were that subjects with a high fat intake had significantly more negative attitudes towards reducing fat consumption compared with those who had lower fat intake.¹⁸ It was concluded that negative attitudes towards reducing fat consumption might be a more important barrier to dietary change than level of nutritional knowledge in male students. However, males

that had a low fat intake also scored higher on the nutritional knowledge portion of the questionnaire. This constitutes an important target for health promoters in encouraging dietary change in men.¹⁸

Dietary Habits

Practices and goals

Frequently, very busy athletic and study schedules prevent many student athletes from preparing and eating well-balanced meals. Student athletes need regular well-balanced meals and snacks to maintain the high energy demands of training, competition, and the rigor of an academic program.¹⁹ Athletes must establish their nutritional goals, and also be able to translate them into dietary strategies that will meet these goals. Meeting energy demand, maintaining body mass and body fat at appropriate levels are key goals.²⁰

A study done by Anderson et al²¹ showed that college athletes' nutritional habits are healthier and follow more strict guidelines than the average student. Out of 163 college students surveyed, 15 of them were athletes. All of these athletes said they eat less fast food than the

average student, therefore making their diet healthier.²⁰

Kirklighter et al²² analyzed the dietary practices of college students enrolled in a nutrition course. This study did not point out how many of the students were athletes. The dietary practices of 149 students enrolled in a nutrition course were compared with the seven current dietary recommendations for healthy eating. Student volunteers completed a three day dietary record. College students represent an important target group for health promotion and disease prevention programs that include nutrition education. Young adults may develop health habits during their college years that put them at risk for chronic diseases, and many college students face unique barriers that limit their ability to maintain healthy eating behaviors.²²

Subjects indicated their greatest nutrition concerns were getting enough vitamins and minerals, eating less cholesterol and fat, and reducing salt or sodium intake. Findings indicated that although variety could be improved, students' diets were not completely lacking in dietary variety. Only three of the seven recommendations were followed by 38.9% of the students, 27% followed four, 8.7% followed one, and 4% followed five. The two recommendations most frequently followed by college

students are those related to appropriate body weight and moderation in alcohol consumption.²²

Another study done by Ziegler et al²³ showed the contribution of meals and snack to nutrient intake of male and female elite figure skaters during peak competitive season. The increase competitiveness of the sport raises concerns about the health of these athletes. Nutrient intake may be influenced by factors such as lack of time, hectic training schedule and increased emphasis on physical features, such as leanness and body image.²³

Compared to the dietary guidelines for the general population, the male figure skaters had high carbohydrate, protein, saturated fat and cholesterol intake. The female figure skaters did not meet the dietary recommendations for these nutrients. The male figure skaters had the lower energy intake at breakfast and the greatest energy intake at dinner. Similar to the meal patterns of the male skaters, dinner and lunch were the main contributors to the energy intake of the female skaters. The most common snack food consumed by these athletes were from the dairy group, which included milk, yogurt, ice cream and cheese. Assessment of meal patterns, not only can facilitate the development of health promotion and prevention, but also can provide information about desirable dietary behaviors

and serve as an aid for nutritional counseling. Small frequent meals that are energy and nutrient dense will assist athletes with meeting their energy and nutrient needs while at the same time prevent overeating, and can safeguard against fatigue.²³

According to Burke,²⁴ current dietary practices during cycle tours appears to favor greater reliance on pre stage intake and post stage recovery meals to achieve nutritional goals. A characteristic of the dietary patterns of endurance cyclists is a high energy intake. The achievement of a high energy intake appears to be accomplished by an increase in the number of separate eating occasions each day. For example, studies commented on cyclists eating up to nine discrete meals and snacks each day or consuming almost 40% of total energy intake from snacks eaten between conventional meals.²⁴

The strategies used by already lean cyclists to 'cut weight' are outlined below:

1. Undertaking a hard three to four hour morning training in a fasted state
2. Consuming breakfast, a carbohydrate drink during a five to seven hour training session, then eating nothing after a post ride carbohydrate meal until next morning (going to bed hungry to use fat stores during sleep)

3. Suppressing appetite with 'diet drugs'
4. Undereating while riding a stage race- treating the race as a training rather than an important competition, and utilizing the supervision of medical staff to ensure adherence to energy-restricted intake.²⁴

Tactics of deliberate undereating after each day's stage and encouraging hunger are detailed, and designated weight loss during tours is noted to be an increasingly common practice among cyclists, to supplement the conditioning achieved on training camps. Burke²⁴ recommends other issues that should receive attention including dietary practices of female cyclists, beliefs and practices regarding bodyweight control among cyclists, and the use of supplements and sports foods.²⁴

Wrestling is a sport of weight class. If an athlete does not make weight then he or she is unable to participate or has to move down to the next weight class or move up a weight class. There are several ways that a wrestler makes weight, though not all methods deals with nutrition but in some way nutrition is affected in all methods. Oppliger et al²⁵ investigate the weight loss practices of college wrestlers. The purpose of this study was to examine the weight management (WM) behaviors of college wrestlers after the implementation of the NCAA's

new weight control rules. When the weight loss methods of three groups were compared, significant differences were apparent in the restriction of food, and the use of saunas, rubber/plastic suits. Use of extreme methods of weight loss includes: vomiting, laxatives, diet pills, diuretics, and enemas.

Survey questions allowed Opplinger et al²⁵ to assess the five criteria of bulimia. Only one wrestler met all five criteria, and a total of four met three or four of the criteria. Fewer than ten considered their body image very underweight or very overweight; however 44.8% reported often or always dieting. Eating "out of control" is a potential indicator of disordered eating behaviors. Some wrestlers believed their eating was out of control at times; 11.9% believed their eating was out of control frequently or always after weight-ins. After a match, 9.9% responded the same way, and 10.2% believed the same way during the off season.²⁵ This study showed that wrestlers too can abuse nutrition in an attempt to better achieve their weight class goals.

Eating disorders

An estimated five million people in the United States,

primarily girls and young women, suffer from a type of eating disorder. Anorexia nervosa and bulimia nervosa are the two most common types of eating disorders. Anorexia is an eating disorder characterized by a refusal to maintain a minimally normal body weight and a distortion in perception of body shape and weight.²⁶ Bulimia nervosa is an eating disorder characterized by repeated episodes of binge eating usually followed by self-induced vomiting, misuse of laxatives or diuretics, fasting or excessive exercise.²⁶ What female athletes need to be careful of is the female athlete triad; which is characterized as eating disorder, amenorrhea and osteoporosis. Many young athletes severely restrict energy intake to improve performance, enhance the aesthetic appeal of their performance, or meet the weight guidelines of their specific sport. They fail to realize that the loss of lean tissue that accompanies energy restriction actually impairs their physical performance.^{26,27} Male athletes, especially wrestlers and gymnasts, are affected by these disorders as well as females.^{26,27}

In an article from Health and Medicine Week,²⁸ eating disorders afflict about 2% of men vs. 4-5% of women, and the rate of men is on the rise. This is a hard fact to calculate because men have been so reluctant to seek treatment. In many cases, men are unaware that they have

an eating disorder. For example, they may exercise obsessively and just think that its regular guy exercise behavior.²⁸

Beals and Manore²⁹ did research about disorders of the female athlete triad among collegiate athletes. The female athlete is driven to excel in a sport and willing to go to any lengths to achieve athletic success and may be at risk for developing disordered eating behaviors. This study consisted of 425 female collegiate athletes from seven different universities and representing 15 different sports. The disordered eating behaviors were measured by the Eating Attitudes Test-26 (EAT-26), and the Body Dissatisfaction Subscale of the Eating Disorder Inventory. Athletes reported significantly higher on the EAT-26 and were more apt to score above both the EAT-26 and EDI-BD cutoffs. Also, athletes reporting menstrual irregularity suffered more bone and muscle injuries during their collegiate career compared to those with normal menses.²⁹ The body weight demands of these sports and the pressure to achieve the ideal body weight causes the female athlete to become overly concerned with her body weight and develop eating disorders. Between 2 and 3% of the female athletes in this study reported a clinical diagnosis of anorexia and/or bulimia nervosa, which is similar to that reported

for the general female population. However, 15-30% of the athletes demonstrated attitudes and behaviors consistent with disordered eating. Those athletes displaying disordered eating behaviors more frequently reported menstrual irregularity and sustained more bone injuries during their collegiate careers.²⁹

There are many ways for an athletic trainer to help those in need of assistance. Identifying the risk factors is one way to step in. Some risk factors for eating disorders among athletes include: pressure to excel at a chosen sport; focus on achieving or maintaining an "ideal" body weight or body fat percentage; being a wrestler, jockey, or competitor in a sport where performance is judged on aesthetic appeal such as gymnastics, figure skating or dance; dieting at an early age; or unsupervised dieting.²⁶ Another way of assistance is to show the athlete what kind of food choices to make. The food selections need to stimulate the athletes to make healthy selections that meet the needs of the day.²⁷ Talking to families, setting goals, and seeking peer support are other ways to help. But the first dietary objective is to stop weight loss while establishing regular eating patterns because as eating becomes more comfortable, energy intake should increase gradually and athletes will be able to reestablish

their athletic goals.²⁶

Summary

The role of nutrition is very important, not only for providing the proper nutrients needed for everyday tasks but also for injury prevention and increasing athletic performance.¹ Carbohydrates, proteins, and fats are the three major nutrients in the athletes diet that contributes to energy. Carbohydrates is the favored fuel and the body's most efficient source of energy.^{4,5} In the pre-game meal athletes should eat at least two to three hours ahead of time. This meal should include high carbohydrate foods and plenty of fluids.⁶ After competition, athletes should eat again to quickly restore the important nutrients that were lost.⁹ Without consuming a post game meal, muscle could breakdown and would later fatigue in future workouts.¹⁰

Nutritional knowledge should be a part of the athletes' everyday routine. If an athlete knows what and when to eat then he or she can benefit from eating the proper foods. The athlete who has more control over what to eat, must make decisions and become aware of his/her nutritional habits.¹¹ Peer education is another way that

the proper education could be met. Kunkel et al,¹⁷ showed that peer education captures the athletes attention and can be modified to meet the specific needs of each athlete. Therefore, knowing what to eat can not only be healthy for the athlete but also improve the performance of the athlete.

The dietary practices of athletes can hurt their performance in the long run. By not getting the right foods athletes won't be able to reach top performance. Some of the common sources of intake that athletes are encountering are: fast food restaurants, quality of food, eating on the run, and the service of the food.¹⁹ With these types of practices athletes are not meeting the balanced diet demands. Another problem with dietary habits are eating disorders. Typically women are the main victims but studies have shown an increase in men.²⁸ With sports such as wrestling, gymnastics, and figure skating where body image also plays a role, athletes tend to please the audience more than themselves.²⁶ Therefore; their nutrition slips and they in turn find themselves in danger with their health. Identifying athletes with the potential to have an eating disorder is a big key in prevention. Observing their appearance and attitude and talking to family and friends is a way to step in and help.²⁶

APPENDIX B

The Problem

The Problem

Statement of the Problem

Understanding proper nutrition is a common problem that most people have. In order to compensate for nutritional deficiency, people normally choose a type of diet to help. The lack of knowledge of what to eat and when can also be the culprit. However, what if those people are athletes? How does their type of diet affect their performance? What are the risks of not eating the right foods and how can athletes be corrected of their eating mistakes?

As athletic trainers, we know how athletes should eat. With gaining knowledge of the new crazes, the athletic trainer should be able to help those who choose types of diets and help them become aware of what foods to eat and how much. The purpose of this study is to examine the relationship between diet habits and knowledge about nutrition for athletes.

Definitions of Terms

The following terms will be used throughout the study,

and therefore will be defined as they pertain to this specific research:

1. Anorexia Nervosa: An eating disorder characterized by a refusal to maintain minimally normal body weight and a distortion in perception of body shape and weight.²⁶
2. Basal Metabolic Rate (BMR): The rate at which the body spends energy for maintenance activities; such as maintaining body temperature, keeping the lungs inhaling and exhaling air, making new red blood cells in the bone marrow.²⁶
3. Bulimia Nervosa: An eating disorder characterized by repeated episodes of binge eating usually followed by self-induced vomiting, misuse of laxatives or diuretics, fasting, or excessive exercise.²⁶
4. Diet Habits: What an athlete eats on a regular basis.
5. Eating disorder: Disturbances in eating behaviors that jeopardize a person's physical or psychological health.²⁶
6. Post-game Meal: The meal that takes place at the end of a game. This meal contains nutrients that will refuel the body's needs.
7. Pre-game Meal: The meal that takes place at least two hours before a game. This meal contains nutrients that will help an athlete through the game without any

problems.

Basic Assumptions

The following are assumptions that can be made for this study:

1. All athletes were NCAA Division II athletes. No intramural or other athletes participated in this study.
2. Athletes answered all questions honestly and to the best of their knowledge.
3. No athlete received assistance from any individual on any question.
4. The sampling was representative of its population.

Limitations of the Study

The following were possible limitations of the study:

1. The subjects may not have answered the questions honestly or received help from another source.
2. A true sampling was not received due to only surveying two NCAA Division II schools.

Significance of the Study

Nutrition knowledge can better the athlete in many ways. This study can help those athletes, coaches, and athletic trainers become aware of the meaning of proper nutrition as it applies to them. Increasing the knowledge of nutrition can teach what foods to eat and when. Also, how nutrition can benefit the performance of the athlete when eating the right foods. When athletes make a habit of eating better it can help them in future endeavors because proper education lasts a long time.

This study can also help athletic trainers identify those athletes that are on the verge of an eating disorder, and what precautions to take in case an eating disorder has come into play. By identifying an athlete with a disorder early, the athlete can get the proper treatment necessary to overcome the problem. Also, proper education about nutrition can help those who are on edge about how they feel about themselves. Just by knowing what an eating disorder is, is one step in cutting off the path that can go wrong.

APPENDIX C
Additional Methods

APPENDIX C1

Informed Consent

Informed Consent Form

1. Sarah Paugh, who is a graduate assistant at California University of Pennsylvania, has requested my participation in a research study at this institution. The title of the research is Dietary Habits and Nutritional Knowledge of College Athletes.
2. I have been informed that the purpose of the research is to determine the difference between gender for nutritional knowledge and dietary habits.
3. My participation will involve answering a questionnaire.
4. There are no foreseeable risks or discomforts by participating in this study.
5. There are no feasible alternative procedures available for this study.
6. I understand that the possible benefits of my participation in the research are enhancing the understanding of knowledge of nutrition and dietary practices.
7. I understand that the results of the research study may be published but that my name or identity will not be revealed. In order to maintain confidentiality of my records, Sarah Paugh will maintain all documents in a secure location in which only the student researcher and research advisor can access. This will be done by the use of subject codes.
8. I have been informed that I will not be compensated for my participation.
9. I have been informed that any questions I have concerning the research study or my participation in it, before or after my consent, will be answered by Sarah Paugh, 261 California Rd, Brownsville PA 15417. (724)938-6257. spaugh@hotmail.com. or Dr. Carol Biddington, biddington@cup.edu.
10. I understand that written responses may be used in quotations for publication but my identity will remain anonymous.
11. I have read the above information. The nature, demands, and benefits of the project have been explained to me. I knowingly assume the risks involved, and understand that my participation is voluntary and I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. In signing this consent form, I am not waving any legal claims, rights, or remedies. A copy of this consent form

will be given to me upon request.

Subject Signature _____ Date _____

1. I certify that I have explained to the above individual the nature and purpose, the potential benefits, and possible risks associated with participation in this research study, have answered any questions that have been asked, and have witnessed the above signature.
2. I have provided the subject/participant a copy of this signed consent document if requested.

Investigator's Signature _____ Date _____

APPENDIX C2

Dietary Habits and Nutritional Knowledge Questionnaire

Dietary Habits and Nutritional Knowledge Questionnaire
 Approved by the California University of Pennsylvania IRB

Please DO NOT write your name anywhere on this questionnaire.
 Please answer the following questions honestly and to the best of
 your knowledge. **All of your responses and the results of this
 study will be kept strictly confidential.** Thank you for your
 time.

Section I:

Male _____ Female _____ Year in College _____

Major _____

Sport _____ Age _____

Height _____ Weight _____

Where do you usually get your nutrition information? Circle one

Coach Magazine TV Athletic Trainer Parents Other _____

Have you had any previous nutrition courses? Yes No

Please Circle the number that applies to each of the following
 questions. Refer to the scale below to determine the number of
 days per week defined in each reading.

4 Always: 5-7 days per week 3 Often: 3-4 days per week
 2 Sometimes: 1-2 days per week 1 Never: Does not occur at all

1. How often do you eat breakfast in the morning? 4 3 2 1

2. Based on three meals per day, how often do you skip at least one meal per day? 4 3 2 1

4 Always:5-7 days 3 Often:3-4 days
 2 Sometimes:1-2 days 1 Does not occur at all

3. How often do you take vitamin supplements?	4	3	2	1
4. How often do you take mineral supplements?	4	3	2	1
5. How often do you eat three base meals per day?	4	3	2	1
6. How often do you record what you eat?	4	3	2	1
7. How often do you drink water?	4	3	2	1
8. How often do you drink carbonated beverages?	4	3	2	1
9. How often are you on a "diet"?	4	3	2	1
10. How often do you eat breads, cereals, pasta, potatoes, or rice?	4	3	2	1
11. How often do you eat fruits, such as apples, bananas, or oranges?	4	3	2	1
12. How often do you eat vegetables, such as broccoli, tomatoes, carrots, or salad?	4	3	2	1
13. How often do you eat dairy products such as milk, yogurt, or cheese?	4	3	2	1
14. How often do you eat berry jams, cookies, candies, or other sweets?	4	3	2	1
15. How often do you snack on foods like potato chips, cakes, candies, donuts, or soda?	4	3	2	1
16. How often do you snack on foods like bagels, yogurt, popcorn, pretzels, or fruits?	4	3	2	1
17. How often do you eat fast food?	4	3	2	1
18. How often do you seek out nutrition information?	4	3	2	1

Please circle the number for each statement indicating to what extent you agree or disagree with each of the following statements.

4 Strongly agree

3 Agree Somewhat

2 Disagree Somewhat

1 Strongly Disagree

1. Skipping breakfast can negatively affect athletic performance.	4	3	2	1
2. Proteins are the best and most efficient source of energy.	4	3	2	1
3. Nutrition affects mental performance	4	3	2	1
4. The pre-event meal should be eaten 3-4 hours prior to competition.	4	3	2	1
5. Calcium excretion from the body increases with alcohol consumption.	4	3	2	1
6. According to the Food Guide Pyramid, one should consume 6-11 servings from the bread, cereal, rice and pasta group.	4	3	2	1
7. According to the Food Guide Pyramid, one should consume 2-4 from the fruit group.	4	3	2	1
8. According to the Food Guide Pyramid, one should consume 2-3 servings from the dairy group.	4	3	2	1
9. According to the Food Guide Pyramid, one should consume 2-3 servings from the meat group.	4	3	2	1
10. Eating breakfast can improve concentration.	4	3	2	1
11. Carbohydrates are less fattening than fatty foods.	4	3	2	1
12. 60% of total calories should come from carbohydrates.	4	3	2	1

4 Strongly Agree 3 Agree Somewhat
 2 Disagree Somewhat 1 Strongly Disagree

13. Carbohydrates are easier to digest than fats or proteins.	4	3	2	1
14. Excess vitamin consumption can be toxic.	4	3	2	1
15. Anemia is a deficiency in iron.	4	3	2	1
16. Average percentage of body fat in females is 20-25%	4	3	2	1
17. Cereal, bread, bagels, and pasta are good sources of carbohydrates.	4	3	2	1
18. Tofu, nuts and beans are good sources of proteins	4	3	2	1
19. Athletes tend to consume twice as much protein as recommended.	4	3	2	1
20. Over consumption of protein is beneficial for athletes.	4	3	2	1
21. The best sources of iron come from animal products and fish.	4	3	2	1
22. Eating cereals or breads enriched with iron should be eaten with a source of vitamin C to enhance absorption of iron	4	3	2	1
23. Proteins act to repair and build muscle tissue and make hormones to boost the immune system.	4	3	2	1
24. Fats are essential in all diets.	4	3	2	1
25. If a diet is lacking in carbohydrates, proteins are then used for energy.	4	3	2	1
26. Oatmeal, legumes, and fruits are sources of soluble fiber.	4	3	2	1
27. The recommended amount of fiber is 25 grams per day.	4	3	2	1
28. Vitamin C is also known as ascorbic acid.	4	3	2	1
29. If you are not thirsty, then you must not be dehydrated.	4	3	2	1

APPENDIX C3

Scoring Key

QUESTIONNAIRE SCORING KEY

SECTION II:

1. How often do you eat breakfast in the morning?	4
2. Based on three meals per day, how often do you skip at least one meal per day?	1
3. How often do you take vitamin supplements?	1
4. How often do you take mineral supplements?	1
5. How often do you eat three base meals per day?	4
6. How often do you record what you eat?	4
7. How often do you drink water?	4
8. How often do you drink carbonated beverages?	4
9. How often are you on a "diet"?	1
10. How often do you eat breads, cereals, pasta, potatoes, or rice?	4
11. How often do you eat fruits, such as apples, bananas, or oranges?	4
12. How often do you eat vegetables, such as broccoli, tomatoes, carrots, or salad?	4
13. How often do you eat dairy products such as milk, yogurt, or cheese?	4
14. How often do you eat berry jams, cookies, candies, or other sweets?	1
15. How often do you snack on foods like potato chips, cakes, candies, donuts, or soda?	1
16. How often do you snack on foods like bagels, yogurt, popcorn, pretzels, or fruits?	4
17. How often do you eat fast food?	1
18. How often do you seek out nutrition information?	4

Range of Scores:18-72

SECTION III:

1. Skipping breakfast can negatively affect athletic performance. 4
2. Proteins are the best and most efficient source of energy. 1
3. Nutrition affects mental performance 4
4. The pre-event meal should be eaten 3-4 hours prior to competition. 4
5. Calcium excretion from the body increases with alcohol consumption. 4
6. According to the Food Guide Pyramid, one should consume 5-6 servings from the bread, cereal, rice and pasta group. 1
7. According to the Food Guide Pyramid, one should consume 2-4 from the fruit group. 4
8. According to the Food Guide Pyramid, one should consume 4 servings from the dairy group. 1
9. According to the Food Guide Pyramid, one should consume 2-3 servings from the meat group. 4
10. Eating breakfast can improve concentration. 4
11. Carbohydrates are less fattening than fatty foods. 4
12. 60% of total calories should come from carbohydrates. 4
13. Carbohydrates are easier to digest than fats or proteins. 4
14. Excess vitamin consumption can be toxic. 4
15. Anemia is a deficiency in iron. 4
16. Average percentage of body fat in females is 20-25% 4
17. Cereal, bread, bagels, and pasta are good sources of carbohydrates. 4
18. Tofu, nuts and beans are good sources of proteins 4
19. Athletes tend to consume twice as much protein as recommended. 4
20. Overconsumption of protein is beneficial for athletes. 1

21. The best sources of iron come from animal products and fish.	4
22. Eating cereals or breads enriched with iron should be eaten with a source of vitamin C to enhance absorption of iron	4
23. Proteins act to repair and build muscle tissue and make hormones to boost the immune system.	4
24. Fats are essential in all diets.	4
25. If a diet is lacking in carbohydrates, proteins are then used for energy.	4
26. Oatmeal, legumes, and fruits are sources of soluble fiber.	4
27. The recommended amount of fiber is 25 grams per day.	4
28. Vitamin C is also known as ascorbic acid.	4
29. If you are not thirsty, then you must not be dehydrated.	1

Range of Scores: 29-116

Classifications:

*excellent=85-100%

*good=70-84%

*fair=55-69%

*poor=54% or lower

APPENDIX C4

Institutional Review Board

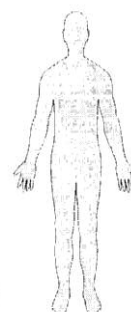


California University
of Pennsylvania

Proposal Number

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PROTOCOL for Research Involving Human Subjects



*Institutional Review Board (IRB) approval is required before beginning any research
and/or data collection involving human subjects*



(Reference IRB Policies and Procedures for clarification)

Project Title Dietary Habits and Nutritional Knowledge of College Athletes

Researcher/Project Director Sarah Paugh

Phone # (724)938-6257 E-mail Address Pau0804@cup.edu

Faculty Sponsor (if you are a student) Dr. Carol Biddington

Department Health Sciences and Sport Studies

Project Dates February '05 to April '05

Sponsoring Agent (if applicable) _____

Project to be Conducted at Alderson-Broaddus College, California University of Pennsylvania

Purpose of the Project ☒ Thesis ☐ Research
☐ Class Project ☐ Other

Required IRB Training

The training requirement can be satisfied by completing the online training session at <http://cme.nci.nih.gov/>. A copy of your certification of training must be attached to this IRB Protocol. If you have completed the training at an earlier date and have already provided documentation to the California University of Pennsylvania Grants Office, please provide the following:

Previous Project Title _____

Date of Previous IRB Protocol _____

(All Proposals Must be Typed)

1. Give a brief overview of your project/proposal with research hypothesis.

The purpose of this study is to examine the relationship of diet habits on athletes and their knowledge about nutrition. There will be a positive relationship between diet habits and knowledge of nutrition. Males will practice better dietary habits than females. Females will have better knowledge about nutrition than males.

2. Give a brief description of the subjects you plan to use, and check the appropriate box(es) below.

Male and female athletes representing from basketball, cross-country, baseball and softball teams.

<input checked="" type="checkbox"/> Adult Volunteers	<input type="checkbox"/> Mentally Ill
<input type="checkbox"/> Minor Volunteers	<input type="checkbox"/> Elderly
<input type="checkbox"/> Children Under 18	<input type="checkbox"/> Mentally Retarded
<input checked="" type="checkbox"/> CAL University Students	<input type="checkbox"/> Physically Handicapped
<input type="checkbox"/> Minorities	<input type="checkbox"/> Prisoners
<input type="checkbox"/> Disadvantaged	<input type="checkbox"/> Pregnant Women

3. Is remuneration involved in your project? ☐ Yes or ☒ No
If yes, Explain below.

4. How do you plan to select subjects? Did they volunteer? Is participation required?
Explain below.

The subjects in this study will consist of 188 college athletes from men's and women's basketball, men's and women's cross country, and softball and baseball. Men's Basketball 23 athletes, Women's basketball 23, Men's Cross-Country 51, Women's Cross-Country 28, Baseball 49, Softball 34. Athletes will volunteer to complete the survey. No participation is required.

5. Does your project involve use of a consent form? ☐ Yes or ☒ No
If yes, attach the form.

Informed consent will be assumed when the questionnaire is returned.

6. What instruments or devices will be used to gather data? Provide a copy of documentation pertaining to the data collection, such as but not limited to:
Cover letter, questionnaire/survey, consent form, interview/focus group sheets.

Instruments include: Cover letter, and Questionnaire

7. Is this project part of a grant? ☐ Yes or ☒ No If yes, provide the following information:

Title of the Grant Proposal

Name of the Funding Agency

Dates of the Project Period

8. Does your project involve the debriefing of those who participated? ☐ Yes or ☒ No
If yes, explain the debriefing procedure.

9. The Federal Regulations require that the protocol meet certain criteria before IRB approval can be obtained. Describe in detail how the following requirements will be satisfied:
- A. Insure that the risks of the subject are minimized.

There are no foreseeable risks
 - B. Justify the degree of risk involved (if any) in relationship to the potential of the project to the subject matter.

There are no foreseeable risks.
 - C. Insure that the selection of the subjects is equitable.

This study will be based on its population for each sport on a voluntary basis.
 - D. Guarantee that informed consent will be obtained for each prospective subject or the subject's legally authorized representative and that consent forms will be adequately documented.

Consent will be implied by the subject completing the questionnaire.
 - E. Monitor the data collected to ensure the safety of the subject.

Once data is collected it will be placed in a sealed envelope and kept in a secure place.
 - F. Protect the privacy of subjects and maintain the confidentiality of data.

Once data is collected it will be placed into a sealed envelope and kept in a secure place.
 - G. Provide for extra safeguards to protect the rights and welfare of "vulnerable" subjects (e.g., children, prisoners, pregnant women, mentally disabled persons or economically or educationally disadvantaged persons).

If a subject is 17 years old, they will be excluded from the study.

Project Director's

Certification

Program Involving HUMAN SUBJECTS

The proposed investigation (*research or training program*) involves the use of human subjects and I am submitting the complete application form and description of the project to the Institutional Review Board for Research Involving Human Subjects.

If the Board grants approval of this application, I agree to:

1. Abide by any conditions or changes in the project required by the Board.
2. Report to the Board any change in the research plan that affects the method of using human subjects before such change is instituted.
3. Report to the Board any problems that arise in connection with the use of human subjects.
4. Seek advice of the Board whenever I believe such advice is necessary would be helpful.
5. Secure the informed, written consent of all human subjects participating in the project.
6. Cooperate with the Board designed in its effort to provide a continuing review after investigations have been initiated.

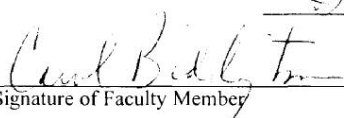
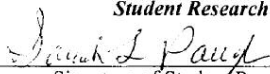
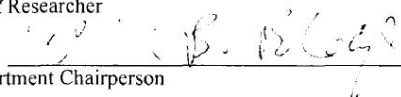
I have reviewed the Federal and State regulations concerning the use of human subjects in research and training programs and the guidelines. I agree to abide by the regulations and guidelines aforementioned and will adhere to policies and procedures described in my application. I understand that changes to the research must be approved by the IRB before they are implemented.

Professional Research

Signature of Project Director

Signature of Department Chairperson

Student Research

Signature of Faculty Member Signature of Student Researcher Signature of Department Chairperson

ACTION OF REVIEW BOARD

The Institutional Review Board for Research Involving Human Subjects has reviewed this application to ascertain whether or not the proposed project:

1. provides adequate safeguards of the rights and welfare of human subjects involved in the investigations;
2. uses appropriate methods to obtain informed, written consent;
3. indicates that the potential benefits of the investigation substantially outweigh the risk involved.
4. provides adequate debriefing of human participants.
5. provides adequate follow-up services to participants who may have incurred physical, mental, or emotional harm.

BOARD DISPOSITION:



Chairperson, Institutional Review Board Date

2/15/05

APPENDIX C5

Cover Letter

7/1/05

Dear Coach,

I am conducting a study on dietary habits and nutritional knowledge of college athletes. For my study to be accurate, it is critical that I obtain my data directly from the college students. My goal is to determine if there are differences between gender for dietary habits and nutritional knowledge. The results of the study may be used to educate college athletes, coaches, and athletic trainers on healthy ways to help athletes improve dietary habits and knowledge about nutrition.

The results of the study will be completely confidential and participation in the study entirely voluntary. Athletes may volunteer to anonymously complete a questionnaire. An informed consent form will be given out prior to the questionnaire. I will administer the questionnaire to the athletes and will ask you to please leave the room to eliminate any participation bias. If you have any questions, do not hesitate to contact me at 724-938-6257 or spaugh@hotmail.com

Thank you for your time and assistance.

Sincerely,

Sarah Paugh

REFERENCES

1. Reid-St. John SU. Working out? Here's what to eat. *Health*. 2003;17(8):92.
2. Rodriguez N. The role of nutrition in injury prevention and healing. *Athletic Therapy Today*. 1999;4(6):27-31.
3. Bernard B. The importance of nutrition in sports. *Positive Health*. 2000;(50):35-38.
4. Vinci DM. The training room: developing a sports-nutrition game plan. *Athletic Therapy Today*. 2002;7(5):52-53.
5. Arnheim DD, Prentice WE. *Principles of Athletic Training*. Madison, WI: Brown & Benchmark, 1997.
6. DeMasi S. Just for athletes. *Coaching Youth Sports*. 2003.
7. Mirkin G. Pre-race or pre-game meal. Available at: www.DrMirkin.com/fitness/8494.html. Accessed September 9, 2004.
8. Gorman B, Bonner S. The optimum pre-game meal. Available at: <http://aspire.cs.uah.edu/aspire/optimummeal.html>. Accessed September 29, 2004.
9. Bonci, L. Refueling the tank. Available at: <http://www.momentummedia.com/articles/cm/cm0902/refuel tank.htm>. Accessed September 29, 2004.
10. Post-game nutrition. *Better Nutrition*. 2004;66(7).
11. Zawila LG, Steib CSM, Hoogenboom B. The female collegiate cross-country runner: nutritional knowledge and attitudes. *J Athletic Training*. 2003;3(8):67-74.
12. Rosenbloom C, Jonnalagadda S, Skinner R. Nutrition knowledge of collegiate athletes in a division I national collegiate athletic association institution. *J Amer Dietetic Assoc*. 2002;102(3):418-420.

13. Abood DA, Black DR, Birnbaum RD. Nutrition education intervention for college female athletes. *J Nutrition Education and Behavior*. 2004;36(3):135-139.
14. Jacobson BH, Sobonya C, Ransone J. Nutrition practices and knowledge of college varsity athletes: a follow-up. *J Strength Conditioning Research*. 2001, 15(1):63-68.
15. Lundell L. Nutritional knowledge, attitudes, and practices and the actual dietary intakes of female college athletes. *Int Institute Sport Human Performance*. Eugene, Oregon. 1993.
16. Kopp SD, Young JC. College students' knowledge of basic nutrition information. *Research Quarterly Exercise Sport*. Washington, DC. 2003.
17. Kunkel ME, Bell LB, Luccia BHD. Peer nutrition educations program to improve nutritional knowledge of female collegiate athletes. *J Nutritional Education*. 2001;3(2)114-116.
18. Packman J, Kirk S. The relationship between nutritional knowledge, attitudes and dietary fat consumption in male students. *J Human Nutrition Dietetics*. 2000; 13(6)389-396.
19. National Collegiate Athletic Association. Sports Nutrition: Nutrition Health. Available at: www.drugfreesport.com/choices/nutrition/health.html. Accessed October 22, 2004.
20. Maughan R. The athlete's diet: nutritional goals and dietary strategies. *Proceedings Nutrition Society*. 2002. 61(1).
21. Anderson S, Frye B, Smithson G. Sports nutrition. *Sports Coach J*. 1999;22(1).
22. Kirklighter JR, Rosenbloom C, Coles M. Dietary Practices of college students enrolled in a nutrition course: compliance with dietary recommendations for healthy eating. *NACUFS J*. 1999;21.

23. Ziegler PJ, Jonnalagadda SS, Nelson JA, Lawrence C, Baciak B. Contribution of meals and snacks to nutrient intake of male and female elite figure skaters during peak competitive season. *J American College Nutrition*. 2002;21(2).
24. Burke LM. Nutritional practices of male and female endurance cyclists. *Sports Med*. 2001;31(7):521-532.
25. Oppliger RA, Nelson Steen SA, Scott JR. Weight loss practices of college wrestlers. *International J Sport Nutrition Exercise Metabolism*. 2003;13(1).
26. Whitney EN, Cataldo CB, Rolfes SR. Understanding Normal and Clinical Nutrition. 6th ed. 2000:296-298.
27. Ellis D. Fundamental fueling tactics: influencing the eating habits of college athletes. Available at: www.fuelingtactics.com/habits2.htm. Accessed October 20, 2004.
28. Eating disorders: unhealthy eating behaviors on rise of men. *Health Medicine Week*. 2004:354-356.
29. Beals KA, Manore MM. Disorders of the female athletic triad among collegiate athletes. *International J Sport Nutrition Exercise Metabolism*. 2002;12:281-293.

ABSTRACT

Title: Dietary Habits and Nutritional Knowledge of College Athletes

Researcher: Sarah L. Paugh

Advisor: Dr. Carol Biddington

Purpose: The purpose of this study was to examine the relationship between diet habits and knowledge about nutrition for athletes.

Method: Participants included 68 athletes from California University of Pennsylvania and 49 athletes from Alderson-Broaddus College. The athletes were mens' and womens' basketball, mens' and women's cross country, baseball and softball. The subjects completed a Dietary Habits and Nutritional Knowledge Questionnaire. The data was analyzed using Pearson Correlations, a MANOVA, and ANOVA at an alpha level of .05.

Conclusions: Athletes who practiced better dietary habits also had a better understanding of nutrition. Females practiced better dietary habits than males. Females had greater nutritional knowledge than males. Womens' sports scored higher on dietary habits and nutritional knowledge than mens' sports. Subjects with lower BMI scores had better dietary habits.