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Protein-related Knowledge, Perceptions, Sources of Information, and Behaviors Among College-Age Males

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To the Graduate Council:

I am submitting herewith a thesis written by Amy Leigh Sparks entitled "Protein-related Knowledge, Perceptions, Sources of Information, and Behaviors Among College-Age Males." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nutrition.

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We have read this thesis and recommend its acceptance:

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Protein-related Knowledge, Perceptions, Sources of
Information, and Behaviors Among College-Age Males

A Thesis Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Amy Leigh Sparks
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ABSTRACT

The objective of this study was to describe thoughts, knowledge, and dietary practices with regard to protein, and how these factors related to current recommendations among college-age males. A convenience sample of non-athlete college-age males (n=47), ages 18-24 years, completed 7 day dietary records (analyzed using NDSR), accelerometer assessments, anthropometric assessments (height, weight, waist circumference, and Bod Pod), and a brief semi-structured interview on protein knowledge and behaviors.

Participants were grouped according to protein intake with 15% consuming less than 0.8 grams of protein per kilogram of body weight per day (g/kg/d), 70% consuming 0.8-1.99 g/kg/d, and 15% consuming ≥ 2 g/kg/d. Overall, 98% fell within the acceptable macronutrient distribution range of protein. Food sources of protein included chicken and a variety of other meats. Participants were involved in an average of 122.57 ± 116.31 minutes of physical activity per week. Primary sources of information about protein included the internet, specifically body building websites, and, word of mouth. Twenty-five percent of the sample thought they needed “at least one gram of protein per pound” of body weight. The other 75% of the population did not mention a specific amount of protein they thought they should be consuming.

Based on data from this research study, non-athlete college-age males were largely misinformed on protein needs and received their information from unreliable sources including word of mouth and the internet. Contradictions were found between two primary recommendations for protein intake (acceptable macronutrient distribution range versus the Recommended Dietary Allowance). For some of the participants,

whether they were found to be consuming appropriate amounts of protein differed by which recommendation system was used in analysis. These conflicting recommendations could result in confusion between professionals and individuals in interpreting protein needs and adequacy.

TABLE OF CONTENTS

CHAPTER I Literature Review	1
Protein recommendations	2
Physical activity and the body’s need for protein	3
Established adverse effects of excessive protein intake	3
College-aged male athletes’ knowledge and beliefs about nutrition	4
Protein supplements and prevalence of use	6
Research gaps and purpose of current study	7
CHAPTER II Manuscript	9
Abstract	10
Introduction	11
Methods	12
Recruitment	12
1 st session	13
2 nd session	14
3 rd session	14
NDSR and physical activity analysis	14
Interview analysis	15
Results	15
Discussion.....	19
Other dietary components.....	19
Sources of information	19
Activity level	19

Body composition.....	21
Conclusions and recommendations	22
CHAPTER III Extended Methods	24
LIST OF REFERENCES	33
APPENDICES	39
Appendix A: Project benefits	40
Appendix B: Anthropometrics sheet	41
Appendix C: Food record instructions	42
Appendix D: Diet record sheet	43
Appendix E: Interview questions and prompts	44
Appendix F: Sample training interview 1	45
Appendix G: Sample training interview 2	46
Appendix H: Code book	47
Appendix I: Sample emails	52
Appendix J: Portion guide handout	53
VITA.....	54

LIST OF TABLES

Table 1. Describing college males by protein consumption group among factors associated with anthropometrics, dietary consumption and physical activity.....	16
Table 2. Thoughts, perceptions, and sources of information by protein consumption (g/kg/d) group (n=47).....	18

CHAPTER I
LITERATURE REVIEW

Protein recommendations

Almost 60% of body protein is located in the skeletal muscles [1]. The liver, which synthesizes plasma proteins and pancreatic digestive enzymes also contains protein [1, 2]. Due to all of the organs and mechanisms that are affected by protein intake, it is crucial for life. However, amounts of protein over the recommendation may not be safe due to the potential for adverse long-term effects [3].

The recommended dietary allowance (RDA) for protein intake for adult men and women is 0.8 g/kg per day [4]. The recommendations for physically-active individuals are slightly higher, at 1.2-1.7 g/kg per day, with all recommended intakes below 2 g/kg per day [4]. The acceptable macronutrient distribution range (AMDR) recommends 10-35% of one's calories to come from protein. More research is needed in order to better define the upper range. Based on the American College of Sports Medicine, strength training and endurance athlete protein recommendations range from 1.2 to 1.7 g/kg of body weight per day [5]. Although these recommendations are higher than 0.8g/kg, they can almost always be met through diet alone, without the use of a protein supplement [5]. The typical 19-30 year old American adult consumes an average of 1.0-1.5 g/kg/d, which is above the recommended amount of 0.8 g/kg/d, but within the bounds of the AMDR [6].

Protein intakes two times the recommendation are unlikely to cause any adverse effects [4]. However, very high intakes of protein, three to four times the recommendation (2.4-3.2 g/kg/d) are likely to be associated with possible health risks relating to kidney function [3]. Protein seems to be well tolerated when consumption levels are as high as 35% of dietary energy [7]. Recommendations for tolerable amounts

of protein and amino acids suggest caution should be used when consuming levels significantly higher than the levels which are found in normal foods [7].

Physical activity and the body's need for protein

Physical activity increases the body's need for protein [1]. Activity influences the amino acids interchange and affects how available amino acids are for protein production [4]. The body requires access to protein during states of high/vigorous physical activity in order to repair and build tissue along with replenishing glycogen stores [5].

The liver and kidneys are the main sites of protein metabolism in the body [1]. When excess amounts of protein are consumed, the amino acids that are not needed for the synthesis of protein and other nitrogenous compounds are unable to be stored or excreted in in the form of amino acids. Therefore, excess amino acids are oxidized for use as an energy source or converted to fat for storage. This occurs during amino acid degradation, when most of the carbon skeleton is metabolized to pyruvate, acetyl-CoA or one of the intermediates of the TCA cycle [1]. The rate of protein degradation is dependent upon the level of physical activity for the muscle [1, 8]. Protein breakdown and a decrease in the rate of synthesis also accompany physical activity or exercise[1].

Established adverse effects of excessive protein intake

There are numerous negative effects associated with high protein intake [9]. This may be especially a concern with physically-active college-age males who may be more likely to be consuming excessively high levels of protein on a regular basis. Various research studies have found that high protein diets (those over 2 g/kg/d) can cause changes in renal function [3, 9]. The main consequence associated with high protein intake is effects on the kidneys, which could lead to end stage renal disease [10].

However much of this evidence is derived from populations who are generally already at risk for kidney disease, for example, individuals with obesity, hypertension, dyslipidemia or uncontrolled diabetes [9]. Therefore, additional research is necessary in order to determine if high protein intake has an effect on healthy kidney function and to what degree this occurs [3].

Although high protein intake has sometimes been shown to have adverse effects on the kidneys, it has been found to negatively affect other health factors as well including increasing the occurrence of calcium stones [11] and causing gastrointestinal discomfort and muscle cramps [12].

College-aged male athletes' knowledge and beliefs about nutrition

Many people do not have any understanding of the concepts associated with protein intake or the amount of protein intake necessary for daily living [13]. This may cause individuals to think they need to consume more than they need [14]. However, previous research in the United States has found that unless individuals are rarely eating protein, they are easily consuming minimum protein recommendations and do not need extra protein from dietary sources or supplements [5].

Research has found college male athletes think they need more than twice the RDA of 0.8g/kg and often over 2g/kg [14]. College-aged males, in general, have inadequate knowledge pertaining to general nutrition and macronutrients including protein and do not know how much protein they should consume per day [14]. Furthermore, due to the widely accepted assumption that high protein consumption leads to increased muscle mass [14], college males may have accepted incorrect information about protein and nutrition.

College athletes have been found to have more knowledge of nutrition than non-athletes, however the level of this knowledge is less among males than females [15]. One particular study by Froiland and colleagues focused on the nutritional knowledge of college athletes [16]. This study's methods included a survey for 115 college male athletes about using nutritional supplements and where they obtained their information. The survey included questions asking the participant to define "supplement", and to report supplement use and type, source of information and reasons for use [16]. Participants in this study were varsity athletes. They were encouraged to choose the source where they obtained their information regarding supplements [16]. The top answers were family members (32.4%), fellow athletes (31.9%), their personal strength coach (28%), athletic trainer (30.0%), Registered Dietitian (28.5%), friend (28.5%), and coach (28.0%). Fewer than 10% of the participants listed television or the Internet as a source of information for supplements [16]. Within the results of the study by Froiland and colleagues it is evident that athletes heavily rely on athletic services for nutrition information. This raises concern for college-age males who are not varsity athletes because the non-athletes are less likely to be seeking information from a Registered Dietitian due to having less access than an athlete. Thus, college and professional athletes may have more access to reliable nutrition information than physically active college males who are non-collegiate athletes. Furthermore, physically-active college-age males who do not play a sport are unlikely to be as educated about nutrition as college athletes [17].

Protein supplementation and prevalence of use

There are over 30,000 protein supplements commercially available in the United States [18]. Over three million people in the United States are either currently using or have used a protein supplement [18]. Younger people are more likely to consume protein supplements than older people [19].

Jacobson and colleagues reported that 79% of males reported using some sort of protein supplement during college athletics [19]. Perkin and colleagues used a 15-question survey, which was given to 1000 college students who were mostly (80%) undergraduates, to explore if students are using protein supplements and what types are being used [20]. Protein powder and/or amino acids were found to be among the top used supplements among the college males. Researchers also found that (among students that used supplements) students used an average of 2.7 different supplements [20].

Morrison and colleagues looked at a convenience sample of regular exercisers at a commercial gym. The participants were given anonymous questionnaires asking if they use supplements and if so what type [13]. A total of 84.7% took supplements. Of the participants who reported using protein supplements, 42.3% consumed protein shakes or protein bars at least five times per week [13]. In addition, most of these supplements were protein and in the form of shakes because they were perceived by the participants to be most effective in producing muscle mass [18]. It has also been shown that many supplement consumers receive their information regarding protein from unqualified sources like family and friends rather than from nutrition professionals [21].

With the large number of physically-active individuals consuming protein over the RDA, and the potential risk of chronic kidney disease and other health issues, there is

a concern for potential harm and a need to further explore knowledge, practices, and extent of potential for adverse effects [11]. Determining where physically-active college-age males get their information regarding protein needs/products containing protein, and determining their current protein intakes, may identify intervention points for reducing the risk of undesired health effects.

Research gaps and purpose of the current study

Although there is some information about protein intake behavior, knowledge, perceptions, and sources of information, there is very little information on college-age males who do not play a varsity level sport [17]. At this time it is unclear whether excessive protein intake causes serious health consequences and future research is needed to elucidate the physiological effects [9]. The first research step necessary is to determine current knowledge, beliefs and behaviors among college-age, non-athlete males. It appears that college males' protein consumption through dietary intake and supplements is likely above that which is recommended by the RDA, but within AMDR recommendations [1]. It is also probable that college students lack knowledge relating to protein [18]. However, there are several gaps in the current literature relating to protein consumption in college-age, non-athlete males. One gap is that previous research only focused on the intake of protein supplements and not the overall protein consumption. Another gap in the literature is that studies have only used athletes as participants. A final gap is the lack of current research literature. In the past ten years there have not been any research studies that looked at protein intake among college-age males.

The purpose of this research was to determine protein intake behavior (including supplements and food sources), protein nutrition knowledge, perceptions about protein,

and sources of protein information among college-age males who were not athletes. This study specifically sought to determine how much protein non-athlete college males consumed on a daily basis (and from what sources) and where they got their information on protein needs and products containing protein.

CHAPTER II
Manuscript

Abstract

The objective of this study was to describe thoughts, knowledge, and dietary practices with regard to protein, and how these factors related to current recommendations among college-age males. A convenience sample of non-athlete college-age males (n=47), ages 18-24 years, completed 7 day dietary records (analyzed using NDSR), accelerometer assessments, anthropometric assessments (height, weight, waist circumference, and Bod Pod), and a brief semi-structured interview on protein knowledge and behaviors.

Participants were grouped according to protein intake with 15% consuming less than 0.8 grams of protein per kilogram of body weight per day (g/kg/d), 70% consuming 0.8-1.99 g/kg/d, and 15% consuming ≥ 2 g/kg/d. Overall, 98% fell within the acceptable macronutrient distribution range of 10-35% of calories coming from protein. Food sources of protein included chicken and a variety of other meats. Participants were involved in an average of 122.57 ± 116.31 minutes of physical activity per week. Primary sources of information about protein included the internet, specifically body building websites, and, word of mouth. Twenty-five percent of the sample thought they needed “at least one gram of protein per pound” of body weight. The other 75% of the population did not mention a specific amount of protein they thought they should be consuming.

Based on data from this research study, non-athlete college-age males were largely misinformed on protein needs and received their information from unreliable sources including word of mouth and the internet. Contradictions were found between two primary recommendations for protein intake (acceptable macronutrient distribution

range versus the Recommended Dietary Allowance). For some of the participants, whether they were found to be consuming appropriate amounts of protein differed by which recommendation system was used in analysis. These conflicting recommendations could result in confusion between professionals and individuals in interpreting protein needs and adequacy.

Introduction

The Recommended Dietary Allowance (RDA) for protein intake for adult men and women is 0.8 g/kg per day [22]. The recommendations for physically-active individuals are slightly higher than the general public. Protein recommendations for strength training and endurance athletes range from 1.2 to 1.7 g/kg of body weight per day with all recommendations ranging below 2 g/kg per day. The Acceptable Macronutrient Distribution Range (AMDR) recommends 10-35% of one's calories to come from protein. These recommendations can almost always be met through diet alone, without the use of protein supplements. The typical 19-30 year old American adult consumes an average of 1.0-1.5 g/kg/day, which exceeds the RDA [6].

Although protein needs can almost always be met through dietary intake alone, many individuals consume protein supplements [20]. There are over 30,000 protein supplements commercially available in the United States [18]. Over three million people in the United States are either currently using or have used a protein supplement [18] and younger people are more likely to consume protein supplements than older people [19]. When protein supplements are used, individuals are likely to consume amounts in excess of the RDA [20]. With intakes three to four times the RDA (2.4-3.2 g/kg/day), potential adverse effects may occur including chronic kidney disease [9].

Research has found that many collegiate male athletes think that they need more than 2g/kg/day of protein [14]. Collegiate athletes have been found to have more knowledge of nutrition than non-athletes, however the level of this knowledge is less among males than females [15]. In addition, many people in general do not know how much protein they should consume per day [14]. Furthermore, due to the widely-accepted belief that high protein consumption leads to increased muscle mass [16], many people may have misconceptions about protein and recommended levels of protein intake [16].

Although there is some information about protein intake behavior, knowledge, perceptions, and sources of information [16], this information with college-age males who do not play a varsity level sport is currently unknown and the research in this field was conducted more than ten years ago. Another gap in the literature is that previous research only focused on the intake of protein supplements and not the overall protein consumption. It is important to determine protein intake behaviors among college-age males because the dietary patterns and behaviors developed in young adulthood often continue into adulthood [23]. The purpose of this research was to determine protein intake behavior (including supplements and food sources), protein nutrition knowledge, perceptions about protein, and sources of protein information among college-age males who are not athletes.

Methods

Recruitment and Eligibility

A convenience sample of males ages 18 to 24, not involved in a varsity level sport, was recruited from the University of Tennessee Recreation Center, University of

Tennessee Library and by word-of-mouth. Researchers sitting at a table near the entrance of the Recreation Center or standing near the entrance of the library distributed information about the study to all male individuals as they passed by and asked if they were interested in participating. If they were interested, eligibility requirements were assessed. Researchers recruited for approximately one hour on four different occasions. Approximately 80 males were approached and asked to participate, with five not interested and 69 meeting eligibility requirements (appropriate age and not a varsity athlete) and signing up. After agreeing to participate, participants scheduled an appointment for an initial session. The University of Tennessee's Institutional Review Board approved all procedures.

First Session

In the initial session the participants had their heights, weights, and waist circumference measured by trained researchers using a stadiometer, scales, and a tape measure, respectively. The researcher then trained the participant on keeping a seven day food record, including visual portion size estimation material, and wearing an Actigraph wGT3x accelerometer for seven days. The participants were instructed to wear the accelerometers around their waists, under or over a shirt, at all times except when swimming or showering. Before leaving the first session, participants scheduled their second session for no less than seven days later. On the fourth day, the researcher sent an email or text message to the participant to remind him about the accelerometer and seven day record usage. Another email was sent on day seven as a reminder to remove the accelerometer and discontinue seven day records and with instructions on preparations for subsequent body composition measurements.

Second Session

At the second session, participants returned their accelerometers, seven-day food and physical activity records and researchers measured their body fat percentage using the COSMED BOD POD. After the body composition measurements were complete, participants participated in in-depth interviews about their protein knowledge, perceptions, and sources of information. The interviewer used questions and prompts from a developed interview script to guide the interview. These questions asked about sources of protein and where participants obtained information relating to protein. The interview was audio recorded on a research computer.

Third Session

As incentive for participation, participants were offered a third session to receive an analysis of their dietary intake and physical activity behaviors, and to discuss general nutrition information. Approximately 35 participants elected to participate in the third session. No data used in analysis were collected during the third session.

NDSR and Physical Activity Analysis

Seven day dietary intake data were collected and analyzed using Nutrition Data System for Research software version developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN. Accelerometer data were analyzed using Actilife data analysis software (the Actigraph program) [24]. Total minutes in sedentary, light, moderate, vigorous, and very vigorous activity, along with minutes of activity in Freedson bouts, were recorded. One Freedson bout was defined as

participating in at least ten minutes of activity at the moderate or vigorous level and not in the light category.

Interview Analysis

Interviews were transcribed using Inqscribe digital media transcription software. A priori coding was used based on initial reoccurring themes presented in the interviews. The researcher who conducted the interviews created the initial codes. Ten researchers were trained in coding techniques and an inter rater reliability was assessed at greater than 80%. When differences occurred in coding, the coded transcripts were compared for differences, new themes were identified and corresponding new codes were created. Then the transcripts were recoded.

Results

There were 69 males who met eligibility requirements and 50 who completed the entire study. The other 19 did not elect to participate at the time of the study. Three subjects were removed from the data analysis due to missing food records and one was removed due to missing percent body fat. Table 1 describes results by group. The groups were created by divided up by participants by those consuming under 0.8 g/kg/d, those consuming within 0.8 and 1.99 g/kg/d and those consuming at or over 2 g/kg/d and are referred to as low protein intake, moderate protein intake, and high protein intake groups, respectively. Table 1 describes dietary intake, physical activity and body composition among the groups.

Table 1. Describing college males by protein consumption group among factors associated with anthropometrics, dietary consumption and physical activity

	Total (n=47)	Low protein (n=7)	Moderate protein (n=33)	High protein (n=7)
Average % Body Fat	15.9 ± 7.00	24.58 ± 7.55	14.45 ± 5.39	12.53 ± 5.74
BMI (kg/m²)	25.33 ± 3.15	29.0 ± 3.99	24.77 ± 2.37	23.73 ± 5.74
Waist Circumference(cm)	84.87 ± 7.68	93.81 ± 10.50	83.29 ± 5.53	81.86 ± 5.89
Bouts of Physical Activity	122.57 ± 116.31	109.8 ± 123.9	119.16 ± 117.24	152.71 ± 115.93
% Using Supplement	59.60%	12.5%	65.6%	85.7%
Average daily protein intake (g)	105.14 ± 43.34	63.02 ± 8.30	97.92 ± 22.48	186.24 ± 37.32
% Within AMDR (10-35%)	98%	86%	100%	100%
% Over AMDR (35%)	0%	0%	0%	0%
% Under AMDR (10%)	2.0%	14%	0%	0%
Average # Fruit servings per day	1.23 ± 1.21	0.53 ± 0.58	1.09 ± 0.98	2.64 ± 1.67
Average # Vegetable servings per day	3.19 ± 2.64	1.82 ± 1.12	3.13 ± 2.31	5.07 ± 4.21
Total Fruit/Vegetable servings per day	4.42 ± 3.30	2.35 ± 1.00	4.22 ± 2.54	7.71 ± 5.51
Total daily energy consumption (kcal)	2245.53 ± 563.261	1763 ± 360.79	2217.28 ± 468.41	2926 ± 540.5
Average grams of protein per kilogram of body weight	1.31 ± 0.56	0.66 ± 0.12	1.24 ± 0.26	2.39 ± 0.31

Table 2 shows the major themes, which emerged from interviews among the low protein, moderate protein, and high protein groups. Based on these interviews, many non-athlete college males had misperceptions about protein recommendations. Although the

majority of the total participants reported some general knowledge of protein and stated that “protein builds muscle”, 25% of the population thought they needed “at least one gram of protein per pound” of body weight.

When it came to whether or not participants thought they were getting enough protein on a regular basis, approximately 40% of the overall sample thought they were consuming an adequate amount, as one participant stated, “I get an average amount, usually around the one gram per pound mark.” However, 50% of the low protein group reported having no idea if they were consuming enough protein. In addition, 14% of the high protein group thought they were not getting enough.

Most (53%) participants mentioned food sources (including chicken and a variety of other meats) as their main source of protein. Some reported extremely large portions, e.g. “I try to eat half of a chicken and one pound of steak per day”. However, approximately 33% of participants also mentioned non-meat sources of protein such as beans, nuts, and dairy; 40% were found in 7-day diet records to be consuming these items.

The majority (60%) of participants said they were currently using a supplement at the time of the study. Only 12.5% of the low protein group was using a supplement at the time of the study. Within the moderate protein group, 65.6% were consuming a supplement. Finally, among the high protein group, 85.7% were consuming a protein shake as their supplement. Some participants who were not currently taking supplements had misperceptions regarding the need for protein supplements, e.g. “I don’t use supplements now, but if you are working out really consistently your body can only

digest a certain amount of protein, then you have to get the rest of it through a supplement.”

Participants’ sources of information on protein mainly came from the internet, word of mouth, and/or the website bodybuilding.com. Comments about bodybuilding.com included statements such as “bodybuilding.com has been really helpful...especially during the winter when I was bulkier; I learned about casein, which really helps your muscles grow perfectly overnight.” Some participants from the high protein group also mentioned classes as a source of information on protein. This was reported more often in this group than the other groups.

Table 2. Thoughts, perceptions, and sources of information by protein consumption (g/kg/d) group (n=47)

Themes	Low protein consumption (n=7)	Moderate protein consumption (n=33)	High protein consumption (n=7)
Think protein builds muscle.	62.5%	65.6%	28.6%
Think they are getting adequate amounts of protein.	25%	40%	42.9%
Gets protein from a variety of meats, including chicken.	85.8%	55.6%	83%
Gets information from internet, word of mouth, and/or bodybuilding.com?	75%	68.8%	57.1%

Discussion

The average intake of protein for the general United States population is 1.0-1.5 gram/kg/day [6]. Within the present study, 98% of non-athlete college-age males reported protein intakes that fell within the AMDR for protein intake, although 14.9% consumed in excess of 2 g/kg/day and another 14.9% fell under the RDA of 0.8 g/kg/d. Due to inconclusive data it is unclear whether protein intake over 2 g/kg/d causes harm to the body over time. However, the participants consuming over 2 gram/kg/day are exceeding this RDA and should be made aware of these recommendations and potential associated risks.

Other Dietary Components

Researchers have previously found fruit and vegetable average intakes among college students to be between 2.4-3.4 cups of fruits and vegetables per day [25-27]. However, overall fruit and vegetable consumption among participants of this research study was higher with a mean of 4.43 ± 3.29 . With an average intake of 2.35 ± 1.00 , the low protein group had average fruit and vegetable intakes closer to those found in previous research. Participants in the high protein group had a daily mean intake of 7.71 ± 5.51 fruit and vegetable servings. Included in the last group were four individuals with total fruit and vegetable intakes of 10.68, 10.73, 13.20, and 18.80 servings/day. These values were double checked by two researchers and verified for accuracy.

Sources of information

Many participants were seeking information from potentially unreliable sources. Similar to the study by Bianco and colleagues, which looked at a convenience sample of males in a commercial gym, no one mentioned obtaining protein- related information

from a dietitian, and only 19 percent obtained information from “classes” [18]. The remaining participants received information relating to protein from potentially unreliable sources such as word of mouth and internet sources. The website “bodybuilding.com” was identified most often as the internet source used and was cited as the source of information on protein requirements, such as “your body needs one gram of protein per pound of body weight each day.” This is very different from the Froiland study, which looked at college athletes and found athletes’ sources of nutrition information to come from more reliable sources including dietitians and classes [16]. This is most likely due to athletes having these resources more easily accessible than non-collegiate athletes. Non-athlete college males were chosen for this study since it is known that many college athletes have direct access to a team dietitian and likely have more knowledge relating to nutrition and it was unknown where non-athlete college males were receiving protein information [16].

Activity level

According to the Physical Activity Guidelines for Americans, adults should do 150 minutes of aerobic activity each week at the moderate or vigorous level or 75 minutes at the vigorous level [28]. It is also recommended that this activity take place for a time span of at least 10 consecutive minutes at the moderate or vigorous level. Ten consecutive minutes is considered one bout of activity. Participant activity was based on the amount of time in bouts in order to reach the 10 consecutive minute point. According to the American College Health Association, only 19.5% of college students meet recommendations of 150 minutes of moderate activity per week [29]. A total of 29.8% of participants within this study met or exceeded the recommended amount. The actual

percentage meeting or exceeding the recommendations may have been slightly higher due to accelerometers having to be removed for swimming as reported by three participants, who swam at least four days during the week. Although this percentage was higher than previously-reported averages, it was still very low. Low physical activity among college-age students is of concern because college is a critical time period in which behavior developed is often carried into later adulthood [30].

Body Composition

Research has found the percent of body fat among college students including males and females to average 24.8% [31]. However, research looking only at body fat percentages of college males showed an average percent body fat of 16.3% [32]. With the average percent body fat of participants in this study being 15.9%, most fell into the moderate level of body fat, which ranges from 13 to 20% [24]. Compared to previous findings, the mean body fat percentage in this sample is slightly lower than average. Participants consuming less than 0.8 g/kg/d had an average percent body fat of 24.58 ± 7.55 . Participants consuming 0.8- 1.99 g/kg/d had an average percent body fat of 14.45 ± 5.39 and participants consuming over 2 g/kg/d had an average percent body fat of 12.53 ± 5.74 .

Interpreting body composition among college students using BMI has limitations due to potentially increased muscle mass. The average BMI among participants in this study was 25.33 ± 3.15 (kg/m^2), which, if used as the sole indicator of body composition, would indicate that the participants were on average overweight. However, the BOD POD results show that the average body fat percentage of participants averaged 15.9 ± 7.00 placing them in the moderately lean category.

Conclusions and Recommendations

Strengths and Limitations

Strengths of the study design included the use of the BOD POD and accelerometer as objective measures to describe the participants. The use of seven day food records and analysis with NDSR provided accurate and complete protein intake data, from foods and supplements, and therefore were also a strength in the design of this research.

Limitations of this study included self-reported dietary intake records. This could have caused inaccurate analysis of results among types and portions of foods consumed. The small sample size reduced the ability to conduct statistical analysis. Also, accelerometers had to be removed for swimming, which may have made a few of the participants' activity totals inaccurate.

Conclusion/Future Research

In conclusion, most college-age males in this sample consumed within the AMDR for protein, but 15% fell below the RDA and 15% exceeded 2g/kg of body weight. Questions remain whether or not protein intake > 2 g/kg/d in this otherwise non-athlete college male population would result in adverse health effects. Researchers in this study were surprised to find the AMDR and RDAs for this population in conflict. With the AMDR and RDA recommendations not the same, there is a question on how much protein males should be consuming and how much protein professionals should be recommending. With the incorrect information many in this population had (e.g. needing one gram per pound of body weight) and the under- and potential over-consumption of

protein observed, it is important to make sure correct nutrition information/resources are readily accessible and provided to non-athlete college males.

CHAPTER III
Extended Methods

Procedure

Physically active college males were recruited from the entrance of the Tennessee Recreational Center for Students (TRECS) and University Library as participants for the study. All participants were between the ages of 18 and 24, male, and not a member of any varsity/college sport team. There were 50 participants recruited. Recruiting occurred during a two-week time frame between the hours of 3 pm and 6 pm Monday through Friday. These days and times were chosen due to the high volume of individuals who attend the TRECS and UT Library during these hours. If interested in participating, and they met the eligibility requirements, participants were informed of the entire research process they would be involved in and signed a consent form. Participants then set up a convenient time to meet with the researcher.

At the first meeting participants completed a demographics survey, and general nutrition knowledge survey. Also, the researcher obtained height, weight, and waist circumference from the participant using a stadiometer, scales, and a tape measure (Appendix B). Finally, the researcher trained the participant on using a seven-day food record (Appendix C), and accelerometer.

Specific instructions were given to participants concerning the seven-day records. These instructions included making sure participants note the amounts of foods, brands if necessary, and quantity. This was especially important if participants used supplements. The researcher also informed participants of the difference between protein enhanced food products, such as protein bars or protein enriched cereals, and protein product supplements such as whey or creatine powders (Appendix J).

Researchers were previously trained to obtain these anthropometrics. Weight assessments followed the following standardized procedures: 1) Scale were zeroed and on a hard, flat surface, not on carpet; 3) Participants were asked to remove excess clothing, shoes, and socks prior to being weighed; 4) Participants were asked to step up onto scale fully; 5) Participants were asked to stand completely still with arms at sides and eyes looking straight ahead; 6) weight was recorded to the nearest 0.1 kg on the data collection sheet; and 7) Measurement procedures were repeated and if there was > 0.2 kg difference between measurements, they were repeated until two measurements were within 0.2 kg.

Height assessments followed standardized procedures. First, participants removed shoes. The participants were asked to step completely under the slide of the stadiometer, making sure that the participant was centered with the stadiometer and standing as straight as possible with feet together and heels, buttock, shoulder blades, and back of head completely touching the wall (or as much as possible). Next, the participants looked straight ahead and the Frankfurt Plane was verified. Participants took and held a deep breath. With the height slide resting lightly on top of the participant's head and the participant resuming normal breathing, the height was recorded to the nearest 0.1 cm by reading the height value at eye level. This measurement was repeated for accuracy. If measurement varied more than 0.2 cm from the first measurement, it was repeated a third time.

Waist circumference was measured using the following procedures. Participants adjusted shorts or pants to a level just below the top of the hip bones and the tape measure was placed around the waist at the level of the iliac crests making sure that the

tape was in a horizontal plane and not twisted. Participants were asked to exhale and the tape was gently tightened without compressing the skin. Measurements were recorded to the nearest 0.1 cm. This measurement was also repeated for accuracy. If the measurement varied more than 0.5 cm from the first measurement, it was repeated a third time.

Before the participant left the first session, a second session was scheduled. This meeting was required to be at least one week later in order for the participant to have time to wear the accelerometer, and obtain a seven-day diet and physical activity record. During this session participants returned their seven-day records and accelerometer, participated in the interview questions, and were measured by the BOD POD. Then, the researcher conducted an interview, questioning the participant about protein, protein supplements, and sources of information regarding protein (Appendix E).

In addition, participants had their body composition measured by the BOD POD in the Kinesiology Department under the supervision of Dr. Dixie Thompson. After they finished, the researcher and participant scheduled one final meeting. The final meeting was the incentive for participants because they received a report of the analysis of their food and activity record along with BOD POD data and diet recommendations.

Accelerometers

Accelerometers are a tool used to record the acceleration of the body through space. They provide researchers an objective assessment of frequency, duration, and intensity. The output gives the number of minutes spent in each of the intensity categories. These categories include, sedentary activity, light physical activity, moderate physical activity, vigorous physical activity, and moderate to vigorous physical activity.

There are samples recorded per second to make up the frequency. This number is multiplied by the interval of time over which acceleration samples are summed [33]. For this research project, a ten second interval was used. The product equals the activity count. At least three good weekdays and one good weekend day are needed in order to be compliant. A good day consists of less than three flags of greater than or equal to a 60-minute string of no activity between waking hours. Participants were instructed to wear the accelerometer on a band around the waist for seven days. The bands and accelerometers were removed when showering or in water [33].

The accelerometers were set up using the Actigraph wGT3x software. Accelerometers were plugged in to the computer with this software using a USB cord. After opening the software, the researcher was able to see when the accelerometer is fully charged. Then, the researcher initialized the accelerometer to start running one hour after the participant's first session time and stop running seven days later at the same time. After this was set, the accelerometer was removed from the USB cord and was able to be worn.

BOD POD

The BOD POD is a fiberglass unit with two chambers. The volume of the test chamber is determined by the pressure changes between the two chambers by moving a diaphragm mounted on the common wall between the chambers [34]. The participant's body volume was equal to the volume of the test chamber before subject entry less the test chamber volume with the participant inside. To avoid errors, it was recommended that testing be prior to exercise, that the participant be dry, and that the participant wear

tight fitting clothing [34]. The BOD POD estimated measures of percent fat, body volume, and body density [34].

Participants were instructed not to eat or exercise in the two hours before the test and to wear minimal, tight-fitting clothing for the actual test (this typically included wearing compression shorts - spandex/athletic type of shorts and no shirt). At the beginning of the session, after making sure an individual was properly dressed and had removed any jewelry, the instructor asked the participant to put on a swim cap. This test typically lasted about 30 seconds. The BOD POD was then opened and the researcher informed the participant that a second test will occur next in order to confirm accuracy of the first test. The second test lasted about 30 seconds as well. After assuring the results from the two tests were accurate, the participant exited the BOD POD and redressed.

Qualitative Research

Qualitative research tends to focus around a small number of respondents and number of settings [35]. This data often comes from interviews [36]. The results and data from qualitative studies are often difficult to analyze. Methods used in qualitative research include in-depth interviewing [35]. I plan to use interviewing as my methodology in receiving information about protein from participants. In-depth interviews are a qualitative approach to provide more detail about the understanding and experiences a person has concerning a topic [37]. Interviews provide a way for new theories to be developed through the understanding which is gained during the interview process [37].

Sample Size

The sample size is determined by the point of saturation [38]. This research study included a sample size of 50 participants. This size was determined by several different sources. The research from Pope et al stated that a sample size must be feasible for a single interviewer to undertake [35]. Also, Green et al recommended using a sample size representative of the population that is targeted. This study interviewed a sample size of 15 from four different populations, interviewing a total of 60 participants [38]. However, this was a larger study. In addition, an average of twenty people is recommended to be interviewed if addressing a fairly specific research topic [38]. Depth and duration are two factors which must be considered with feasibility as well [37].

Convenience sampling was also used. This enabled researchers to find potential participants in a generalized location for similar interests [39]. The sample for the study was obtained from the TRECS and library on University of Tennessee's campus. In order to prevent bias when asking potential participants, every male entering or leaving the facilities will be asked if interested in participating.

Interviews

The interviews were held in a University of Tennessee public location chosen by the participant in order to make him feel most comfortable [19]. The participant had the options of the TRECS or Jesse Harris Building. The questions asked in the interview were open-ended. This allowed the participant to feel comfortable responding freely and with as much information as he wished [35]. After the initial question, these questions focused on information the participants seems to leave out [39]. A list of initial questions and probing questions (Appendix E) were used. Probing questions are an active listening

method for encouraging elaboration [39]. This helped the participant fully express how he felt regarding the question or topic. Interviewing is a highly beneficial tool used in qualitative research. Limitations include there only being access to what the participants are expressing, not what they actually do [38]. However, this was at least partially improved through the seven-day physical activity record, seven-day diet record, and accelerometer data recorded by the participant.

Analysis

Data and analysis is a vital part of the qualitative research process. After obtaining information from the interviews, the researcher must accurately transcribe the data. The analytical process of qualitative research often begins during data collection [35]. When collecting data through interviews, the researcher often begins to analyze the information being expressed by the participant. The use of computer assisted qualitative data analysis software packages has become prevalent [35]. These software packages aid in the analysis of unstructured textual data. There are several options when it comes to choosing which software to use. After obtaining data, I transcribed from the interviews through Inqscribe. This occurred with teams of two. One person did the initial transcription, and a second person verified for accuracy. Next, I generated a priori code list and initiated a reflexivity journal. Then I made sure to be familiarized with the data and expanded the initial codes. I used inter/intra rater reliability training where I created two sample documents, and showed researchers how the coding worked. The researchers independently coded the documents and made sure there was 80 percent accuracy between the two. The coding information was based on themes. Interpretation included describing theme frequencies and relationships between different themes.

In addition, I completed quantitative data frequencies. These outcomes included data from the anthropometrics, BOD POD, protein intake, and accelerometer data.

Changes Between Proposed Methods and Actual Methods

There were a few changes in methods that occurred over the process of the study. First, initially participants were to answer two IPAQ questions that would determine the group in which they would be included. The two groups would include highly physically active and moderately physically active college males and there would be thirty participants per group. However, it was decided to include college males with all levels of physical activity to get a more diverse population sample. Since this was decided, the sample size was decreased from a sample size of 30 participants from each group to a total of 50 participants. Next, I had planned to use ATLAS for the coding of this research project data. However, I ended up coding without a computer analysis program. Finally, I had planned to use analysis with T-tests to compare the outcomes between the two groups, but I ended up using frequency reports only due to the small sample size.

LIST OF REFERENCES

1. Poortmans, J.R., et al., *Protein turnover, amino acid requirements and recommendations for athletes and active populations*. Braz J Med Biol Res, 2012. **45**(10): p. 875-90.
2. Guillet, C., Y. Boirie, and S. Walrand, *An integrative approach to in-vivo protein synthesis measurement: from whole tissue to specific proteins*. Curr Opin Clin Nutr Metab Care, 2004. **7**(5): p. 531-8.
3. Lentine, K. and E.M. Wrone, *New insights into protein intake and progression of renal disease*. Curr Opin Nephrol Hypertens, 2004. **13**(3): p. 333-6.
4. *Protein and amino acid requirements in human nutrition*. World Health Organ Tech Rep Ser, 2007(935): p. 1-265, back cover.
5. Rodriguez, N.R., N.M. Di Marco, and S. Langley, *American College of Sports Medicine position stand. Nutrition and athletic performance*. Med Sci Sports Exerc, 2009. **41**(3): p. 709-31.
6. Fulgoni, V.L., 3rd, *Current protein intake in America: analysis of the National Health and Nutrition Examination Survey, 2003-2004*. Am J Clin Nutr, 2008. **87**(5): p. 1554S-1557S.
7. Watford, M. and G. Wu, *Protein*. Adv Nutr, 2011. **2**(1): p. 62-3.
8. Goldberg, A.L., C. Jablecki, and J.B. Li, *Trophic functions of the neuron. 3. Mechanisms of neurotrophic interactions. Effects of use and disuse on amino acid transport and protein turnover in muscle*. Ann N Y Acad Sci, 1974. **228**(0): p. 190-201.
9. Martin, W.F., L.E. Armstrong, and N.R. Rodriguez, *Dietary protein intake and renal function*. Nutr Metab (Lond), 2005. **2**: p. 25.

10. CDC. *Protect your kidneys: Control diabetes and blood pressure*. 2012 [cited 2013 February 18]; Available from: <http://www.cdc.gov/Features/WorldKidneyDay/>.
11. Parks, J.H. and F.L. Coe, *Evidence for durable kidney stone prevention over several decades*. *BJU Int*, 2009. **103**(9): p. 1238-46.
12. Calfee, R. and P. Fadale, *Popular ergogenic drugs and supplements in young athletes*. *Pediatrics*, 2006. **117**(3): p. e577-89.
13. Morrison, L.J., F. Gizis, and B. Shorter, *Prevalent use of dietary supplements among people who exercise at a commercial gym*. *Int J Sport Nutr Exerc Metab*, 2004. **14**(4): p. 481-92.
14. Fox, E.A., et al., *Perceived protein needs and measured protein intake in collegiate male athletes: an observational study*. *J Int Soc Sports Nutr*, 2011. **8**: p. 9.
15. Heaney, S., et al., *Nutrition knowledge in athletes: a systematic review*. *Int J Sport Nutr Exerc Metab*, 2011. **21**(3): p. 248-61.
16. Froiland, K., et al., *Nutritional supplement use among college athletes and their sources of information*. *Int J Sport Nutr Exerc Metab*, 2004. **14**(1): p. 104-20.
17. Torres-McGehee, T.M., et al., *Sports nutrition knowledge among collegiate athletes, coaches, athletic trainers, and strength and conditioning specialists*. *J Athl Train*, 2012. **47**(2): p. 205-11.
18. Bianco, A., et al., *Protein supplementation in strength and conditioning adepts: knowledge, dietary behavior and practice in Palermo, Italy*. *J Int Soc Sports Nutr*, 2011. **8**(1): p. 25.

19. Jacobson, B.H., C. Sobonya, and J. Ransone, *Nutrition practices and knowledge of college varsity athletes: a follow-up*. J Strength Cond Res, 2001. **15**(1): p. 63-8.
20. Perkin, J.E., et al., *Prevalence of nonvitamin, nonmineral supplement usage among university students*. J Am Diet Assoc, 2002. **102**(3): p. 412-4.
21. Lyle, B.J., et al., *Supplement users differ from nonusers in demographic, lifestyle, dietary and health characteristics*. J Nutr, 1998. **128**(12): p. 2355-62.
22. Otten, J., Hellwig J., Meyers, L., *Dietary Reference Intakes: The Essential Guide to Nutrient Requirements*. 2006.
23. Park, M.J., et al., *The health status of young adults in the United States*. J Adolesc Health, 2006. **39**(3): p. 305-17.
24. Utah, U.o. *Body Composition Information*. 2008 [cited 2014; Available from: http://www.health.utah.edu/peak/services/health_fitness_testing/body_composition_information.html].
25. Small, M., et al., *Changes in eating and physical activity behaviors across seven semesters of college: living on or off campus matters*. Health Educ Behav, 2013. **40**(4): p. 435-41.
26. Strong, K.A., et al., *Weight gain prevention: identifying theory-based targets for health behavior change in young adults*. J Am Diet Assoc, 2008. **108**(10): p. 1708-1715.
27. Greene, G.W., et al., *Identifying clusters of college students at elevated health risk based on eating and exercise behaviors and psychosocial determinants of body weight*. J Am Diet Assoc, 2011. **111**(3): p. 394-400.

28. *Physical Activity Guidelines for Americans*. 2008 [cited 2014; Available from: <http://www.health.gov/paguidelines/guidelines/chapter1.aspx>.
29. *American College Health Association: National College Health Assessment*, 2012.
30. Downs, A., et al., *Accelerometer-Measured Versus Self-reported Physical Activity in College Students: Implications for Research and Practice*. *J Am Coll Health*, 2013.
31. Carpenter, C.L., et al., *Body fat and body-mass index among a multiethnic sample of college-age men and women*. *J Obes*, 2013. **2013**: p. 790654.
32. Gropper, S.S., et al., *Changes in body weight, composition, and shape: a 4-year study of college students*. *Appl Physiol Nutr Metab*, 2012. **37**(6): p. 1118-23.
33. Chaix, B., et al., *GPS tracking in neighborhood and health studies: A step forward for environmental exposure assessment, a step backward for causal inference?* *Health Place*, 2013. **21C**: p. 46-51.
34. Fields, D.A., P.B. Higgins, and G.R. Hunter, *Assessment of body composition by air-displacement plethysmography: influence of body temperature and moisture*. *Dyn Med*, 2004. **3**(1): p. 3.
35. *Qualitative Research in Health Care*. third ed. 2006: Blackwell Publishing Limited. 156.
36. Patton, M.Q., *Qualitative Research & Evaluation Methods*. 3rd Edition ed. 2002: Sage Publications Ltd. . 598.
37. Liamputtong, P.E., Douglas, *Qualitative Research Methods*. 2nd ed. 2005: Oxford University Press. 410.

38. Green, J.T., Nicki, *Qualitative Methods for Health Research*. 2004: SAGE Publications Ltd. 262.
39. *The Sage Handbook of Qualitative Methods in Health Research*. 2010: SAGE Publications Ltd.

APPENDICES

What are YOUR benefits from participating in this project??

- Full 7-day diet analysis (protein, carbohydrates, fat, vitamins, minerals, etc.) estimated value: \$80
- BOD POD results (body composition) estimated value: \$75
- Physical activity analysis- estimated value: \$80
- Personalized nutrition and physical activity information- estimated value: \$168

Estimated value of your benefits: \$403

Your cost: FREE

APPENDIX B

Anthropometric Sheet

ID Number	Height	Weight	Waist

APPENDIX C

7-Day Food Record Instructions

1. Write down all drinks, candies and snacks you consume. Write any supplements on the log as if they were food. It would be best to fill the log out right after you eat.
2. Be sure to include all “hidden foods” and toppings.
 - a. *Ex: milk with cereal or coffee (note whether whole, 2%, skim). Sugar added to cereal, coffee, etc. Spreads on toast. Oils added when frying or baking foods. Salt or other spices.*
3. **Time column:** requires that you write the exact time you had your food.
4. **Food/beverage column:** record everything you eat and drink (i.e.: meals, snacks, toppings, drinks). Include brand names of foods, flavors, low-fat, and no-fat specifics. If you are eating a new product, bring the label in, so we re able to match your foods up precisely. **Amount:** try to be exact as possible. Use any form of measurement necessary.
 - a. *Ex: grams, oz., cup, slice, piece of fruit, inches of diameter, fl. Oz., tablespoon, teaspoon, leaf of lettuces, ½ inch slice of tomato.*
5. **How it was prepared:** please specify as to if the food was home made, cooked, uncooked, cooked with butter and if so how much, etc.
 - a. *Ex: if you write ½ cup of rice, specify whether that’s ½ cup cooked rice or uncooked rice, and if it is cooked did you add any salt or butter.*

APPENDIX D

Diet Record Date _____

	Time	Foods and amounts (Be specific, include EVERYTHING)	Preparation methods	Beverages	Condiments	Anything Else?
Breakfast						
Lunch						
Dinner						
Snacks (Be sure to list all snacks and different times						

APPENDIX E

Tell me about protein.

- How much protein do you think you should be consuming per day?
 - How much do you think you usually consume?
 - Where do you get most of your protein?
 - What foods do you usually eat to get protein?
 - How much do you try to eat of those foods?
 - Where have you gotten your information on protein?
 - Magazines?
 - Internet?
 - Other People?
 - What information have you gotten on protein from those sources?
 - What differences do you see if you do get the amount of protein you typically consume?
2. There are protein supplements like whey powder and then there are protein enhanced food products like protein rich cereal, water, and bars. First we are going to talk about protein supplements. Tell me about protein supplements.
- Are you taking any protein supplements?
 - How often are you taking protein supplements?
 - What type and how many protein supplement products do you use?
 - Why did you choose this (brand/type of) protein supplement?
 - What other protein supplements have you tried?
 - Where do you get protein supplements?
 - Where have you gotten your information about protein supplements?
 - What made you decide to use protein supplements?
3. Now I will ask you some questions about protein enhanced food products like protein rich cereal, water, and bars. Tell me about protein enhanced food products.
- Are you taking any protein enhanced food products?
 - How often are you taking protein enhanced food products?
 - What type and how many protein enhanced food products are you using?
 - Why did you choose this brand/type of protein enhanced food products?
 - What other protein enhanced food products have you tried?
 - Where do you get protein enhanced food products?
 - Where have you gotten your information about protein enhanced food products?
 - What made you decide to use protein enhanced food products?

APPENDIX F

Sample Training Interview 1

R: Tell me about protein

P: Protein has amino acids and is in meats and nuts and dairy I think

R: ok, how much protein do you think you should be consuming on a daily basis?

P: I aim for 185 grams per day.

R: ok, Do you usually get about that much or more, less?

P: usually about that, maybe a little less

R: Where do you get most of your protein?

P: grilled chicken and my protein shakes

R: Where have you gotten your information on protein?

P: Other people at the gym that work out, and body-building.com

R: anything specific come to mind that you have found out from those sources about protein?

P: which supplements are recommended

R: Are you taking any protein supplements?

P: Yes

R: what type?

P: whey protein

R: how often are you taking that?

P: 4-5 times per week

R: Do you take it on days when you don't work out?

P: No, just when I work out

R: Where have you gotten your information on protein supplements?

P: Men's health magazine and my roommate

R: Why did you start taking protein supplements?

P: I want to bulk up.

R: Do you ever eat any protein enhanced food products?

P: Not really, once in a while I will get a cliff bar from the store.

R: ok

P: that is mainly when I need a little extra to eat, it doesn't replace my protein shake.

R: Where have you gotten your information on protein enhanced food products?

P: I just read the nutrition facts.

APPENDIX G

Training Sample Interview 2

R: Tell me about protein

P: Protein has amino acids and is in meats and nuts and dairy I think

R: ok, how much protein do you think you should be consuming on a daily basis?

P: I aim for 185 grams per day.

R: ok, Do you usually get about that much or more, less?

P: usually about that, maybe a little less

R: Where do you get most of your protein?

P: grilled chicken and my protein shakes

R: Where have you gotten your information on protein?

P: Other people at the gym that work out, and body-building.com

R: anything specific come to mind that you have found out from those sources about protein?

P: which supplements are recommended

R: Are you taking any protein supplements?

P: Yes

R: what type?

P: whey protein

R: how often are you taking that?

P: 4-5 times per week

R: Do you take it on days when you don't work out?

P: No, just when I work out

R: Where have you gotten your information on protein supplements?

P: Men's health magazine and my roommate

R: Why did you start taking protein supplements?

P: I want to bulk up.

R: Do you ever eat any protein enhanced food products?

P: Not really, once in a while I will get a cliff bar from the store.

R: ok

P: that is mainly when I need a little extra to eat, it doesn't replace my protein shake.

R: Where have you gotten your information on protein enhanced food products?

P: I just read the nutrition facts.

APPENDIX H

Code Book

What do you think about protein

1. Build Muscles: they think they need protein to build muscles
2. Bulking up: they think they need protein to bulk up
3. Sore: If they don't get enough they will have muscle soreness
4. Portion size: How much protein they think they need at a meal
74. Facts: Tells a true fact about protein e.g. it is a nutrient, necessary to the human diet
75. Sources: Tells best sources of protein.
76. Fat: To lose fat you need to avoid carbs and eat protein instead
77. Wrong: Tells a untrue fact about protein
97. Helps your body grow

Do they think they are getting enough protein

5. Getting More: They think they are getting more protein than they need
6. Getting Less: They think they are getting less protein than they need
107. They have no clue
131. They think they are getting an adequate amount

Where do you get your protein?

7. Meat: They get their protein from meat
8. Chicken: They get their protein from chicken
9. Tuna: They get their protein from tuna
10. Steak: They get their protein from steak
11. PShake: They get their protein from shakes
12. Protein Supplements: PSupp
13. Gold Standard Whey: GSW
14. Muscle Milk: MM
15. Casein Protein:
16. Cliff Bars:
17. Syntha-6: S6
18. Whey
78. Dairy
79. Smoothie King
80. Specific Other: a specific brand or type not listed above
94. Optimum Nutrition
95. Muscle Farm
98. Eggs
99. Protein Bars (in general)

- 100. Nuts
- 104. Creatine
- 108. Beans
- 122. Fish
- 123. Beef
- 126. Turkey

How much protein do you think you need?

- 19. GPPound: They think they need a gram per pound of body weight
- 81. Specific: A specific grams of protein is mentioned.
- 120. I don't know
- 121. You shouldn't over do it/not too much meat
- 128. Twice your body weight

Do you use protein supplements?

- 82. Yes
- 83. No

When do you use supplements?

- 20. AWorkoutsS: After workouts they use protein supplements
- 21. BWorkoutsS: Before they workout they use protein supplements
- 22. AWorkoutF: After workouts they eat protein
- 23. BWorkoutF: Before workouts they eat protein
- 24. Workout days: Just the days you work out
- 84. Once a day
- 124. When I am low on protein

How much protein supplement do you use?

- 25. #S: They use one or two scoops when they use protein supplements

Where do you get your information about protein in general?

- 26. Internet:
- 27. Word of mouth:
- 28. Friends/significant other
- 29. Bodybuilding.com:
- 30. Coaches: Coaches
- 31. Men's Health Magazine: MHM
- 32. Information from classes: class
- 33. No idea/ I don't know- does not know
- 85. Family:
- 86. Common sense
- 87. Other magazine(s)
- 88. Other website(s)
- 96. Learning more about weight lifting/working out/being healthy

- 129. Reading labels
- 134. Employee's at health stores

Where do you get your information about protein supplements?

- 34. Internet: Internet
- 35. Word of mouth:
- 36. Friends
- 37. Bodybuilding.com:
- 38. Coaches: Coaches
- 39. Men's Health Magazine: MHM
- 40. Information from classes: class
- 41. No idea/ I don't know- does not know
 - 116. Vitamin shoppe
 - 124. Vitamin World/Employee's
 - 127. GNC/GNC employee's

Where do you get your information about protein enhanced foods?

- 42. Internet: Internet
- 43. Word of mouth:
- 44. Friends
- 45. Bodybuilding.com:
- 46. Coaches: Coaches
- 47. Men's Health Magazine: MHM
- 48. Information from classes: class
- 49. No idea/ I don't know- does not know
 - 105. Back of the box/ on the label

What information have you gotten about protein

- 50. Spread: It needs to be spread out throughout the day
- 51. EP: If you get too much protein you excrete it.
 - 101. Protein provides energy
 - 109. Your body can only digest a certain amount then you have to get it through supplements
 - 110. Good when trying to add weight
 - 130. How much protein you need, when to get it

What do you think happens if you don't get enough protein?

- 52. Losing Muscle:
- 53. Getting Smaller:
- 54. More sore:
 - 89. Tired:
 - 90. Quickly: Don't get results at the gym as quickly
 - 102. Feel weaker
 - 111. Less energy

What do you think happens when you don't consistently take your protein?

- 55. Losing Muscle:
- 56. Getting Smaller:
- 57. More sore:
- 58. Not filling: They don't feel full

Are you taking protein supplements?

- 112. Yes
- 113. No

Where do you buy your protein supplements?

- 59. Amazon:
- 60. Walmart:
- 61. GNC:
- 62. Bodybuilding.com:
- 94. Kroger

Why did you start using protein supplements or why do you use protein supplements?

- 63. Coaches advice
- 64. To bulk up/add weight
- 65. Friends did it
- 91. Curb hunger
- 92. To burn fat
- 93. Unhealthy diet: As transitioned to college life, started having a less healthy lifestyle- as a part of trying to get healthy started using protein supplements.
- 103. To help rebuild
- 114. Stronger: To get stronger
- 125. To relieve the pain after working out

Why did you stop using protein?

- 115. Stopped playing sports/exercising consistently/didn't need to be as heavy of a weight.

How do you choose which protein supplements to use?

- 66. Taste: taste
- 67. Read information : Read
- 68. No information, just buy product: No info

Have you taken protein before?

- 69. Not taking protein now, but took protein in past: Past Protein
- 70. Not taking protein regularly

Are you taking/eating protein enhanced food products?

- 132. Yes
- 133. No

Why do you use protein enhanced foods?

71. Meal Replacement: Replacement

72. Not enough food/low energy intake: low intake

117. To get protein and not have to eat a shake

When using protein enhanced foods, do you also use a shake on those days too?

118. No, just alternate

Is there anything you would like to add about protein?

106. Protein is awesome

119. I love protein

73. Other

APPENDIX I

Sample Emails

Sample check-in email on day four:

Hi,

I just wanted to check in and make sure everything was going well with your 7 day records and accelerometer. Please let me know if you have any questions.


Thanks!

Sample email on day seven:

Hello!












I hope you have had a good week. We will be meeting tomorrow at 3pm for your interview and BOD POD assessment. Please do not eat or exercise at least 2 hours before the test. You need to wear minimal, tight-fitting clothing for the actual test (typically men will wear compression shorts - spandex/athletic type of shorts and no shirt). The Bod Pod is in room 319 in the Health, Phys. Ed., and Rec. Bldg. You can wear those shorts underneath your clothing or there will be a place for you to change. Also, remember to bring back your dietary records and accelerometer. (You can take off the accelerometer today at 4pm). Thanks so much and I will see you tomorrow!





































APPENDIX J



Portion Size Pocket Guide

Portion size you can visualize: an on-the-go guide to smarter eating.

Folding Instructions			Visualization Key			
 Fold in Half	 Fold in Half Again	 Fold One Last Time	 Insert into Pocket	 Computer Mouse	 Deck of Cards	 Baseball
 Tennis Ball	 Golf Ball	 Nine-Volt Square Battery	 Small Postage Stamp			

Fruits	  1 oz dried fruit	  1 cup strawberries	  1 cup blueberries	  1 cup broccoli	  1 cup green beans	  1 medium baked potato	Veggies
Dairy	  1 & 1/2 oz cheese	  1 cup milk	  1/2 cup frozen yogurt	  3 oz cooked chicken	  2 tbsp peanut butter	  1/2 cup cooked beans	Meat, Nuts and Beans
Fats and Oils	  1 tsp butter	  1 tsp vegetable or olive oil	  1 tbsp salad dressing	  1 cup cold cereal	  1/2 cup cooked rice	  1 whole grain muffin	Grains

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VITA

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