

The Assessment of Nutrition Knowledge in ROTC Cadets

Original Research

Lara Boyum¹, Samantha Kostelnik¹, Corbit Franks¹, Thomas Andre¹, Hyun-Woo (David) Joung¹, Melinda W. Valliant¹

¹The University of Mississippi, Oxford, MS/United States of America

Open Access



Published: February 13, 2024



Copyright, 2024 by the authors. Published by Pinnacle Science and the work is licensed under the Creative Commons Attribution 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>

Journal of Exercise and Nutrition: 2024, Volume 7 (Issue 1): 5

Abstract

Introduction: The purpose of this study was to measure the nutrition knowledge of Army ROTC cadets before and after the implementation of nutrition education sessions presented by a registered dietitian nutritionist (RDN), while observing the effectiveness of the nutrition intervention on this population.

Methods: Army ROTC cadets (n=33; 19±1 years old) from a southeastern university participated in a nine-week study in which they completed a nutrition knowledge survey pre- and post-implementation of six nutrition education sessions. General nutrition knowledge (GNK) and sports nutrition knowledge (SNK) were measured via the Abridged Nutrition for Sport Knowledge Questionnaire (ANSKQ).

Results: General, sports, and total nutrition knowledge (TNK) improved significantly between pre-survey and post-survey scores (GNK $p < .001$; SNK $p < .01$; TNK $p < .001$). Independent samples *t*-test showed large *t*-score values (GNK $t = -3.559$; SNK $t = -2.794$; TNK $t = -3.776$), indicating a strong difference between the three groups. Army ROTC cadet ANSKQ scores significantly improved GNK from adequate to good, SNK from poor to adequate, and TNK from poor to adequate.

Conclusions: The results of this study indicate nutrition knowledge is poor in ROTC cadets but may improve from a nutrition education intervention conducted by an RDN.

Key Words: Army, Abridged Nutrition for Sport Knowledge Questionnaire (ANSKQ), registered dietitian nutritionist (RDN)

Corresponding authors: Lara Boyum, lboyum@go.olemiss.edu; Melinda W. Valliant, valliant@olemiss.edu

Introduction

The United States Military creates Army officers through various programs, the largest being Reserve Officers' Training Corps (ROTC), which contributes to over 70% of the total military officer corps.¹ Every soldier is expected to display preparation to fight and win in short notice anywhere in the world; this form of readiness is determined by physical fitness, body composition, and appearance.² Similar to a high-performance athlete, military members are classified as tactical athletes, defined by Wise et al.³ as individuals who perform service occupations that have significant physical fitness and performance requirements with an additional daily exposure to possible life-threatening situations. ROTC cadets are a hybrid of college student and tactical athlete, which produces unique challenges for the cadet's education, military skills, physical fitness, and body composition.

The standards of military readiness and appearance for ROTC cadets are unfortunately not well supported with nutrition resources for all ROTC programs. A food and nutrition expert, known as a registered dietitian nutrition (RDN), is typically not funded to oversee or educate the hundreds of enrolled cadets in a university program.⁴ Each

ROTC program is encouraged to include nutrition education in their military curriculum; although, despite this recommendation, ROTC cadets have been reported to have suboptimal nutrition knowledge, intake, attitudes, and behaviors related to nutrition.⁵⁻⁸ Research reports ROTC cadets are at an increased risk of engaging in disordered eating behaviors to manage weight and manipulate body composition, similar to the increased risk of elite athletes.⁶ Additionally, low energy availability is also related to low bone mineral density, and musculoskeletal injuries are a very common injury reported in service members and ROTC cadets.⁹⁻¹² Nutrition knowledge is one of the many influential factors of dietary habits that effect overall health, physical performance, and body composition,¹³⁻¹⁷ and a nutrient dense diet adequate in calories is essential to support basic bodily functions, assist the demands of increased physical activity, and reduce the risk of injury.¹⁸ Experiencing similar environmental barriers any college athlete may face, the ROTC cadet may be living independently for the first time with the responsibility to buy, select, or prepare healthy meals. This is in addition to managing school and military responsibilities and may contribute to the potential stress a cadet feels to perform or meet body composition standards.⁴ Poor nutrition knowledge and behaviors may negatively enhance these barriers and poorly affect the individual's health and performance.

The use of interventions such as nutrition education presentations or interactive resources have been found to be effective in increasing nutrition knowledge and improving dietary habits in college students.^{19,20} Nutrition knowledge also significantly improved in college athletes after the intervention of weekly nutrition education sessions,^{21,22} with one study specifically utilizing an RDN.²² Increasing nutrition knowledge and the practical application to daily dietary habits is essential for a tactical athlete's military readiness and quality of life. Therefore, the purpose of the current investigation was to measure the level of general nutrition knowledge (GNK), sports nutrition knowledge (SNK), and total nutrition knowledge (TNK) of the ROTC cadets and observe the effectiveness of the nutrition education series on nutrition knowledge. We hypothesized the nutrition education sessions presented by an RDN would significantly increase overall nutrition knowledge scores from baseline.

Scientific Methods

The research team used a longitudinal survey design with the implementation of a pre- and post-survey; specifically, the Abridged Nutrition for Sport Knowledge Questionnaire (ANSKQ) was distributed to evaluate nutrition knowledge before and after the nutrition education series intervention.

Participants

A convenience sample of 46 Army ROTC cadets (19±1 years old) from a southeastern university were recruited for this study. A recruitment script was read in the first session to educate about possible advantages and disadvantages of participating in the research study. Consent forms were completed by cadets before the distribution of the participant characteristics survey (Appendix A) and the ANSKQ survey (Appendix B). This study was approved by the University Institutional Review Board as exempt 45 CFR 46.101(b)(#2).

Tools

The validated 35-item ANSKQ was utilized to measure both general nutrition knowledge (11-item) and sports nutrition knowledge (24-item).²³ It has a higher completion rate and is more time efficient, with half the completion time (12 minutes) compared to the original 89-item Nutrition for Sports Knowledge Questionnaire (NSKQ) (25 minutes)²³ and was chosen because it is commonly used in research with recreational and elite athletes^{23,24} but has not been conducted in tactical athletes to our knowledge. The characteristic survey utilized the Likert scale to measure self-assessed nutrition knowledge prior to the implementation of the nutrition education series. This five-point scale is commonly used in medical educational research, in which respondents pick the number on the scale to which they agree or disagree with a statement.²⁵ In this study, instead of a statement, a question was asked about self-perceived nutrition knowledge for both general nutrition and sports nutrition.

Protocol

Over the course of nine weeks, seven in-person sessions were held at the beginning of cadet lab time. The first session included the recruitment script and completion of consent forms, characteristics survey, and pre-survey via paper copies. The following six sessions were comprised of different nutrition topics and completion of the post-survey. The education material was made by the primary investigator, also an RDN, and focused on six basic nutrition education topics of the ANSKQ survey: weight management, macronutrients, micronutrients, sports nutrition, supplements, and alcohol.²⁶ Weight management information was included in the macronutrient session, and hydration and electrolytes were an additional session.

Material was presented via Canva Pro in a lecture style format with interactive learning techniques implemented throughout each session to enhance knowledge retention. The macronutrients session included optional equations for cadets to calculate individual basal metabolic rate and specific macronutrients needs, as well as true and false questions and open-ended questions to increase engagement. Tips on how to incorporate fruits and vegetables into diet were included in the micronutrient's session, and supplements such as greens powders and vitamin C were reviewed as a group. Additional resources were provided such as information about food pantries and farmers markets in proximity to the university. After the basic education for hydration and electrolytes, cadets were shown pictures of beverages and asked to identify which were hydrating or dehydrating. Nutrition labels of sports drinks were also compared to practice reading product labels and identifying electrolytes and their amounts. At the end of this session, a 13 question Kahoot game was created and utilized to review information on topics already covered. The performance nutrition session utilized information from Gatorade Sports Science Institute (GSSI) and the Collegiate and Professional Sports Dietetics Association (CPSDA) and compared to the U.S. Department of Agriculture (USDA) MyPlate recommendations. During the session, cadets were asked to decide between two meal options before a workout and provide reasoning for their selection before the correct answer was revealed. True or false questions were utilized at the end of the supplement session, and nutrition tips were provided at the end of the alcohol session. Education sessions lasted for approximately 30 minutes with additional time allowed for open group questions at the end. Individual questions from cadets outside of sessions were not encouraged throughout the duration of the study, in order to provide the same nutrition information to all participants. Each education session was scheduled to occur weekly, with exceptions to ROTC schedule conflicts. The post-survey was given at the completion of the final nutrition session; see Appendix C for full timeline of nutrition education sessions.

Statistical Analysis

All survey data was transferred from the original paper copies to Microsoft Excel spreadsheets and peer-reviewed for human error before being entered into Statistical Package for Social Sciences (SPSS) analysis software, version 29.0. In the instance an answer was marked as "not sure," left blank, or multiple answers were chosen, it was categorized as incorrect and was not awarded points for ease of comparing incorrect and correct answers. This aligns with the most common scoring system, which is to award a point for each time the correct answer is selected.²⁷ Negative point penalization was not used when grading data.

Descriptive statistics were used to summarize participant characteristic data. Independent samples *t*-test was conducted to compare the mean scores of pre- and post-survey scores. Cohen's *d* was the standardizer used to measure the effect size between the pre- and post-survey averages. Scores were categorized into four nutrition knowledge categories: poor (0%-49%), adequate (50%-65%), good (66%-75%), and excellent (>75%) for further comparison.²³ Each question (Q) was categorized as GNK or SNK and analyzed individually via mean comparison of pre- and post-survey scores. Data are reported as mean±standard deviations and significance was set at $p \leq .05$.

Results

A total of 46 cadets completed the pre-survey and 33 cadets completed the post-survey; resulting in a 72% completion rate. Participant dropout was suggested by ROTC leadership as cadet's dropping out of the ROTC program or excused absence from class on the day the post-survey was given. The sample was comprised of underclassmen with a reported average age of 19±1 years old.

One participant left the characteristics survey blank, but the other 45 participants filled it out and majority reported their age, year in college, prevalence of previous nutrition education, and self-assessment of current general and sports nutrition knowledge (Table 1). Of the 14 participants that answered "Yes" to having received previous nutrition education prior to the study, the open-ended answers specified this background knowledge came from high school health class, high school football and wrestling teams, strength and wellness coaches, fathers, sports medicine facilities, personal trainers and the military. The average rating of self-perceived general nutrition knowledge was 3.2 on the 5-point Likert scale, compared to the lower self-perceived sports nutrition knowledge average of 2.8.

Total Nutrition Knowledge

ROTC cadets scored highest on the GNK questions compared to the SNK questions (Table 2). All three categories of nutrition knowledge reported statistically significant increases between pre- and post-survey scores (Table 3). Using predetermined classifications of nutrition knowledge²⁸ to compare pre- and post-survey data following the education sessions, GNK significantly increased from adequate to good, SNK significantly increased from poor to adequate, and TNK significantly increased from poor to adequate (Table 3 and Graphic 1).

Table 1: Descriptive Statistics of Sample

Participant Characteristics		n	%
Average Age (19±1 years)		41	
Year in College			
	Freshman	21	47%
	Sophomore	24	53%
Previous Nutrition Education			
	Yes	14	31%
	No	31	69%
GNK ^a (Likert Scale)			
	1-Not knowledgeable at all	-	-
	2-Slightly knowledgeable	11	24%
	3-Not sure (Neutral)	13	29%
	4-Somewhat knowledgeable	21	47%
	5-Extremely knowledgeable	-	-
SNK ^b (Likert Scale)			
	1-Not knowledgeable at all	5	11%
	2-Slightly knowledgeable	14	31%
	3-Not sure (Neutral)	12	27%
	4-Somewhat knowledgeable	14	31%
	5-Extremely knowledgeable	-	-

Note: ^aGNK = general nutrition knowledge; ^bSNK = sports nutrition knowledge

Table 2: Overall Nutrition Knowledge Scores

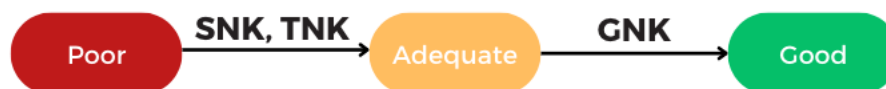
Section	Total Score % (M±SD)	Minimum Score %	Maximum Score %
GNK ^a	62±16	18	91
SNK ^b	48±13	17	79
TNK ^c	52±12	23	80

Note: ^aGNK = general nutrition knowledge; ^bSNK = sports nutrition knowledge; ^cTNK = total nutrition knowledge

Table 3: Independent Samples *t*-test of Nutrition Knowledge Scores

Section	Avg. Pre-Survey (%)	Avg. Post-Survey (%)	<i>t</i>	<i>p</i> -value	Cohen's <i>d</i>
GNK ^a	57	69	-3.559	< .001	1.684
SNK ^b	45	52	-2.794	< .01	2.949
TNK ^c	48	58	-3.776	< .001	3.779

Note: ^aGNK = general nutrition knowledge; ^bSNK = sports nutrition knowledge; ^cTNK = total nutrition knowledge

Graphic 1: Improvement of Nutrition Knowledge Categories

Note: GNK = general nutrition knowledge; SNK = sports nutrition knowledge; TNK = total nutrition knowledge

General Nutrition Knowledge

Of the 11 GNK questions, 82% improved from pre- to post-survey, ranging from a 2-45% individual question improvement on topics ranging from calorie intake, body fat, macronutrients, micronutrients, and alcohol (Table 4). The second alcohol-related question (11: Q11) had the largest increase in the GNK section between pre- and post-survey scores, demonstrating increased knowledge about the definition of binge drinking. The second highest increase in GNK was by 35% seen in Q6, demonstrating knowledge about the body's limited ability to utilize protein for muscle protein synthesis. There was a slight decrease in survey scores in Q4 and Q5. These questions topics were specific to the high or low content of dietary fat in a food item. Additionally, one of the lowest scored questions (Q8) demonstrates many participants believed thiamin (vitamin B1) is needed to take oxygen to the muscle.

Table 4: GNK^a Individual Question Mean Comparison

Section	Question	Pre-Survey Score % (M±SD)	Post Survey Score % (M±SD)	Knowledge Difference (%)
GNK	Q1	54±50	61±50	6
	Q2	76±43	85±36	9
	Q3	80±40	88±33	7
	Q4	57±50	52±51	-5
	Q5	70±47	61±50	-9
	Q6	43±50	79±42	35
	Q7	59±50	76±44	17
	Q8	7±25	18±39	12
	Q9	35±48	52±51	17
	Q10	98±15	100±0	2
	Q11	46±50	91±29	45

Note: ^aGNK = general nutrition knowledge

Sports Nutrition Knowledge

Of the 24 SNK questions, 83% of survey answers increased by 2-29% when comparing pre- and post-survey scores (Table 5). These questions are specific to macronutrient and hydration needs for athletes before, during, and after exercise, and supplement knowledge. The largest increases measured in sports nutrition questions were about daily protein needs for 100 kg athlete (Q21), carbohydrate intake during exercise to stabilize blood sugar levels (Q29), and the banned use of testosterone by the World Anti-Doping Agency (WADA) (Q35). Optimal calcium intake for adolescent and young adult athletes (Q22) and purposeful hydration for an athlete (Q25) showed no difference in pre- and post-survey scores. The calcium intake question was addressed in the nutrition education sessions and remained consistent between pre- and post-survey scores. All participants incorrectly answered Q25 in both the pre- and post-survey, with majority selecting the answer “All of the above;” believing water should be drank in order to keep plasma volume stable, stop dry mouth, and allow proper sweating.

Five SNK questions decreased when comparing average pre- and post-survey scores. The largest decreases were seen in questions specific to food items and amounts for carbohydrate and protein intake post-workout for optimal recovery in athletes (Q12 and Q15) and hydration for athletes (Q26). The other two decreases reported in Q31 and Q13 were about macronutrient amounts for an athlete post-exercise, with Q13 additionally asking about specific portion sizes of food. Three of the five questions with decreasing score differences asked about specific portion size of food (e.g., Q15; “Do you think 1 Cup Baked Beans has enough protein to promote muscle growth after a bout of resistance exercise?”).

Table 5: SNK^a Individual Question Mean Comparison

Section	Question	Pre-Survey Score % (M±SD)	Post Survey Score % (M±SD)	Knowledge Difference (%)
SNK	Q12	89±31	64±49	-25
	Q13	33±47	24±44	-8
	Q14	74±44	94±24	20
	Q15	76±43	48±51	-28
	Q16	63±49	73±45	10
	Q17	28±46	39±50	11
	Q18	46±50	61±50	15
	Q19	37±49	39±50	2
	Q20	54±50	79±42	24
	Q21	35±48	64±49	29
	Q22	15±36	15±36	0
	Q23	11±31	15±36	4
	Q24	13±34	27±45	14
	Q25	0	0	0
	Q26	59±50	42±50	-16
	Q27	48±51	67±48	19

Q28	63±49	82±39	19
Q29	50±51	79±42	29
Q30	48±51	52±51	4
Q31	9±28	6±24	-3
Q32	91±28	97±17	6
Q33	63±49	85±36	22
Q34	7±25	21±42	15
Q35	59±50	85±36	26

Note: ^aSNK = sports nutrition knowledge

Discussion

The goal of this research was to measure the nutrition knowledge level of Army ROTC cadets while observing the effectiveness of the nutrition education series utilized. The results support the hypothesis that the implementation of nutrition education sessions presented by an RDN improves overall nutrition knowledge scores in ROTC cadets. Statistically significant increases were measured between pre- and post-survey scores in GNK, SNK, TNK. In this sample, initial nutrition knowledge scores before the nutrition education sessions were adequate in GNK (average 57%), poor in SNK (average 45%), and poor in TNK (average 48%). These results were slightly lower than nutrition knowledge measured in other studies with ROTC cadets. One study utilized questions from the validated Military Eating Behavior Survey (MEBS) and reported an average composite nutrition knowledge score of roughly 67% in 205 ROTC cadets from two Midwestern universities.⁵ Another study measured an inadequate sports nutrition knowledge score of 55±13% in 77 ROTC cadets from two southeastern universities.⁶ A different study used the validated 59-item Nutrition Knowledge for Young Adult Athletes (NUKYA) survey to measure sports nutrition knowledge in ROTC cadets and scores averaged 39%, which is more consistent with the findings in this study.⁷ With a few inconsistencies amongst research, general and sports nutrition knowledge in ROTC cadets is generally reported low or inadequate.

To our knowledge this is the first study to utilize the 35-item ANSKQ with ROTC cadets. The questionnaire has been used in research with athletes, and the results from this study strongly compare to the outcomes of nutrition knowledge in 328 female Gaelic games players, reporting adequate GNK (average 58%), poor SNK (average 40%), and poor TNK (average 46%).²⁴ Results in this study were also similar to a sample of 177 non-elite football and netball athletes predominately aged 17-25 years and reported nutrition knowledge scores as adequate in GNK (average 59%), poor in SNK (average 35%), and poor in TNK (average 47%).²³

In addition, many studies measuring nutrition knowledge in ROTC cadets and athletes conduct a one-time measurement of nutrition knowledge without the use of a nutrition education intervention and reassessment. The evaluation of each ANSKQ question score pre- and post-intervention is helpful to observe effectiveness and assess specific improvements needed for the nutrition education series. Improvements were seen in 74% of ANSKQ questions which involved nutrition topics such as weight management, macronutrients, alcohol, and supplements. The high scores for questions related to alcohol may be influenced by the recency of the educational material covered during the same class as the post-survey. Similarly, the seven questions that reported decreases between the pre- and post-survey scores were related to macronutrients or sports nutrition and may have the limitation of the long-term gap between the presentation of the material and post-survey. There was no difference measured between the pre- and post-survey scores for two questions (Q22 and Q25), indicating nutrition knowledge neither increased nor decreased for these specific questions related to calcium intake and purposeful hydration for athletes. One micronutrient question (Q8) did improve between pre- to post-survey but was still commonly answered incorrectly. This reflects the nutrition education intervention may not be as effective in teaching micronutrient and hydration information, or the specific ANSKQ questions may be difficult. Poor scores related to hydration and micronutrient questions are reported in other studies with ROTC cadets⁵ and studies using the ANSKQ.^{23,24} Overall, with significant score improvements in all nutrition knowledge categories and increases in more than 70% of individual questions, the nutrition education series provided by an RDN seems to have been effective at increasing nutrition knowledge.

Strengths and Limitations

The strengths of this study involved the use of a fairly long intervention length (more than two months) and a validated nutrition knowledge questionnaire. The ANSKQ questions were mostly all answered by participants, with less than one percent of answers left unanswered between the pre- and post-survey. This is likely due to the shorter length of the questionnaire and distributing it in person. Also, participants were unaware the post-survey would be the same as

the pre-survey but using the same survey may be both a strength and limitation. There is a strength in comparing data based on the same set of questions, but a limitation in the possibility of individuals remembering the exact questions; although, this is unlikely with nine weeks between the pre- and post-survey. Correct answers were not discussed after the pre-survey but were indirectly taught throughout the nutrition education sessions.

This study is limited by the lack of participant identifiers and small sample size of participants. Also, the sample may not represent the Army ROTC population well since it is comprised of only underclassmen (i.e., freshmen and sophomores) and lacks representation of upperclassmen. Research shows nutrition knowledge is higher in cadets who are upperclassmen or have been enrolled in the ROTC program for longer than 1 year.²⁹ Additionally, other military branches are not represented in this sample.

Future Research

The nutrition education intervention in this study could be improved by adding serving size examples to the performance nutrition section, practice questions with specific foods, and further elaboration on nutrient recommendations based on body weight since these were commonly answered incorrectly. For data collection, participant identifiers would enable the comparison of individual pre- and post-survey scores and may allow further conclusions to be drawn. Future studies should include ROTC upperclassmen, other military branches, and collect more participant identifiers (e.g., gender). Also, with the scarcity of ANSKQ use in ROTC populations, this could be an area of implementation to acquire more nutrition knowledge research and use to further evaluate the influence on daily dietary habits, physical performance, or body composition.

Conclusions

Initial SNK and TNK were measured as poor in ROTC cadets, and GNK was measured as adequate. The implementation of six nutrition education sessions created and presented by an RDN significantly improved ROTC cadet nutrition knowledge scores to adequate in SNK and TNK, and good in GNK. The nutrition education intervention was effective at increasing nutrition knowledge in cadets.

Acknowledgements

The authors would like to thank the Army ROTC cadets who participated and the ROTC leadership who helped facilitate the research in this study.

References

1. Leadership Innovation in the Reserve Officer Training Corps and the Future of the Force Improving Fighter Management. Army University Press. Accessed February 18, 2023. <https://www.armyupress.army.mil/Journals/Military-Review/English-Edition-Archives/January-February-2017/ART-015/>
2. Institute of Medicine, Food and Nutrition Board, Committee on Body Composition Nutrition, and Health of Military Women. Assessing readiness in military women: the relationship of body, composition, nutrition, and health. *National Academies Press*. 1998. <http://umiss.idm.oclc.org/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=896&site=ehost-live&scope=site>
3. Wise SR, Trigg SD. Optimizing health, wellness, and performance of the tactical athlete. *Curr Sports Med Rep*. 2020;19(2):70-75. doi:10.1249/JSR.0000000000000684
4. Smith A, Emerson D, Winkelmann Z, Potter D, Torres-McGehee T. Prevalence of eating disorder risk and body image dissatisfaction among ROTC cadets. *Int J Environ Res Public Health*. 2020;17(21):8137. doi:10.3390/ijerph17218137
5. Moorhead-Hill KM. Nutrition knowledge, motivation for healthy eating, and diet quality in Army ROTC cadets at two midwestern universities. M.S. Michigan State University. Accessed October 12, 2022. <https://www.proquest.com/docview/2186378145/abstract/87375A6721014DF2PQ/1>
6. Connell SA, Torres-McGehee TM, Emerson DM, Jenson M, Ferland L. Examination of sports nutrition knowledge and prevalence of disordered eating among ROTC cadets. *J Athl Train*. 2017;52(6):S40.
7. Daniels E, Hanson J. Energy-adjusted dietary intakes are associated with perceived barriers to healthy eating but not food insecurity or sports nutrition knowledge in a pilot study of ROTC cadets. *Nutrients*. 2021;13(9):3053. doi:10.3390/nu13093053
8. James D, Wilson J. Weight loss strategies used by Army ROTC cadets. *J Acad Nutr Diet*. 2018;118(9):A82. doi:10.1016/j.jand.2018.06.083

9. Absolute and relative morbidity burdens attributable to various illnesses and injuries, active component, U.S. Armed Forces, 2018. Military Health System. Published May 1, 2019. Accessed January 26, 2023. <https://www.health.mil/News/Articles/2019/05/01/Absolute-and-relative-morbidity-burdens-active>
10. Armed Forces Health Surveillance Branch. Ambulatory visits, active component, U.S. Armed Forces, 2017. *MSMR*. 2018;25(5):17-23.
11. Radzak KN, Sefton JM, Timmons MK, Lopp R, Stickley CD, Lam KC. Musculoskeletal injury in reserve officers' training corps: a report from the athletic training practice-based research network. *Orthop J Sports Med*. 2020;8(9):2325967120948951. doi:10.1177/2325967120948951
12. Scott SA, Simon JE, Van Der Pol B, Docherty CL. Risk factors for sustaining a lower extremity injury in an Army reserve officer training corps cadet population. *Mil Med*. 2015;180(8):910-916. doi:10.7205/MILMED-D-14-00618
13. Fogelholm M, Anderssen S, Gunnarsdottir I, Lahti-Koski M. Dietary macronutrients and food consumption as determinants of long-term weight change in adult populations: a systematic literature review. *Food Nutr Res*. 2012;56:10.3402/fnr.v56i0.19103. doi:10.3402/fnr.v56i0.19103
14. Drenowatz C, Shook RP, Hand GA, Hébert JR, Blair SN. The independent association between diet quality and body composition. *Sci Rep*. 2014;4(1):4928. doi:10.1038/srep04928
15. Newby P, Muller D, Hallfrisch J, Qiao N, Andres R, Tucker KL. Dietary patterns and changes in body mass index and waist circumference in adults. *Am J Clin Nutr*. 2003;77(6):1417-1425. doi:10.1093/ajcn/77.6.1417
16. The female athlete triad. *Med Sci Sports Exer*. 2007;39(10):1867. doi:10.1249/mss.0b013e318149f111
17. Nutrition and athletic performance. *Med Sci Sports Exer*. 2009;41(3):709-731. doi:10.1249/MSS.0b013e31890eb86
18. Wasserfurth P, Palmowski J, Hahn A, Krüger K. Reasons for and consequences of low energy availability in female and male athletes: social environment, adaptations, and prevention. *Sports Med - Open*. 2020;6(1):44. doi:10.1186/s40798-020-00275-6
19. Brown ON, O'Connor LE, Savaiano D. Mobile MyPlate: a pilot study using text messaging to provide nutrition education and promote better dietary choices in college students. *J Am Coll Health*. 2014;62(5):320-327. doi:10.1080/07448481.2014.899233
20. Lua PL, Wan Putri Elena WD. The impact of nutrition education interventions on the dietary habits of college students in developed nations: a brief review. *Malays J Med Sci MJMS*. 2012;19(1):4-14.
21. Abood DA, Black DR, Birnbaum RD. Nutrition education intervention for college female athletes. *J Nutr Educ Behav*. 2004;36(3):135-139. doi:10.1016/S1499-4046(06)60150-4
22. Valliant MW, Pittman Emplaincourt H, Wenzel RK, Garner BH. Nutrition education by a registered dietitian improves dietary intake and nutrition knowledge of a NCAA female volleyball team. *Nutrients*. 2012;4(6):506-516. doi:10.3390/nu4060506
23. Trakman GL, Forsyth A, Hoyer R, Belski R. Development and validation of a brief general and sports nutrition knowledge questionnaire and assessment of athletes' nutrition knowledge. *J Int Soc Sports Nutr*. 2018;15(1):17. doi:10.1186/s12970-018-0223-1
24. Renard M, Kelly DT, Chéilleachair NN, Catháin C. Evaluation of nutrition knowledge in female Gaelic games players. *Sports*. 2020;8(12):154. doi:10.3390/sports8120154
25. Sullivan GM, Artino AR. Analyzing and interpreting data from Likert-type scales. *J Grad Med Educ*. 2013;5(4):541-542. doi:10.4300/JGME-5-4-18
26. Trakman GL, Forsyth A, Hoyer R, Belski R. The nutrition for sport knowledge questionnaire (NSKQ): development and validation using classical test theory and Rasch analysis. *J Int Soc Sports Nutr*. 2017;14:26. doi:10.1186/s12970-017-0182-y
27. Trakman GL, Forsyth A, Hoyer R, Belski R. Developing and validating a nutrition knowledge questionnaire: key methods and considerations. *Public Health Nutr*. 2017;20(15):2670-2679. doi:10.1017/S1368980017001471
28. Elshahry NA, Trakman G, Kilani AA. General and sports nutrition knowledge among Jordanian adult coaches and athletes: a cross-sectional survey. *PLOS ONE*. 2021;16(11):e0258123. doi:10.1371/journal.pone.0258123
29. Nevarez L. Evaluation of MyPlate recommendations and dietary habits of EIU ROTC cadets: a mixed methods approach. :69.

Appendices

Appendix A: Participant Characteristics Survey

Age: _____

***If under the age of 18, please discontinue and refrain from engaging in this study.**

Year in school (circle one):

Freshman Sophomore Junior Senior Graduate Student

Have you received any previous nutrition education? (circle one) Yes No
 If yes, from where?

On a scale of 1-5, how knowledgeable do you feel about **general** nutrition information? (circle one):

1-Not knowledgeable at all 2-Slightly knowledgeable 3-Not sure (Neutral)

4-Somewhat knowledgeable 5-Extremely knowledgeable

On a scale of 1-5, how knowledgeable do you feel about **sports** nutrition information? (circle one):

1-Not knowledgeable at all 2-Slightly knowledgeable 3-Not sure (Neutral)

4-Somewhat knowledgeable 5-Extremely knowledgeable

Appendix B: ANSKQ with correct answers highlighted (GNK questions 1-11)

General Nutrition Knowledge	
1.	Eating more energy from protein than you need can make you put on fat. (agree/disagree/not sure)
2.	The body needs fat to fight off sickness. (agree/disagree/not sure)
3.	Do you think cheddar cheese is high or low in fat? (high/low/not sure)
4.	Do you think margarine is high or low in fat? (high/low/not sure)
5.	Do you think honey is high or low in fat? (high/low/not sure)
6.	The body has a limited ability to use protein for muscle protein synthesis. (agree/disagree/not sure).
7.	Eggs contain all the essential amino acids needed by the body. (agree/disagree/not sure)
8.	Thiamine (Vitamin B1) is needed to take oxygen to muscles. (agree/disagree/not sure)
9.	Vitamins contain energy (kilojoules/calories). (agree/disagree/not sure)
10.	Do you think alcohol can make you put on weight? (yes/no/not sure).
11.	“Binge drinking” (also referred to as heavy episodic drinking) is generally defined as: (a) having two or more standard alcoholic drinks on the same occasion (b) having four to five or more standard alcoholic drinks on the same occasion (c) having seven to eight or more standard alcoholic drinks on the same occasion (d) not sure

Appendix B continued: ANSKQ with correct answers highlighted (SNK questions 12-35)

Sports Nutrition Knowledge	
12.	Do you think 1 medium banana has enough carbohydrate for recovery from intense exercise? Assume the athlete weighs about 70 kg (154 lbs) and has an important training session again tomorrow. (enough/ not enough /not sure)
13.	Do you think 1 cup of cooked quinoa and 1 can of tuna has enough carbohydrate for recovery from intense exercise? Assume the athlete weighs about 70 kg (154 lbs) and has an important training session again tomorrow. (enough/ not enough /not sure)
14.	Do you think 100 g of chicken breast has enough protein to promote muscle growth after a bout of resistance exercise? (yes /no/not sure)
15.	Do you think 1 Cup Baked Beans has enough protein to promote muscle growth after a bout of resistance exercise? (yes/ no /not sure)
16.	Do you think ½ Cup Cooked Quinoa has enough protein to promote muscle growth after a bout of resistance exercise? (yes/ no /not sure)
17.	Eating more protein is the most important dietary change if you want to have more muscle. (agree/ disagree /not sure)
18.	Which is a better recovery meal option for an athlete who wants to put on muscle? (a) A ‘mass gainer’ protein shake and 3 – 4 scrambled eggs (b) Pasta with lean beef and vegetable sauce, plus a dessert of fruit, yoghurt and nuts) (c) A large piece of grilled chicken with a side salad (lettuce, cucumber, tomato) (d) A large steak and fried eggs (e) Not sure
19.	When we exercise at a low intensity, our body mostly uses fat as a fuel. (agree /disagree/not sure)
20.	Vegetarian athletes can meet their protein requirements without the use of protein supplement. (agree /disagree/not sure)
21.	The daily protein needs of a 100 kg (220 lb) well trained resistance athlete are closest to: (a) 100g (1g/kg) (b) 150g (1.5g/kg) (c) 500g (5g/kg) (d) They should eat as much protein as possible (e) Not sure
22.	The optimal calcium intake for athletes aged 15 to 24 years is 500 mg. (agree/ disagree /not sure)
23.	A fit person eating a balanced diet can improve their athletic performance by eating more vitamins and minerals from food. (agree/ disagree /not sure)
24.	Vitamin C should always be taken by athletes. (agree/ disagree /not sure)
25.	Athletes should drink water to: (a) keep plasma (blood) volume stable) (b) stop dry mouth (c) allow proper sweating (d) All of the above (e) Not sure
26.	Experts think that athletes should: (a) drink 50 – 100 mL (1.7 – 3.3 fluid ounces) every 15 - 20 minutes (b) suck on ice cubes rather than drinking during practice (c) drink sports drinks (e.g. powerade) rather than water during intense sessions (d) drink to a plan, based on body weight changes during training sessions performed in a similar climate) (e) Not sure
27.	Before competition, athletes should eat foods that are high in: (a) fluids, fat and carbohydrate (b) fluids, fiber, carbohydrate (c) fluids and carbohydrate) (d) Not sure
28.	In events last 60 - 90 minutes, 30 - 60 g (1.0 - 2.0 ounces) of carbohydrates should be consumed per hour. (agree /disagree/not sure)
29.	Eating carbohydrates when you exercise will help keep blood sugar levels stable. (agree /disagree/not sure)
30.	Which is the best snack to have during an intense 90-minute training session? (a) A protein shake (b) A ripe banana) (c) Boiled eggs (d) A handful of nuts (e) Not Sure
31.	How much protein do you think experts say athletes should have after completing a resistance exercise session? (a) 1.5g/kg body weight (~ 150 - 130g/ 5.3 - 10.6 ounces for most athletes) (b) 1.0 g/kg body weight (~ 50 - 100 g / 1.9 - 2.3 ounces) for most athletes) (c) 0.3g/kg body weight (~ 15 - 25 g/ 0.53-0.88 ounces) for most athletes) (d) Not sure

32. Supplement labels may sometimes say things that are not true. (agree/disagree/not sure)
33. All supplements are tested to make sure they are safe and don't have any contamination. (agree/disagree/not sure)
34. Which supplement does not have enough evidence in relation to improving body composition, sporting performance? (a) Caffeine (b) Ferulic acid (c) Bicarbonate (d) Leucine (e) Not sure
35. The WORLD ANTI-DOPING AGENCY (WADA) bans the use of (a) caffeine (b) bicarbonate (c) carnitine (d) testosterone (e) Not sure

Appendix C: Timeline of Nutrition Education Presentations in 2022

August 25th

Week 1 – Introduction

- Recruitment Script
- Consent Form
- *Pre-survey (paper copy)

September 1st

Week 2 – Macronutrients

- Calories/BMR/TDEE
- Carbohydrates, protein, fat

September 8th

Week 3 – Micronutrients

- Vitamins and minerals
- Fruits and vegetables

September 22nd

Week 4 – Hydration and Electrolytes

- Water & hydrating beverages
- Electrolytes
- *Kahoot Review

September 29th

Week 5 – Performance Nutrition

- Performance plate building
- MyPlate recommendations
- Nutrient timing for exercise

October 6th

Week 6 – Supplements

- What they are/how to identify them
- Researched supplements
- Risks & Third-Party Testers

(2 weeks off for ROTC events/cadets unable to meet)

October 27th

Week 7 – Alcohol

- Effect on the body
- Caloric content
- Binge drinking
- Recommendations
- *Post-survey (paper copy)