

Building Collegiate Student-Athlete Self-Efficacy to Improve Diet Quality through a Pilot Nutrition Intervention

Original Research

Jess Groch, Rebecca Gonter-Dray, Diana Cuy Castellanos

University of Dayton, Dayton, Ohio/USA

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Abstract

Introduction: The objective of this pilot study was to develop, implement, and evaluate a skill-based sports nutrition education intervention, informed by previous research, with the goal of improving self-efficacy skills and diet quality in division I collegiate volleyball athletes.

Methods. This was a pilot study. The nutrition education intervention was evaluated from baseline to post-intervention by comparing sports nutrition knowledge, self-efficacy skills, and dietary intake to determine the success of the program. Descriptives were used to examine the impact of the program.

Results: The pilot intervention was developed to integrate skill-based sport nutrition education. Specific validated impact measures were identified and implemented. All seven volleyball athletes attended the six sessions. Carbohydrate intake (+.4) and sports nutrition self-efficacy scores for meal planning (+.54), cooking (+.14) and choosing healthy foods (+.29) improved from pre- to post-intervention.

Conclusion: Using research to guide the development of targeted sports nutrition interventions for specific athlete populations could enhance learning and behavior change. Due to the lack of consistent evaluation measures across studies, impact and outcomes of certain interventions are difficult to determine.

Key words: collegiate athlete, sports nutrition, volleyball, carbohydrate intake

Corresponding author: Diana Cuy Castellanos, dcuycastellanos1@udayton.edu

Introduction

Individualized nutrition influences athletic performance as athletes have an increased need for energy, nutrients, and fluids to optimize body composition and athletic performance.¹ According to the Academy of Nutrition and Dietetics Joint Position Statement with Dietitians of Canada and the American College of Sports Medicine, optimal athletic performance is achieved when an athlete's energy, fluid needs, and timing/frequency of meals are individualized to provide support and maximize training outcomes. Adequate nutrition is also needed to maintain optimal health as well as accommodate the type of sport the athlete plays, their player position, training schedules, age, gender, and competition schedule.¹

Previous work has demonstrated that successful implementation of nutrition education interventions that emphasize individualized energy, macronutrient, and hydration needs, and meal planning result in an increase in athletes' understanding of the importance of adequate nutrition to support nutritional needs and performance goals.²⁻⁴

However, research has stated that despite the increase in sports nutrition knowledge, athletes continue to struggle to consume an adequate amount of energy to offset energy expenditure which contributes to performance inadequacies.^{2,5-13} This may be due to specific social and environmental barriers, such as busy class schedules, limited time to prepare and eat meals, frequency of travel, food access, and preconceived nutrition beliefs.^{12,13} Although nutrition education interventions have been successful in increasing sport-related nutrition knowledge, the ability to improve an athletes' diet quality, body composition, and performance through behavior changes remains a challenge. Therefore, skill-building may need to be included in nutrition interventions to aid athletes in addressing nutrition-related social and environmental barriers inhibiting the ability to consume a desirable diet for performance.^{2,3,11,12,14,15} Previous research has demonstrated that providing education that addresses these social and environmental barriers through skill-building can result in an increase in self-efficacy and provide athletes with the tools needed to navigate barriers to adequate nutrition, subsequently improving diet quality.¹⁶ Over time, the improvement in diet quality that supports the athlete's nutritional needs can lead to improved body composition by appropriately fueling for lean body mass synthesis and ultimately improving sport performance.¹

Therefore, this paper outlines procedures used in the development, implementation, and assessment of a sports nutrition intervention that addresses social and environmental barriers to optimal nutrition in a cohort of collegiate division I volleyball athletes. The intervention focused on building self-efficacy to provide athletes with the skills necessary to align diet habits with nutritional needs. In this pilot study, an evidenced-based nutrition education intervention was developed and implemented with a cohort of collegiate division I volleyball athletes. Impact measures that have previously been utilized in sports nutrition interventions were identified to assess diet quality, sports nutrition knowledge, and body composition. A detailed description of the development, implementation, and assessment of the interventions is provided.

Methods

This was a pilot study to examine the development, implementation, and evaluation of a sport nutrition program in collegiate division I volleyball athletes. The research team developing the intervention consisted of a dietetic intern and two registered dietitians, both with sport nutrition experience. The study was reviewed and approved by the Institutional Review Board at the University.

Protocol

The development and the implementation of this pilot study occurred over one year. First, a review of the literature was completed to assess current research (published between 2011-2021) on nutrition education interventions for student athletes and identify any gaps to be addressed. Databases used to identify current literature included Pubmed, Sportdiscus, CINHALL and Google Scholar. Search terms included volleyball, sports nutrition, interventions, and dietary intake. In the review, the intervention team concluded sports nutrition education programs for collegiate athletes should target nutrition-related skill building to elicit dietary behavior change and ultimately support performance goals.^{2-4,16} Additionally, standardized evaluation measures were identified as current research on sports nutrition education interventions use a wide variety of assessment tools making results difficult to generalize to the population.³ An assessment plan to determine impact of the intervention was developed after identifying appropriate impact measures to assess dietary intake, nutrition-related self-efficacy, and body composition.

Based on the results of the literature review, six nutrition education sessions were developed and focused on nutrition-related skill building.^{4,16,17} Skill building components of the intervention were informed by previous research using Social Cognitive Theory (SCT) to strengthen self-efficacy skills in student athletes to address the social and environmental barriers previously mentioned.¹⁶ The intervention consisted of six sessions involving nutrition lectures and activities, a cooking demonstration, and a grocery store tour. The SCT guided the development of the intervention and focused on building self-efficacy through "observational learning, outcome expectations, and behavioral capability" and targeted behavior changes that would result in improved dietary intake to support athletic performance.^{16(p.2)} The group lectures addressed one topic over four separate lectures and skill-based activities; hydration, pre- and post-exercise food selection, energy needs during pre- and post-season, and eating out while traveling or on campus. The grocery store tour was developed and recorded and electronically delivered to student athletes. Finally, the cooking demonstration took place on Zoom video communication software and involved food preparation techniques and a recipe demonstration.

Table 1: Structural Design of Program

Description		
Session Number	Education Topic	Education Type
1	Energy and Macronutrient Needs	Lecture
2	Hydration Needs	Lecture
3	Pre and Post Exercise Meal Choices	Lecture
4	Dining on Campus	Lecture
5	Grocery Store Tour	Recorded Tour
6	Recipe Demonstration	Live Demonstration

Instruments

Standardized impact measures are needed to generalize results more easily to the priority population.³ To assess the success of this pilot program, diet and self-efficacy skills were evaluated utilizing validated impact measures or screeners previously used with the priority population.^{16,18,19} Participants self-reported dietary intake using a web-based fruit, vegetable, and fiber screener and a carbohydrate intake screener for endurance athletes.^{18,19}

The vegetable, fruit and fiber screener's reliability in predicting the respondents' fruit and vegetable intake is based on the correlations with associated nutrients, such as Vitamin C. These tended to be lower when compared to fortified foods found on the full-length questionnaire, indicating that the screener can accurately measure fruit and vegetable intake. The ten item, web-based questionnaire measures the adequacy of the respondents' fruit, vegetable, and fiber intake based on their age and gender.¹⁸

The Harrison et al.¹⁹ carbohydrate intake screener for endurance athletes was distributed to student athletes to determine a baseline measurement of carbohydrate intake pre- and post-intervention. This screener was chosen because it had been previously validated as accurately predicting carbohydrate consumption with "both a high sensitivity and specificity in the target population (89.5 and 87.3%, respectively)" indicating accuracy in identifying respondents that meet or do not meet carbohydrate intake recommendations.¹⁹ The 15 dichotomous yes/no screener lists food choices that determine if the total carbohydrate consumption of the respondent is at least 6 g/kg of body weight. It is generally recommended that volleyball athletes consume 3-5 g/kg of carbohydrates on low intensity training days and 5-7 g/kg of carbohydrates on moderate/high intensity training days to maintain energy levels for performance goals.^{17,19,20}

Self-efficacy skills regarding dietary habits were measured using questionnaires developed by Ellis and colleagues.¹⁶ The self-efficacy skills were divided into four subscores: making healthy food choices, meal planning, cooking, and eating patterns. The four subscores were calculated to determine an overall self-efficacy score for each athlete. The first three subscores established self-efficacy in making healthy food choices, meal planning, and cooking. Participants scored themselves on a scale in which '0' indicated strongly agree to '3' indicating strongly disagree. The fourth section established food preparation and eating patterns by asking participants to rate how many times a week participants engaged in the described behavior.¹⁶

To examine the athlete's perception of the impact of the program, participants rated on a scale from 0 (agree) to 2 (disagree) the perceived impact of the grocery store tour, and the cooking demonstration, and lectures on improved sports nutrition knowledge and dietary habits.

Finally, BOD POD measurements were collected to determine body composition of participants, as body composition is influenced by diet quality and directly affects sport performance.¹ BOD POD air displacement accurately determines fat mass and fat free mass and has been previously tested for validity and reliability for use in athletes.²¹ The intent for collecting BOD POD measurements for this intervention was to compare measurements pre- and post-intervention to determine measurable changes in body composition. Weight, height, and body composition were collected pre-intervention. Height was self-reported by athletes and weight was measured using a calibrated BOD POD electronic scale and recorded to the nearest 0.1 kg by the primary researcher. Body composition was assessed using air displacement with the BOD POD body composition system, following the manufacturer's recommendations, and recorded to the nearest 0.1%. The participants energy requirements were then calculated using the Nelson Equation:

$$\text{RMR (kcal/day)} = 25.80 \times \text{Fat Free Mass (kg)} + 4.04 \times \text{Fat Mass (kg)}$$

Participants

For the pilot test, collegiate division I volleyball athletes were recruited, and assessment of dietary intake, nutrition-related self-efficacy, and body composition measures were collected. The athletes were selected by convenience sampling from the University women's volleyball team during their off season after receiving approval from the University's Institutional Review Board. Fifteen athletes were initially contacted in May 2021 via email and seven athletes agreed to participate. Prior to the first nutrition education intervention, all seven athletes completed the previously described fruit, vegetable, and fiber screener, carbohydrate intake screener, self-efficacy questionnaire, and impact of program questionnaire. The athletes also met the primary researcher in the Human Physiology lab at the University to review and sign the informed consent and complete the initial BOD POD fitness assessments. Information on the participant ethnicity, age, gender, major, and school year were also collected.¹⁶

Analysis

For this pilot study, descriptive statistics were used to observe the differences in dietary intake and nutrition-related self-efficacy at baseline and at the end of the intervention (six-weeks). Body composition, height, and weight were also measured at each time period.

Results

As stated, all participants (N=7) were currently enrolled as undergraduate students at the University. The participants were between the ages of 18-21. All participants were non-Hispanic White. Participants were not currently enrolled in a college level nutrition courses at the time of the intervention, however, three of the seven participants reported having previously been enrolled in a college level nutrition course, and two of the seven participants reported they had previously attended a cooking class. Furthermore, all athletes were free from any special dietary needs that included food intolerance or allergies. Average fat free body fat from the Bod Pod measurements across participants was 21.5% with an average BMI of 23.3.

All participants attended the six education sessions and completed the pre-intervention impact and outcome measures. Only four of the seven participants completed the post-intervention measurements. Table 2 displays the results from the measures at baseline and post-intervention for the carbohydrate screener, fruit, vegetable, and fiber screener, self-efficacy questionnaire and perceived impact of the program questionnaire. Mean carbohydrate intake improved slightly (.40) and fiber intake decreased and did not meet the recommended intake of 25g per day of fiber per day for women under the age of 50. Overall, the results of the carbohydrate and fruit, vegetable, and fiber intake screener indicate that the participants had improved their intake of carbohydrates to support performance goals but did not improve the amount of fiber intake from fruit, vegetables and whole grains.

Results from the self-efficacy questionnaire indicated that participants demonstrated an improvement in making healthy food choices (.29), meal planning (.54), and cooking (.14). Mean results from the perceived impact of the program questionnaire indicated the athletes felt their knowledge and understanding of sports nutrition improved and they believed their dietary intake could impact their performance goals (.95). Additionally, five of the seven athletes agreed that their current diet was considered healthy and supported their nutrition goals.

Discussion

Overall, this pilot study was successfully able to meet the primary aim of developing and implementing a sports nutrition education intervention that focused on building self-efficacy skills to improve diet quality. All six sessions were implemented and the seven participants attended each of the sessions. Further, the pre- and post-measurements were incorporated to evaluate the impact of the intervention. Results indicated that athletes improved knowledge and understanding of sports nutrition. Results from the self-efficacy screeners indicated athletes reported an increase in self-efficacy skills surrounding dietary habits that supported their nutrition and performance goals, such as eating out less often and meal planning/preparation. Regarding the secondary aim of improved diet quality, athletes reported a slight improvement in carbohydrate intake but not in fiber intake. These results are similar to other studies with the priority population that have demonstrated improvement in diet quality and sports nutrition knowledge following individualized nutrition education sessions.⁴ However, due to the low sample the results cannot be interpreted

regarding intervention effectiveness but provides an outline for future intervention evaluation with a larger sample size.

Table 2: Impact Measures

Mean Carbohydrate Intake Score	
<i>Pre-Intervention Carbohydrate Intake (n=7)</i>	<i>Post-Intervention Carbohydrate Intake (n=4)</i>
10.29±1.50	10.25±2.50
Mean Fruit Vegetable and Fiber Intake Score	
<i>Pre-Intervention Fiber Intake (g) (n=7)</i>	<i>Post-Intervention Fiber Intake (g) (n=4)</i>
15.00±3.65	13.25±1.50
Mean Making Healthy Food Choices Score	
<i>Pre-Intervention (n=7)</i>	<i>Post- Intervention (n=4)</i>
1.00±0.481	0.714±0.202
Mean Meal Planning Score	
<i>Pre-Intervention (n=7)</i>	<i>Post-Intervention (n=4)</i>
1.299±0.951	0.75±0.500
Mean Cooking Score	
<i>Pre-Intervention (n=7)</i>	<i>Post Intervention (n=4)</i>
0.917±0.853	0.771±0.740
Mean Perceived Impact of Program Score	
<i>Pre- Impact of Program (n=7)</i>	<i>Post- Impact of Program (n=4)</i>
1.64±0.593	0.69±0.340

The findings of this pilot study also indicated that SCT-based education may improve an athlete's self-efficacy related to skills necessary to make healthful food choices that support their performance goals. These findings suggest that providing athletes with both sports nutrition education and education on how to modify their diet for their lifestyle can support their nutritional needs and performance goals. Previous nutrition education interventions have observed an improvement in sports nutrition knowledge but no improvements in diet quality or LBM synthesis.¹⁴ Therefore, an emphasis on skill-based learning that addresses social and environmental barriers and increases diet-related self-efficacy may be needed to observe improvements in diet quality, body composition and sport performance.

It is difficult to determine if this intervention resulted in a change in dietary habits that support body composition goals of the participating athletes, as the sample size of the pilot study was small, and three of the seven athletes were unable to complete the post-intervention screeners. One limitation in determining overall diet quality of the participants was not collecting their energy intake, as it is difficult to determine if the athletes were meeting their macronutrient goals without knowing their overall caloric intake. Future research should follow up on dietary habits post-intervention to determine if self-efficacy skills resulted in behavior changes and improved diet quality over time. Implementation of the intervention in this article and evaluation measures in a adequate sample size can inform effectiveness in relation to perceived changes in volleyball-specific sports nutrition knowledge and understanding, as well as self-efficacy skills in healthy food choices, cooking, and meal planning, improved diet quality and body composition.

Limitations of this study include the small sample size and the attrition of three athletes resulting in conclusions being difficult to generalize to the priority population. Data collecting during the off season also resulted in limitations in maintaining participation in the intervention program as the athlete's schedules became full as the pre-season began resulting in three participants unable to return post-intervention screeners and the inability to collect post-intervention BOD POD assessments for all seven participants. Additionally, the research team's University volleyball team point of contact person was unable to communicate with the athletes per National College Athletic Association (NCAA) guidelines resulting in difficulties in communication during the data collection period.

Conclusion

Future research is warranted to determine if SCT-based nutrition education intervention results in an increase in self-efficacy that provides student athletes with the necessary skills to navigate social/ environmental barriers influencing

dietary quality and nutrition goals. However, the results of this pilot study indicate that sport-specific nutrition education may be useful in improving self-efficacy related dietary habits and general sports nutrition knowledge among student athletes.

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Conflicts of interest: No conflict of interest to report.

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