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Impact of a nutrition education intervention on eating behaviors in adolescent combat sports athletes: An observational study

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Abstract
Background: Adolescent athletes in endurance and combat sports often face unique nutritional challenges that can affect their growth, performance, and recovery. While School Meal Programs (SMPs) aim to meet students' dietary needs, their effectiveness for this subpopulation is not well understood-particularly in underserved communities.
Aims and Objectives: This study aimed to (1) observe dietary intake and eating behaviors of adolescent combat sports athletes; (2) evaluate the influence of SMP participation on nutritional outcomes; and (3) assess the impact of a 6-week nutrition education and cooking course on eating habits, meal preparation, and program engagement.
Materials and Methods: This observational study included 25 adolescent athletes from USA Boxing-affiliated clubs in Denver, Colorado. Participants completed pre- and post-intervention surveys and interviews, with the intervention being a 6-week applied nutrition education course focused on cooking skills and practical dietary strategies. Statistical analysis was performed using SPSS (v.27) to assess behavioral changes.
Results: Before the intervention, 67% of participants were active in USA Boxing programs, and 44% (n = 11) reported participating in SMPs. Post-intervention, 88% of participants reported a positive impact from the course, including increased frequency of cooking at home and improvements in meal quality. The proportion of SMP users remained unchanged at 44%, suggesting persistent barriers to access or utilization. A statistically significant increase in home meal preparation was observed post-intervention (P = 0.030). Additionally, qualitative feedback indicated greater awareness of nutrition's role in performance and a higher reported sense of confidence in preparing meals independently.
Conclusion: This study demonstrates that a short-term, targeted nutrition education intervention can lead to meaningful improvements in dietary behavior and self-sufficiency among adolescent combat sports athletes. However, the lack of change in SMP utilization highlights potential systemic limitations that require further policy and programmatic attention. Integrating nutrition literacy into youth sports development may serve as a scalable strategy to support athletic performance, healthy growth, and long-term behavior change.

Keywords: Youth health, cooking skills, school food access, food literacy, athlete development, underserved populations

Introduction

Adolescent athletes involved in endurance and combat sports face distinct nutritional challenges due to their increased energy demands and developmental needs. Adequate nutrition during adolescence is essential not only for athletic performance, but also for long-term physical growth and cognitive development [1]. However, many youth athletes particularly those from underserved communities-lack the guidance and resources necessary to make informed dietary choices or to meet their elevated nutritional needs.

School Meal Programs (SMPs) such as the National School Lunch Program aim to alleviate food insecurity and support academic achievement through access to balanced meals. While these programs are critical for general student populations, their effectiveness in meeting the higher energy and nutrient demands of young athletes remains uncertain [2]. For student athletes who participate in after-school sports, particularly combat sports, this gap in support may increase reliance on unsupervised and potentially dangerous practices like weight-cutting or chronic under-fuelling [3].

In combat sports especially, there is a well-documented pattern of risky nutritional behaviors, including extreme caloric restriction and dehydration tactics used to "make weight," which are often initiated during adolescence [3]. These behaviors not only compromise performance but also pose long-term risl<s to physical and psychological health. interventions targeting these practices through education and behavior change strategies are urgently needed.

Current literature suggests that structured nutrition education and cooking skill development may be effective tools for improving eating behaviors and fostering long-term self-sufficiency in dietary choices [4]. Such interventions, when integrated into athletic training environments, offer a promising avenue for simultaneously improving athlete health, performance, and overall well-being.

This study aims to examine the eating behaviors and nutritional intake of adolescent combat sports athletes in relation to their use of School Meal Programs. Additionally, it evaluates the effects of a 6-week applied nutrition and cooking course on dietary habits. Findings from this work can help inform future programmatic efforts to better support the specific nutritional needs of youth athletes through both school-based and extracurricular.

Initiatives

Materials and Methods

Study Design

This was a mixed-methods observational study conducted over a 6-week period. The primary aim was to examine eating behaviors, food environment factors, and nutritional intake among adolescent athletes engaged in combat sports, with additional emphasis on evaluating the impact of a 6-week nutrition education and cooking course. Pre- and post intervention data were collected using structured surveys and participant interviews.

Study Area

The study was conducted at Brick City Boxing Academy and Johnson Recreation Center, both located in Denver, Colorado, USA. These community-based boxing programs serve youth populations from underserved backgrounds and are affiliated with USA Boxing Clubs. The study leveraged existing training environments to facilitate the integration of nutrition education within the athletes' regular schedules.

Participants

Participants were adolescent athletes (ages 12-18) affiliated with USA Boxing Clubs. Eligibility criteria included active or recent participation in a combat sports program and willingness to participate in both the pre- and post-survey process. Initially, 33 participants enrolled in the study; however, 8 were excluded from analysis due to not completing the 6- week course or the post-survey. The final sample size was 25.

Intervention: Nutrition Education and Cooking Course

A 6-week educational intervention was implemented between the pre- and post-surveys. The course covered basic sports nutrition principles, label reading, hydration strategies, meal planning, food group functions, and safe food preparation. Lessons were delivered in an interactive format using visual aids, live demonstrations, and hands-on cooking sessions. Each weekly session lasted approximately 60-75 minutes and was led by a certified sports nutritionist with prior boxing experience. Emphasis was placed on culturally relevant meals, affordability, and accessibility of ingredients.

Data Collection Tools

Surveys

Standardized surveys were developed to assess:

- Meal frequency and patterns
- Food choice determinants
- School meal participation
- Self-efficacy around meal preparation
- Perceived impact of nutrition on performance

Both pre- and post-surveys were administered in person using paper forms and later digitized for analysis.

Interviews

Brief semi-structured interviews were conducted with select participants (n = 6) to collect qualitative data on perceived barriers and benefits related to food access and the nutrition course. These were audio-recorded and transcribed for thematic analysis.

Statistical Analysis

Quantitative data were analyzed using IBM SPSS Statistics (version 27). Paired-sample t- tests were conducted to determine statistically significant differences in pre- and post intervention responses. Statistical significance was set at $p < 0.05$. Qualitative data from interviews were analyzed using a thematic content analysis approach to identify recurring themes related to food access, cooking behavior, and perceived value of the intervention.

Results

Study Population

A total of 33 adolescent athletes enrolled in the study. Eight participants were excluded for not completing the intervention or follow-up surveys, resulting in a final sample size of 25. Participants were aged 12-18 years and included both male and female athletes actively training in combat sports.

Nutrition Education Outcomes

Following the 6-week intervention, 88% (n = 22) of participants reported gaining beneficial knowledge or skills from the course (Figure 4). This included topics such as basic cooking techniques, hydration strategies, and understanding nutrient timing.

Meal Preparation and Eating Behavior

A statistically significant improvement in meal preparation behavior was observed. The proportion of participants who reported preparing their own meals increased from 36% pre-intervention to 64% post-intervention ($p = 0.030$, paired-sample t-test). This was accompanied by a reduction in reliance on others (e.g., family members or roommates) for meal preparation (Figure 5).

School Meal Program Participation

No change was observed in School Meal Program (SMP) utilization before and after the intervention. Eleven participants reported using school meals, while fourteen did not, at both time points (Figure 3). This static trend suggests

systemic barriers to SMP access or appeal that were not influenced by the intervention.

Sports Participation

An increase in boxing participation was observed post-intervention. At baseline, 67% (n = 17) reported regular boxing involvement, compared to 76% (n = 19) post-intervention (Figure 2). Though not statistically analyzed due to sample size, this suggests a positive trend in continued athletic engagement.

Discussion

This study provides evidence that a brief, structured nutrition education intervention can effectively shift eating behaviors and food preparation habits among adolescent combat sports athletes. The statistically significant increase in self-prepared meals and high rates of reported benefit from the course emphasize the intervention's potential for scalability in community-based athletic settings.

The findings are consistent with previous research indicating that adolescents in sport are often under-informed about basic nutrition principles and meal planning strategies [1, 2]. Unlike other studies that have focused primarily on supplementation or weight cutting [2], this program emphasized foundational nutrition skills and food literacy, resulting in practical behavior change rather than temporary dietary adjustments.

Interestingly, there was no observed change in School Meal Program (SMP) utilization, even though nutrition behaviors outside of school improved. This suggests that structural or psychosocial barriers (e.g., stigma, schedule conflicts, or food preferences) may limit SMP engagement, as echoed in prior literature on adolescent food access in public school settings [3]. Future studies should investigate these barriers in depth to inform policy and programmatic changes that enhance accessibility and relevance of SMPs for student athletes.

The increased engagement in after-school boxing programs following the intervention, though not the primary outcome, may reflect an added benefit of enhanced nutrition confidence and athlete empowerment. While causality cannot be inferred, this finding warrants further exploration into how nutrition education may contribute to sport retention and long-term athletic development.

Conclusion

This study highlights the effectiveness of a 6-week nutrition and cooking education course in improving eating behaviors among adolescent combat sports athletes. Participants demonstrated greater autonomy in meal preparation and reported significant learning outcomes. However, unchanged participation in School Meal Programs suggests persistent access or perception issues that require additional inquiry.

Overall, the intervention shows promise as a scalable model to enhance health, performance, and self-sufficiency among youth athletes, particularly those in underserved communities. These results contribute to a growing body of evidence supporting the integration of practical nutrition education into athletic training environments.

Acknowledgments

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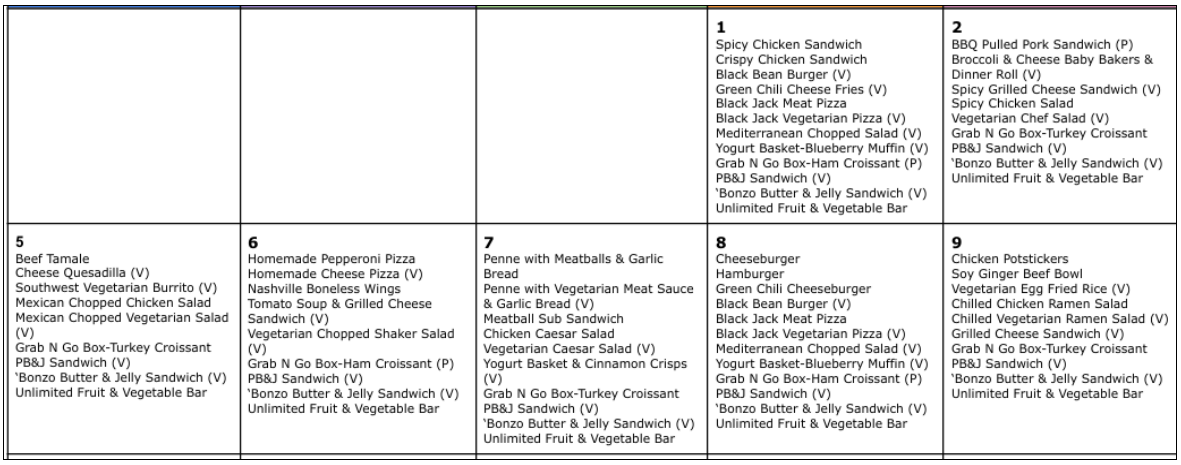
Disclosure

The author reports no conflicts of interest in this work. This study was funded by a grant from the *Reimagine Wellness Challenge* to support community-based adolescent health interventions.

Table 1: Summary of participant characteristics and program engagement

Characteristic	Pre-Intervention (n =25)	Post-Intervention (n = 25)
Actively boxing in a USA Boxing program	67%	76%
Preparing meals at home	28%	56%
Reported learning something valuable	N/A	88%
Utilizing School Meal Programs (SMPs)	11yes/ 14 no	11 yes/ 14 no



			1 Spicy Chicken Sandwich Crispy Chicken Sandwich Black Bean Burger (V) Green Chili Cheese Fries (V) Black Jack Meat Pizza Black Jack Vegetarian Pizza (V) Mediterranean Chopped Salad (V) Yogurt Basket-Blueberry Muffin (V) Grab N Go Box-Ham Croissant (P) PB&J Sandwich (V) 'Bonzo Butter & Jelly Sandwich (V) Unlimited Fruit & Vegetable Bar	**2** BBQ Pulled Pork Sandwich (P) Broccoli & Cheese Baby Bakers & Dinner Roll (V) Spicy Grilled Cheese Sandwich (V) Spicy Chicken Salad Vegetarian Chef Salad (V) Grab N Go Box-Turkey Croissant PB&J Sandwich (V) 'Bonzo Butter & Jelly Sandwich (V) Unlimited Fruit & Vegetable Bar
5 Beef Tamale Cheese Quesadilla (V) Southwest Vegetarian Burrito (V) Mexican Chopped Chicken Salad Mexican Chopped Vegetarian Salad (V) Grab N Go Box-Turkey Croissant PB&J Sandwich (V) 'Bonzo Butter & Jelly Sandwich (V) Unlimited Fruit & Vegetable Bar	**6** Homemade Pepperoni Pizza Homemade Cheese Pizza (V) Nashville Boneless Wings Tomato Soup & Grilled Cheese Sandwich (V) Vegetarian Chopped Shaker Salad (V) Grab N Go Box-Ham Croissant (P) PB&J Sandwich (V) 'Bonzo Butter & Jelly Sandwich (V) Unlimited Fruit & Vegetable Bar	**7** Penne with Meatballs & Garlic Bread Penne with Vegetarian Meat Sauce & Garlic Bread (V) Meatball Sub Sandwich Chicken Caesar Salad Vegetarian Caesar Salad (V) Yogurt Basket & Cinnamon Crisps (V) Grab N Go Box-Turkey Croissant PB&J Sandwich (V) 'Bonzo Butter & Jelly Sandwich (V) Unlimited Fruit & Vegetable Bar	**8** Cheeseburger Hamburger Green Chili Cheeseburger Black Bean Burger (V) Black Jack Meat Pizza Black Jack Vegetarian Pizza (V) Mediterranean Chopped Salad (V) Yogurt Basket-Blueberry Muffin (V) Grab N Go Box-Ham Croissant (P) PB&J Sandwich (V) 'Bonzo Butter & Jelly Sandwich (V) Unlimited Fruit & Vegetable Bar	**9** Chicken Potstickers Soy Ginger Beef Bowl Vegetarian Egg Fried Rice (V) Chilled Chicken Ramen Salad Chilled Vegetarian Ramen Salad (V) Grilled Cheese Sandwich (V) Grab N Go Box-Turkey Croissant PB&J Sandwich (V) 'Bonzo Butter & Jelly Sandwich (V) Unlimited Fruit & Vegetable Bar

Fig 1: Example of a typical school lunch menu offered by Denver Public Schools

This figure presents a representative menu from the DPS Food Services Department, illustrating commonly available school lunch items, including entree choices, fruit and vegetable servings, and beverage options.

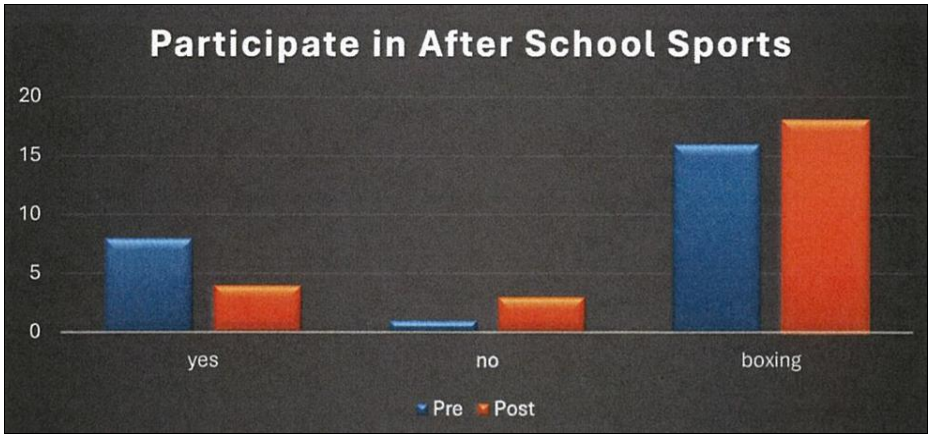


Fig 2: Participation in after-school sports before and after the intervention.

Bar chart comparing participant responses pre- and post-intervention. Categories include "Yes," "No," and "Boxing." Results indicate increased engagement in after-school boxing programs following the 6-week course.

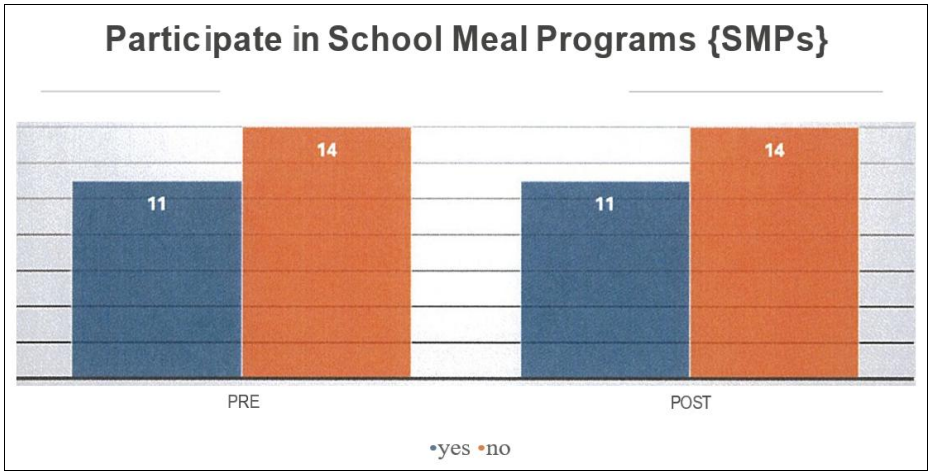


Fig 3: Use of School Meal Programs (SMPs) before and after intervention.

Bar chart showing reported participation in SMPs. No change was observed between pre- and post- intervention, with 11 participants answering "Yes" and 14 answering "No" in both cases.

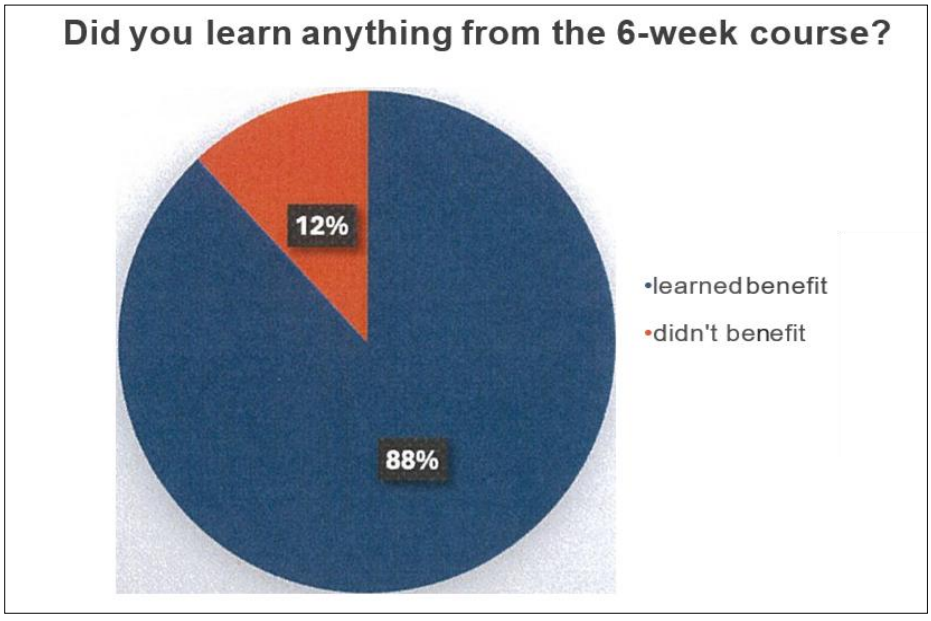


Fig 4: Perceived benefit from the 6-week nutrition course.

Pie chart illustrating participants' feedback. 88% of participants reported learning something valuable, while 12% reported no benefit.

Fig 5: Who prepares meals at home, pre- vs. post-intervention.

Bar chart categorizing cooking responsibility among participants with the following options: "Me," "A Family Member," "A Roommate," "I Don't Cook," and "Other." Results show an increase in self-prepared meals and a decline in reliance on others post-intervention.

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