Development of Nutrition Guide to Improve Adolescent Endurance Runners' Bone Mineral Density and Energy Availability

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Abstract

The goal of this directed project is to **provide an evidenced-based**, **online educational resource** for **female adolescent endurance runners.** The project synthesizes **complex topics** and presents information with **engaging visuals** and **infographics** for the adolescent runner population. The guide aims to **promote** a level of **food intake** in adolescent runners that provides an adequate level of **energy availability** and intake of key macro- and micronutrients with the goal of promoting **bone health** among the female adolescent population. The guide also utilizes **social cognitive theory** in a **goal**-setting feature to promote change. The content is based on key topics focused on in the literature. The main topics include: **energy availability, carbohydrates, protein, nutrient timeline, performance plate , bone health, full day of eating, typical school meal options, goal setting and scenarios**. These topics also include subtopics that dive deeper into the topic specifically for runners. The project went through external review by the expert panel and modifications were made to improve the guides content. In the future, it may be beneficial to have pre-test and post-test assessing the viewers knowledge to determine its efficacy of the projects information.

Introduction

The period of adolescence includes **critical years for growth** and **development**, particularly for **accumulating bone mass.** The **intake** of adequate nutrition plays an important role in optimizing development during this critical life stage. Consuming **adequate calories** is a potential concern for female and male adolescent endurance athletes, as adolescent endurance runners are at risk for **energy deficiency or low energy availability (LEA)**(Matt et al., 2021).

Chronic energy deficiency and **dietary intake** has been associated with **low bone mineral density** (BMD) and risk for **stress fracture.** In addition, **low EA** may contribute to **low bone mineral accumulation** which then increases risk for bone stress injuries and low peak bone mass (Barrack et al., 2008).

In order to promote the importance of nutrition, **educational interventions** are imperative to reduce risks. The literature provides evidence on the **positive impacts** of **nutrition education** among the adolescent population but lacks the variety of intervention modalities. Although, the use of educational tools that **focuses on visual explanations** of **complex topics** is **lacking research**. The development of a visually comprehensive electronic educational nutrition guide catered specifically towards the female adolescent runner population may promote energy availability and bone health.

Purpose

Develop an evidence-based online nutrition guide resource including a series of topics related to energy availability and bone health, catered specifically for female adolescent endurance runners.

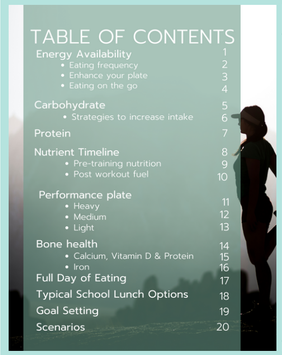


Figure 1. *Table of Contents*

Figure 2. *Energy Availability*

Methods

1. **Literature Review**
   - Identified main topics & subtopics within the literature highlighting areas of increased need for educational nutrition support
2. **Development**
   - Used Canva to create an online educational guide for female adolescent runners.
     - Develop a plan using social cognitive theory in connection with the research literature, to decrease the risk for energy deficiency and optimize bone health in adolescent female runners.
     - Adequate energy availability among female adolescent runners and increases frequency of meals.
     - Increase intake of carbohydrates to optimize energy levels and recovery.
     - Optimize bone health and prevent bone injury's in female adolescent runners.
     - Adequate protein intake to help promote muscle recovery and maintenance.
3. **Evaluation**
   - Conducted a evaluation using a Qualtrixs survey which was completed by the expert panel.
4. **Adjustments**
   - Made recommended adjustments to the guidebook based off survey responses.

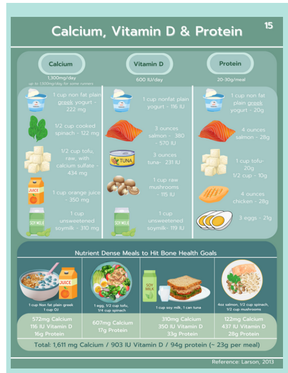
Results

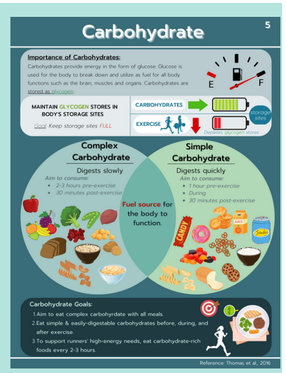
The results can be seen in **Table 1**, provided below.

- The majority of the additional feedback includes: grammatical changes, recommendations for adding on, and positive comments.
- Descriptive statistics include gathering the mean scores and standard deviations.

Question	Descriptive	
	X	SD
The guidebook is clear and to the point.	5.0	0.0
The guidebook is an efficient tool to increase energy availability and bone health among adolescent runners.	4.75	.43
The content is appropriate for adolescent runners.	5.0	0.0
The content is neat, organized, and visually appealing.	5.0	0.0
The guidebook includes culturally competent foods.	4.75	.43
The guidebook gives realistic food options.	4.75	.43
The content is relevant to female adolescent runners.	4.75	.43
The guidebook promotes taking action and provides skills to optimize energy availability and bone health.	4.75	.43
Overall, I was satisfied with the guidebook.	5.0	0.0
I am confident and female adolescent runners would understand and learn from the guidebook.	4.75	.43
Would you recommend the use of this curriculum	4.0	0.0

Table 1. *Results from Expert Review Panel Evaluation Averages and Standard Deviations (n = 4)*





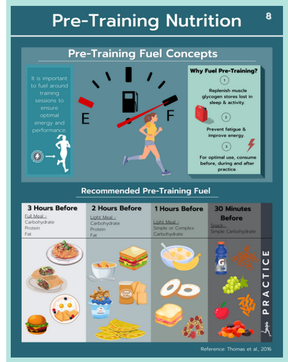


Figure 3. *Calcium, Vitamin D, Protein*
Figure 5. *Pre-training Nutrition*

Figure 4. *Carbohydrates*
Figure 6. *Eating Frequency*

Some areas of **strengths** noted by the formative evaluation includes:

- "takes a variety of challenging and tough topics and helps readers understand concepts in a simplified way."
- "Consider a list of eating disorder sign and symptoms and if an athlete is experiencing these signs how they should get help."
- "really liked the add-in of cultural foods, bone-supporting nutrients, specific meal and snack examples that help athletes meet their individualized ratios for carb/protein goals post training."
- "suggest also including some plant based proteins as well just to give more options and education around different protein foods."
- "Consider adding some information on fast food and sweets."

Conclusion

Female adolescent runners are **at increased risk for low energy availability**, **low bone mineral density** and **bone stress injur**y. With the feedback from the expert panel, adjustments were made to improve the guide for the specific populations needs. Therefore, promoting **self-efficacy** among the female adolescent athlete population, may **impact adequate energy availability** and **optimize bone health. Implementations** of the guide **will promote key nutrition knowledge, improve energy availability** and **reduce adverse effects of endurance running** and **low energy availability.**

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Acknowledge

I would like to give thanks to my committee chair, Michelle Barrack as well as my family for their support, motivation and commitment to my success.

For more Information

Please contact ***Madison.Robello@student.csulb.edu.***
More information on this project can be obtained at *www.csulb.edu.*