Attitudes and Beliefs of Division II Collegiate Swimmers on the Adoption of a Whole-Foods, Plant-Based Diet

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Abstract

Plant-based diets are increasing in popularity, especially among college students and athletes. This may be attributed to the considerable attention given to the adoption of plant-based diets by high-profile athletes. Research suggests that supplementing an athlete's diet with plant-based foods can lead to alleviating effects on markers of oxidative stress, reduced symptoms of exercise-induced muscle damage, and the maintenance of greater functional performance. There is, however, limited research on the feasibility and benefits of a plant-based diet for the collegiate swimmer. This two-part study was conducted on a Division II collegiate men and women's swim team to explore the attitudes and beliefs of collegiate swimmers on the adoption of a plant-based diet. The initial phase included completion of a nutrition knowledge questionnaire, a nutrition lecture, virtual plant-based supermarket tour, and a cooking workshop. Analysis indicated swimmers believed nutrition was "important" for athletic performance, but demonstrated a mixed understanding of nutrition in general, citing cost and accessibility as barriers in consuming a predominately plant-based diet. A follow-up study, removing barriers of cost and accessibility by provision of plant-based breakfasts after weekday practices was conducted. Follow-up analysis revealed swimmers continued to have doubts about the sufficient availability of protein in a plant-based diet but believed eating a plant-based diet can be easy and affordable. Swimmers indicated convenience as a major factor on food choices, and will gravitate towards foods that are most readily available to them, justifying the need for future studies on the accessibility to foods most appropriate for athletic recovery.

Introduction

Vegetarian and Vegan diets are increasing in popularity, especially among college students and athletes. This may be attributed to considerable attention in recent years of the plant-based diets of high-profile athletes, thanks in large part to the public's ability to access celebrity nutritional regimens through social media (7). From power athletes like Kendrick Farris, US Olympic weightlifter, to ultramarathon runners like Scott Jurek, winner of seven-consecutive Western States 100 Mile Endurance Runs, anecdotal claims include enhanced performance and recovery. A nationwide poll conducted in 2016 reported approximately 3.3 % of American adults follow a vegetarian diet with 45% of all vegetarians following a vegan diet (5). A vegetarian diet excludes consumption flesh foods, and may or may not include fish, eggs or dairy products; a vegan diet excludes all forms of animal products including eggs and dairy products (5). Definition of variations of the vegetarian diet that

can be found in **Table 1** (5). The term "whole-food, plant-based" (WFPB) is increasing in popularity and is being used to replace the severity and often negative connotation of the terms "vegetarian" and "vegan." A WFPB diet can be defined as an eating pattern comprised of minimally processed plant foods, including fruits, vegetables, whole grains, nuts, seeds, and legumes with few or no animal products. The term WFPB will be used in the paper representing the vegetarian and vegan eating patterns.

Table I. Types of Vegetarian Diets

Classification	Nature of Diet
Vegetarian	Omits all flesh foods. May or may not include eggs or dairy products.
Lacto-Ovo-Vegetarian	Omits all flesh foods but includes eggs and dairy products.
Lactco-Vegetarian	Omits all flesh and eggs; includes dairy products.
Ovo-Vegetarian	Omits all flesh foods and dairy products; includes eggs.
Pescatarian	Omits all flesh foods with the exception of fish. May or may not include eggs or dairy products.
Vegan	Excludes all flesh foods, eggs, and dairy. May exclude honey.
Raw Vegan	75-100% uncooked food including vegetables, fruit, nuts and seeds, legumes, and sprouted grains.

Purpose

The initial purpose of this mixed-method study was to examine the beliefs and attitudes of Division II collegiate swimmers on a WFPB and athletic performance. Based on the preliminary results, a follow-up study was conducted with the hypothesis that removal of barriers of cost and limited access to WFPB foods would improve the attitudes and perception of a WFPB diet on athletic performance.

Methods

Participants

Permission was obtained to collect data on human subjects from the university's human subject committee prior to the start of the study. All subjects in both studies met the selection criteria of being over the age of 18, an active member of the University's Men or Women Division 2 swim team, and in good academic standing. Subjects were given a thorough explanation of the study and signed informed consent forms prior to participation in the study. The mean body weights of the male and female swimmer for the initial study were 181.9 and 140.3 pound respectively. No body weight data was available for the follow-up study.

Initial Study Procedures

Participants (N=31) completed a nutrition knowledge questionnaires pre and post intervention. Focus groups exploring the perceptions of a WFPB diet to support athletic performance were conducted pre and post intervention. At the start of the initial phases of the study subjects attended a nutrition education lecture led by a Board-Certified Sports Specialist in Sports Dietetics (CSSD) that included a WFPB breakfast and a virtual supermarket tour. The breakfast included and oatmeal buffet with various plant protein toppings, tofu scramble, fresh fruit, 100% fruit/vegetables juices, and an assortment of whole grain breads and nut butters. The virtual supermarket tour highlighted the economic and nutrient properties of various forms of fruits, vegetables, and plant-based proteins. This was followed by a three-hour, hands-on plant-based culinary instruction. Subjects prepared and tasted recipes that could easily be re-created in student housing. Subjects were given a take-home box that included recipes of foods prepared and an assorted of food items for re-creation of recipes. A post intervention nutrition knowledge questionnaire and focus group were completed at the end of the academic swim season.

Initial Study Quantitative Results

All athletes indicated that nutrition was "very important or "important" for athletic performance (100%). Most rated their nutrition knowledge as "good" to "acceptable" (83.8%). The majority of athletes followed a "normal diet" with no restrictions (90.3%). Cooking skills were rated as "good to acceptable" (74.1%).

Pre-intervention self-reported dietary intake showed the majority of subject's diet included fruits, vegetable and whole grains.

- 6.6% of subjects reported consumption of no fruit at all while 53.4% consumed "1-2" servings and 40% consumed "3-5" servings of fruit daily. A serving of fruit was defined as one piece of whole fruit or a ½ cup of cut fruit.

- 9.8% of subjects reported consuming no vegetables at all while 57.9% consumed 1-2 servings and 32.3% consumed 3-5 servings. A serving of vegetables was defined as ½ c. cooked or 1 c. raw vegetables daily.
- 6.5% reports consuming no whole grains at all while 43.7% consumed 1-2 servings and 49.8% consumed 3-5 servings daily. A serving of whole-grains was defined as ½ cup cooked grain, 1/2- ¾ c. dry or ready-to eat cereal, 1 slice of bread, or ½ small bagel or muffin.

Post-intervention intake showed no significant changes in nutrition knowledge or in fruit, vegetable and whole grain consumption.

Initial Study Qualitative results

The initial study focus groups were coded and themed. Three themes emerged from the focus groups: student athletes have a mixed understanding of nutrition as a whole and for athletic performance, there are mostly negative views on consuming a WFPB diet while in season, and barriers of cost and easy access to WFPB foods on campus exist among the athletes. These themes are supported by quotes from athletes including:

- "I don't think you can get enough or protein, especially for swimming and for recovery.
- "I think it's generally healthier to eat more plant-based products, but…I don't think doing a strictly plant-based diet is better for athletes."
- "Calories. I think it's a big problem. You'd have to eat a lot of it to maintain your calorie base need for swimming."
- "Athletes need a lot of protein and meat"
- "It costs so much more to eat healthy. Fruits and vegetables and healthy foods are so expensive"
- "The fruits and vegetable served in the café are horrible. They are old and tasteless or have tons of butter on them to make them taste good"

Initial Study Conclusion

Student athletes have varying levels of nutrition knowledge and should receive nutrition education on the WFPB diet and the potential benefit of the diet on athletic performance and overall health. Working with campus administration to reduce barriers to following a plant-based diet should be investigated.

Follow-Up Study Procedures

Subjects (N-36) participated in focus group prior to the start and at the end of the academic swim season the year following the initial study. Twenty-four of the thirty-six were returning swimmers who participated in the original study. All subjects met the initial study participant criteria previously described. The first focus group of the follow-up study discussed the emerging theme extracted from the initial study of cost concerns of a WFPB,

and lack of good tasting plant-based foods on campus. It was determined that these barriers still existed, prohibiting the adoption and consumption of a WFPB eating pattern by subjects. This led to the provision of WFPB breakfast foods for subjects at the end of weekday practices throughout the academic season. The breakfast consisted of oatmeal, bagels, toppings of nuts and seeds, peanut and almond butters, soy and almond milks, 100% fruit jam, dried fruit, and spices. The campus Board Certified Specialist in Sports Dietetics (CSSD) was in attendance for three breakfasts each week providing casual nutrition education, shopping and cooking tips, and observation of consumption patterns. Observational field notes were recorded. In addition to the weekday breakfast meals, a WFPB pre-competition meal was provided at a home meet during the season. A second focus group was held at end of the academic swim season to analyze the acceptance of the study, and to evaluate if removal of barriers of cost and access of WFPB foods impacted the attitudes and perception of a WFPB diet on athletic performance.

Observational Field Notes Summary

The CSSD was present three of the five days per week that breakfast was provide in the follow-up study. In order to minimalize the "researcher effect" it was made known that the CSSD followed an omnivore dietary pattern, not an exclusively plant-based diet. The majority of the athletes consuming the provided breakfast on a regular basis were female. Average estimated intake per person was 1.5 cups of cooked oatmeal with the addition of 1-2 tablespoons of peanut butter or nuts, 1-2 Tablespoons of dried fruit and 2 Tablespoons of non-dairy milk, or one large whole grain bagel with 1-2 Tablespoons of peanut butter. Total estimated nutrient profile of the average intakes, calculated using the ESHEA Food Processing program for the oatmeal and bagel selection were 420 kcal, 63 g carbohydrate, 14 g protein, and 14 g fat, and 440 kcal, 58 grams carbohydrate, 19 grams protein, and 18 grams of fat respectively. Informal conversations on the benefits of a WFPB diet was held at each meal. The athletes seemed eager to try new food items when available. Most athletes expressed appreciation for the meal, commenting they felt it had a positive impact on their recovery. Some athletes reported using the foods as their "recovery meal", reporting consuming a second "breakfast" at the school cafeteria. Suggestions were made to include eggs, cow's milk, and cheese to the breakfast offering to increase the protein options.

Follow-Up Study Qualitative Results

The follow-up study focus group were coded and themed. Three emerging themes came from the second focus group of the follow-up study: plant-based proteins alone are not sufficient for athletic performance, eating a plant-based diet can be easy and affordable, and stressing "healthy eating" will get better results than stressing "WFPB" eating. The themes were supported by quotes from the athletes including:

- "WFPB eating is ok, but not all the time"
- "Use the term "plant-based" "Vegan is too restrictive"
- "If WFPB are given to me I will eat it, but I won't go out of my way to find them"
- "I ate the oatmeal because it was there, but I still went to the café to get eggs"

- "Plant-based is ok for the off season, but an athlete needs meat and chicken during the season"
- "I started buying the stuff we made last year and it is very cheap and good"
- "Honestly I'm just tired after practice. I'm just going to grab whatever is easiest and you have a bunch of work to do."

Discussion

The joint position statement of The Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine**:** Nutrition and Athletic Performance recognizes the necessity to personalize nutrition eating patterns to meet the specific needs of the athlete**,** including but not limited to basic energy requirements, performance goals, logistical challenges and personal preferences (6). The position supports a vegetarian diet as being "nutritionally adequate containing high intakes of fruits, vegetables, whole grains, nuts, soy products, fiber, phytochemicals, and antioxidants" (6).

Energy availability, the amount of energy available to support growth, repair, maintenance, and recovery, is based on energy intake minus the cost of exercise (6). Adequate energy availability must be achieved to support athletic performance. WFPB diets can provide adequate energy but must be properly planned to ensure the adequate intake of n-3 fatty acids, iron, zinc, iodine, calcium, vitamin D, and vitamin B12 (5, 7). Inclusion of foods and supplements listed in **Table 2** provide nutrients that may be low in a WFPB diet (5). Consultation with a Registered Dietitian/Nutritionist (RDN) or Board-Certified Specialist in Sports Dietetics (CSSD) can guide the athlete in personalizing a WFPB diet ensuring it meets all nutrient recommendations for athletic performance.

Table 2: Nutrients to include to ensure adequate intake

Nutrient	**Include in diet to ensure adequate intake**
Omega 3-Fatty Acids	Flax, chia, and hemp seeds. Walnuts, walnut and canola oil
Iron	Iron fortified cereal. Supplementation under physician recommendation and guidance
Iodine	Iodized sea salt, sea vegetables
Calcium	Dairy products, calcium-set tofu, fortified plant-based milk
Vitamin D	Exposure to sunlight, dairy products, fortified foods. Supplementation of 1,000-2,000 IU
Vitamin B-12	Eggs, B-12 fortified foods, B-12 supplements
Zinc	Legumes, soy, grains, seeds, nuts, and cheese

The joint position delineates carbohydrate as the nutrient of choice for athletic performance, acting as the primary fuel for the brain and central nervous system (8). Carbohydrate stores in the body are limited but can be easily manipulated by dietary intake and recovery practices. The WFPB diet is predominately carbohydrate making it conducive to support athletic performance. Prolonged**,** sustained**,** or intermittent high-intensity exercise can be enhanced by strategies that maintain high carbohydrate availability**.** This includes pre and post exercise carbohydrate fueling in addit**i**on to a high carbohydrate diet, that can be achieved by a WFPB diet. Carbohydrate recommendations for athletic performance range from 5-12 g/kg per day. **Table 3** outlines levels of carbohydrate recommendations (8).

Table 3. Carbohydrate Recommendations for Athletic Performance

Activity Level	**Light** Low intensity or skill-based activities	**Moderate** ~ 1h/day	**High** 1-3 h/d of moderate to high intensity	**Very High** >4-5 h/d of moderate to high intensity
Carbohydrate	3-5 g/kg/d	5-7 g/kg/d	6-10g/kg/d	8-12/kg/d

It is a common misconception that a WFPB diet do not provide sufficient amounts of protein. Approximately 40% consume protein supplements [6]. Regular consumption of plant foods, nuts, beans, legumes and soy foods will provide adequate amounts of dietary protein. Protein guidelines are no longer solely categorized to the "strength" or "endurance" athlete, but should be based on adaptation specific training, energy and nutrient needs, personal goal, and dietary preferences (8). More important is adequate energy consumption, especially from carbohydrate, which spare amino acids from oxidation, allowing them to be readily available for protein synthesis. General recommended dietary protein intake to support athletic performance ranges from 1.2 to 2.0 g/kg/day (8).

It is hypothesized that chronic training increases cellular oxidative stress (8). Antioxidants are known to play an important role in protecting cells from oxidative stress, however little evidence exists on antioxidant supplementation and athletic performance (8). Student athletes consume dietary supplements for a variety of reasons including health improvement and compensation for a poor diet [4]. A study of well-trained half-marathon athletes who supplemented with a daily spinach dosage of 1g/kg, found "alleviating effects on known markers of oxidative stress and muscle damage" and concluded that the enhanced recovery may be credited to spinach's promotion of antioxidant capacity [2]. Studies using juices derived from antioxidant-rich foods have demonstrated the importance of regular fruit consumption. Black currant nectar supplementation has been shown to reduce muscle soreness biomarkers in weight-lifting college students, grape juice

supplementation can increase "time-to-exhaustion" (endurance) and antioxidant activity while possibly decreasing inflammatory markers, and tart cherry juice has been found to be "accelerate the recovery of a number of functional performance measures following prolonger intermittent sprint activity" [1,3,9]. A 2015 review of dietary supplement by athletes, concluded that athletes should ask a series of questions before considering supplementation including, "Is my diet all that it could be in terms of eating a variety of healthy foods, including at least five servings of fruits and vegetables each day?" (6). The WFPB eating pattern is rich in antioxidants and is considered the "safest and most effective strategy" in addressing micronutrient antioxidant needs of the athlete (8). Athletes may benefit from a WFPB diet, meeting their nutrient needs without the excessive cost and without the risk of violating NCAA guidelines by consuming unregulated supplements.

Summary and Conclusion

Swimmers continued to have doubts about the sufficient availability of protein in a plant-based diet but believed eating a plant-based diet can be easy and affordable. Swimmers indicated that convenience is a major factor on food choices and still gravitate towards the food that's most readily available to them, justifying the need for future studies on the accessibility to foods most appropriate for athletic recovery. This supports the hypothesis that removal of barriers of inadequate access of plant-based foods and cost may improve the attitudes, perceptions, and adoption of a plant-based diet in collegiate swimmers. There is limited literature on the WFPB/vegan diet in reference to athletic performance, however research suggests adoption of this eating pattern will aid in providing ample carbohydrate and nutrients that are beneficial to recovery (1,2,3,7). Special consideration of food selection must be made to ensure the WFPB diet is nutritionally adequate to support basic and athletic performance requirements; athletes should seek consultation with a registered dietitian (RDN) or Board-Certified Specialist in Sports Dietetics to ensure CSSD to ensure their diet is sufficient in energy and nutrient recommendations (5,7). Many Division II swimming programs are utilizing the NCAA's allotted 20 training hours/week, leading many athletes to look for an edge when it comes to recovery. Studies suggest the daily inclusion of fruits and vegetables in an athlete's diet, even when consumed in juice form for convenience, may be that edge (12,3,7). Currently, research is lacking regarding the influence on athletic performance from long-term vegetarianism among athletic populations, thus a need for further research on this topic.

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