



Research Article

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# Nutrition and Mental Health Outcomes for Female College Athletes and the Impact of an Interprofessional Approach for NCAA Programs



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## Abstract

Previous studies point to the recurring association between nutrition and mental health for various populations. As such, a higher diet quality is often associated with better mental health and a lower diet quality is linked to poorer mental health. College student athletes have been identified as one of the most susceptible populations to high levels of physiological and psychological stress. Specifically, studies point to significant complications for female college athletes including higher rates of anxiety, depression, and lowered diet quality. Despite this, there is no review yet published detailing the relationship between nutrition and mental health outcomes for female college athletes. Therefore, the objective of this review is to investigate the interactions of these health markers for women in college sports. PubMed was utilized to review literature published up to January 30, 2023.

Key search words were grouped into the areas of diet quality, mental health, and athletics. Inclusion criteria included female athletes and prospective, present, or previous NCAA student-athletes. Exclusion criteria involved research concerning males, unless differences between men and women were specified, and any topics not related to mental health and nutrition status. The preliminary search totaled 3,272 articles and analysis left four articles included in the study synthesis. Two recurring topics appeared: dietary pattern analysis and individualized nutrient intake. Dietary pattern analysis outcomes demonstrated that attention to nutrition and both unhealthy and healthy dietary habits were significantly associated with elevated levels of psychological distress for female collegiate athletes. Individualized nutrient intake outcomes indicated that higher levels of polyunsaturated fatty acids and vitamin D in the diet may be protective against stress and anxiety for female college athletes. This literature review provides evidence suggesting female college athletes require greater care in these domains. More rigorous observational studies or randomized control trials are needed to confirm relationship findings.

**Keywords:** Nutrition; Diet Quality; Mental Health; Athlete; Female

**Abbreviations:** CDC: Center for Disease Control; NCAA: National Collegiate Athletic Association; REDS: Relative Energy Deficiency Syndrome; BSI: Brief Symptom Inventory; PSS: Perceived Stress Scale; APSQ: Athlete Psychological Strain Questionnaire; DASS: Depression Anxiety and Stress Scale; CSS: COVID Stress Scales; HEI: Healthy Eating Index; PUFAs: Polyunsaturated Fatty Acids; ALA: Alpha Linolenic Acid; EPA: Eicosapentaenoic Acid; DHA: Docosahexaenoic Acid; LA: Linoleic Acid; AA: Arachidonic Acid; BAI: Beck Anxiety Inventory; SAS: Sport Anxiety Scale; MTS: Mental Toughness Scale; STAI: State and Trait Anxiety Inventory; GLMM: Generalized Linear Mixed Model

## Introduction

Research continually points to a cyclical relationship between nutrition status and mental health [1-5]. For many individuals, severe and chronic psychological distress leads to poor lifestyle choices and consequent decreased quality of life [6,7]. Often, this can be exemplified through nutrition behaviors such as a lack in adequate fruits, vegetables, whole grains, and lean proteins, all necessary components of a balanced diet to promote health [8]. In fact, numerous studies reveal a consistent trend

of higher diet quality relating to better mental health outcomes as well as decreased diet quality associated with poorer mental health outcomes [9-11]. Without a proper understanding of the interrelated nature of nutrition status and mental health, populations are left susceptible to various debilitating and chronic diseases. The Center for Disease Control (CDC) specifically warns against poor nutrition outcomes that can manifest from and into mental health issues involving overweight and obesity, heart disease, stroke, type 2 diabetes, and cancer [12].

Moreover, hyper-scheduled and highly pressured college athletes often have a greater predisposition to both nutrition and mental health issues than the general population [13] leaving them at an increased risk for numerous health complications that can evolve into chronic conditions. To help student-athletes succeed, institutions support their athletes with a network of professionals including coaches, trainers, and other staff to optimize performance. However, the relationship between mental health and diet quality are not emphasized nearly to the same degree as training, competition, and recovery [14,15]. In fact, the National Collegiate Athletic Association (NCAA) only requires a medical doctor and athletic trainer be on staff with limited support in place regarding the relationship between dietary and mental health [16]. As a result, collegiate athletes are left with complications impacting their lifelong health that may never receive proper care [17,18].

Unfortunately, college student-athletes are a population whose wellbeing is overlooked because of the stereotypical expectation to push through adversity but whose health can end up compromised as a result [19,20]. Due to the competitive nature of the NCAA, student-athletes have become conditioned to withhold signs of weakness that naturally arise from the stressors that accompany academic, athletic, and social pressures [21]. Consequently, student-athletes are more at-risk to underreport mental health concerns and underutilize counseling services. The lack of concern for mental health issues can then manifest to impact physical health even more than outright athletic injuries [22]. Considering the immense, multifaceted strains placed on student-athletes, the group is pinpointed as a high-risk population for both nutritional and mental health issues that needs much greater attention [23].

Exhaustion from high levels of competitive pressure for college athletes often leads to health risks including insufficient sleep, poor eating habits, severe fatigue [24] digestive issues, heightened anxiety, and more. Over time, this depleted state of wellbeing can result in severe physical issues such as heart disease, obesity, substance misuse, and eating disorders. Specific to women's sports, stress-related nutrition status is a growing area of concern as an increased number of athletes are developing insufficient bone health, amenorrhea, and other complications because of psychological struggles that evolve into physical consequences [25]. Additionally, the stigmatization society places on college-aged women and their bodies [26] particularly in the realm of aesthetic sports where body ideals exist [27,28] can heighten the aggressive cycle of stress and worsened health outcomes [29].

### Female College Athletes

Female collegiate athletes are pushed to maintain a top-tier level of athleticism where they must sustain a fine balance between peak fitness and optimal health. Different from men, women have unique signs and symptoms of imbalanced health that can show

up due to the impact stress has on their physiology. Physical, tangible examples of these health manifestations can include menstrual irregularities, loss of bone density, iron deficiency, impaired hydration status, shifts in body fat percentages, eating disorders, and Relative Energy Deficiency Syndrome (RED-S) [30]. Studies indicate that as many as half of all female athletes in aesthetic sports present with these symptoms. Evidently, the demands of collegiate athletics places both women's bodies and minds under immense levels of stress making it challenging to maintain homeostatic balance.

In fact, recent use of the NCAA's Growth, Opportunities, Aspirations, and Learning of Students survey demonstrates that 27.3% of collegiate athletes report clinically significant symptoms of mental health complications with depression and anxiety rates higher among females compared to males [31]. Given the strong connection between diet and mental health, along with the specific demands of collegiate athletics that impact diet and mental health, understanding the relationship between these two factors could help improve the overall health of female collegiate athletes and inform decisions regarding necessary medical staff inclusions for NCAA medical teams. However, several studies have pointed out the need for greater understanding and support regarding mental health and nutrition for the female college athlete population [32,33].

To the best of our knowledge, no review has explored the body of literature on the topic of nutrition and mental health outcomes for female college athletes. It is hypothesized that an extensive literature review will reveal a strong association between the two factors. Highlighting this relationship will be critical for advocacy efforts aimed at additional support for female student-athletes in the areas of nutrition and mental health to help improve their diet, performance, and overall health.

### Materials and Methods

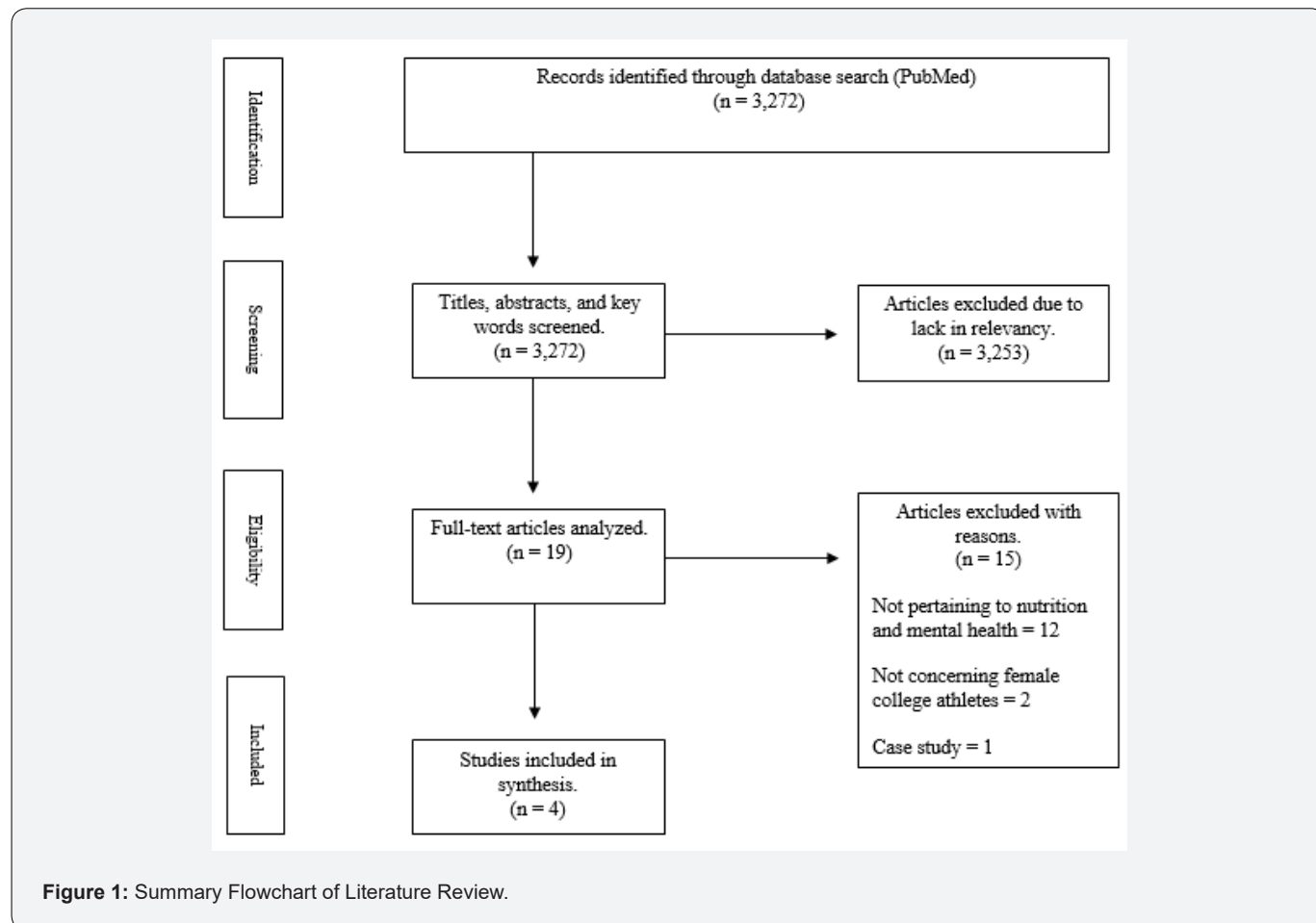
The search included a review of articles published up to January 30, 2023. PubMed was the database used to identify relevant research. Within the database, we combined keywords of: (nutrition OR "diet quality" OR diet OR food) AND (mental health OR mental wellbeing OR depression OR anxiety OR "eating disorder" OR "disordered eating") AND (athletes OR athletics OR sports). To identify applicable literature, only studies that involved female athletes were included, excluding research relating to males from the review unless the differences between genders were assessed. Additionally, the population had to involve student-athletes who are, will soon be, or have been on a team roster for a NCAA program, regardless of the division [34]. Finally, studies with a purpose to understand the complex nature of mental health and nutrition status were included and all other topics excluded.

### Results

The results of the preliminary search totaled 3,272 articles. An initial identification was performed by screening titles, abstracts,

and key words which excluded 3,253, leaving 19 articles. The eligibility of the 19 studies was assessed via thorough review of the full-text articles. Exclusions were made for 15 articles based on: 12 not pertaining to nutrition and mental health, two not concerning female college athletes, and one case study. Finally,

four papers (Figure 1) met the specific inclusion criteria to be included in this review (Table 1). Next, synthesis, analysis, and presentation will be delivered in a thematic manner on recurring topics from the literature.



### Dietary Patterns and Mental Health Status

Emerging evidence utilizes dietary pattern analysis to assess the relationship between diet and disease. The pattern analysis approach is intended to characterize a broader view of overall diet composition as compared to individualized foods or nutrients [35]. It is hypothesized that this method of diet analysis may be more predictive of diseases or risks of diseases because a diet is comprised of a combination of foods and nutrients, i.e., dietary patterns, as opposed to a singular source [36]. These eating patterns can be grouped according to either a priori criteria or empirically and further evaluated a posteriori. Two of the articles assessed for the present review consider the relationship between dietary patterns and mental health outcomes. In a 2021 study by de Souza et al., 183 prospective NCAA student athletes were assessed to examine how health behaviors including eating, sleeping, substance use, sexual, and aggressive behaviors impact mental health functioning.

Collegiate athletes completed a 150-item health behavior survey that covered the co-occurring health behaviors. Specific to eating behaviors, participants responded to three items regarding meals, eight items on types of food, five on hydration, and five on attention to nutrition to establish a posteriori pattern. Regarding mental health, The Brief Symptom Inventory-18 (BSI-18) assessed the severity of psychological distress including depression, anxiety, and somatization. Additionally, the 4-item Perceived Stress Scale (PSS) was used to gauge levels of stress.

Partial least squares modeling was applied to assess the simultaneous relationships between health behaviors, dietary patterns, and mental health functioning between male and female athletes. Latent variable research findings demonstrate attention to nutrition, unhealthy dietary habits, and lower alcohol use are significantly related to higher psychological distress among female athletes ( $p = .002$ ). This study therefore reveals that female college athletes have specific links between heightened

psychological distress and poorer dietary patterns. Contrast to their male counterparts, female college athletes were found to have greater mental health issues due to a large presence of eating disorders, depression, and body or weight dissatisfaction.

At the same time, however, female student-athletes were found to receive and maintain higher levels of nutrition knowledge compared to males.

**Table 1:** Summary Table of Articles Demonstrating Nutrition and Mental Health Outcomes for Female College Athletes.

Title (Author)	Population	Test	Main Outcomes	Significance
Associations among omega-3 fatty acid status, anxiety, and mental toughness in female collegiate athletes (Wilson P, Madrigal L., 2017) [2]	54 female Division I NCAA athletes	Fatty acid blood measure; food frequency questionnaire (FFQ); Beck Anxiety Inventory (BAI); Sport Anxiety Scale (SAS-2); Mental Toughness Scale (MTS)	Blood levels of PUFAs, EPAs, and DHAs negatively correlated with BAI scores; dietary intakes of EPA and DHA negatively correlated with BAI scores; blood DHA positively correlated with MTS; neither blood nor dietary fatty acids correlated with SAS-2 scores.	Blood and dietary omega-3 fatty acid levels are associated with general but not sport-specific anxiety in female college athletes during the off-season.
Diet quality and mental health status among D1 female collegiate athletes during the Covid-19 pandemic (Christensen N. et al., 2021) [3]	77 female Division I NCAA athletes	Depression Anxiety and Stress Scale (DASS-21); Athlete Psychological Strain Questionnaire (APSQ); COVID Stress Scales (CSS); Diet History Questionnaire (DHQ-III)	Healthy Eating Index (HEI) scores were higher for athletes with poorer mental health; HEI scores were positively associated with stress, performance concerns, CSS components of danger, contamination, and traumatic stress.	Improved diet quality is associated with poor mental health in female college athletes.
Increased vitamin D intake may reduce psychological anxiety and the incidence of menstrual irregularities in female athletes (Miyamoto M, Hanatani Y, Shibuya K, 2022) [4]	107 female athletes (41 college-level; 66 international-level)	Dietary intake analysis via meal recording, dietitian review, and Japan National Nutrient Database or nutrition facts panels; Body mass and body fat percentage using home scales; State and Trait Anxiety Inventory (STAI); Menstrual cycle tracking and reporting via paper/pen/calendar	Higher levels of vitamin D associated with decreased mental anxiety and incidence of menstrual irregularities; participants also had normal BMI, BF%, and sufficient levels of calories, macronutrients, and micronutrients.	Vitamin D may effectively reduce mental anxiety and menstrual irregularities for female college and professional athletes.
Patterns of health behaviors affecting mental health in collegiate athletes (de Souza, N et al., 2021) [5]	183 prospective Division I NCAA athletes (54.6% male, 45.4% female)	150-item health behavior survey covering eating and hydration, fatigue and sleeping habits, aggressive behaviors, sexual behaviors, and substance use behaviors; Brief Symptom Inventory-18 (BSI-18); 4-item Perceived Stress Scale (PSS)	No significant differences between mental health outcomes for males and females; females had higher healthy factor scores and total attention to nutrition score; higher psychological distress associated with unhealthy dietary habits, reduced attention to nutrition, and less frequent alcohol use among females.	Attention to nutrition, unhealthy dietary habits, and lower alcohol use is related to psychological distress in female college athletes.

Healthier dietary patterns based on this nutrition knowledge are typically thought to serve as an indicator for improved self-perception, overall health, and decreased mental health issues, however, the opposite was found to be true in this research. Additionally, counter to study expectations, more frequent alcohol consumption was correlated with social connectedness which may assist in mediating psychological distress. Due to the observational design of this study, causal relationships are

challenging to determine because of the presence of residual confounding. Furthermore, the research took place among student-athletes at a single university prior to their enrollment in the athletic programs. Nevertheless, the observations of this study promote the necessity for further research on dietary patterns as an objective measure for mental health outcomes among female college athletes. The results also allude to the need for supplementary support and assist in laying the foundation

for the integration of an interprofessional approach within NCAA programs to leverage the skills of medical experts in the areas of diet quality and mental health.

Based on the high prevalence of disordered eating patterns and mental distress demonstrated in research, Christensen et al. sought to examine the association between diet quality and mental health for female college athletes. 77 female collegiate athletes were recruited to the study to complete three online questionnaires including the Athlete Psychological Strain Questionnaire (APSQ), Depression Anxiety and Stress Scale (DASS-21), and COVID Stress Scales (CSS). The DASS-21 was utilized to assess levels of depression, anxiety, and stress with subcategories relevant to each. The APSQ was used to specifically target the athlete population by asking questions pertaining to issues such as sport pressures or injury. The CSS was included to understand the impact of Covid-19 on stress through measures such as danger, socioeconomic consequences, traumatic stress, and contamination. The questionnaires were designed to be scored as either a total number and/or subscale values to represent the corresponding level of mental health, with high scores representing a greater level of distress for each. Additionally, the Diet History Questionnaire (DHQ-III) was included to gauge the diet quality of the subjects by using a food frequency questionnaire of the last month with corresponding portion sizes. From the DHQ-III a priori Healthy Eating Index (HEI) scores were established for the athletes.

Study outcomes found that there were significant differences between the HEI with the DASS-21 ( $p = .015$ ), the APSQ related to performance concerns ( $p = .048$ ), and the CSS pertaining to traumatic stress ( $p = .003$ ). Unexpectedly, study participants who reported poorer mental health in the questionnaires consistently had higher HEI scores. These results suggest that higher dietary quality or enhanced dietary pattern analysis is associated with elevated levels of stress for female collegiate athletes. Though this outcome is counter to the study hypothesis, Christensen et al. suggest the issues of food-body relationships, response bias, impact of Covid-19, presence of research staff during study, length of questionnaires, and limited sample size to be possible reasons to explain this outcome.

In addition to the potential limitations the authors list, it is also worth considering the cross-sectional design of this study. While the researchers assess the demographics and key variables for the female student athletes, there is no appropriate analysis that effectively adjusts for potential covariates. Therefore, while the outcomes of the study suggest an inverse relationship between healthy dietary patterns and psychological distress, the results should be interpreted with caution of potential residual confounding. Still, the conclusions point to future initiatives to assist female college athletes in establishing well-rounded health

through nutrition education to optimize mental health outcomes.

### Individualized Nutrient Intake and Mental Health Status

The evaluation of individualized nutrient intakes enables researchers to draw conclusions about specific dietary components impact on human health status [37]. Different from dietary pattern analysis, nutrient intake measures assess the relationship of macronutrient or micronutrient interaction on health by attempting to isolate singular nutrients, not the combination of multiple food sources. Two studies included in this review pertain to the relationship between individualized nutrient intake and mental health status in female college athletes. Omega-3 polyunsaturated fatty acids (PUFAs) are a specific dietary component that have been identified to assist in modifying anxiety, and a 2017 study by Wilson and Madrigal assessed the associations of omega-3 PUFA levels and psychological measures for female college athletes.

The study included 54 female Division I NCAA athletes of various collegiate sports who had their dietary and serum fatty acid levels measured. Food frequency questionnaires were utilized to estimate subject's consumption of foods rich in omega-3 PUFAs over the last six months. Additionally, intake of any omega-3 PUFA containing supplements was assessed. Whole dried blood spots measured included alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and docosapentaenoic acid (DPA). A sum of EPA and DHA was quantified, represented as the HS-Omega-3 Index. Omega-6 PUFAs linoleic acid (LA) and arachidonic acid (AA) were also included. Next, the Beck Anxiety Inventory (BAI), 15-item Sport Anxiety Scale-2 (SAS-2), and 11-item Mental Toughness Scale (MTS) were delivered. The BAI was used to assess general anxiety, the SAS-2 to evaluate sport-specific anxiety, and MTS to evaluate resiliency and perseverance related to competition and training.

The results of the study demonstrated that higher levels of dietary EPA ( $p = .007$ ) and DHA ( $p = .02$ ) were correlated with lower BAI scores. Furthermore, increased HS-Omega-3 Index ( $p = .02$ ), EPA ( $p = .003$ ), and DHA ( $p = .02$ ) levels were also associated with lower BAI scores. DPA was the only blood PUFA associated with MTS scores ( $p = .049$ ) where greater blood levels were protective for mental health. Interestingly, none of the fatty acid levels were significantly correlated with SAS-2 scores. Overall, the study suggests that both blood and dietary omega-3 PUFAs specifically in the forms of EPA, DHA, and DPA likely have protective effects against anxiety for female college athletes. As a population prone to high levels of mental distress, the support of the study's hypothesis is helpful for healthcare professionals working with female college athletes to make suggestions for foods rich in omega-3 PUFAs such as fatty fish, walnuts, or supplementation of EPA, ALA, and DHA according to the study's

median findings for protective PUFA levels over six months at 31 mg EPA, 49 mg ALA, and 49 mg DHA.

However, the association of sport-specific anxiety was not significant in the study and might be due to the research occurring during the off-season or with athletes who are well-conditioned to competition anxiety. Though these outcomes are beneficial for NCAA programs to consider with the inclusion of an interprofessional approach, the ability to make causal inferences is challenging. While fatty acid consumption is apt to a balanced diet and therefore improved mental functioning, the study fails to consider other dietary, behavioral, and lifestyle factors that may serve as covariates and skew the results. Similarly, Miyamoto et al. looked at the effect that dietary intake of vitamin D has on psychological anxiety and menstrual function. Prior research demonstrates that vitamin D deficiency has been tied to major depression, premenstrual mood symptoms, and mood and cognitive disorders among women and older adults. As such, this study aimed at understanding the multifaceted relationship of the nutrient intake and mental health outcomes for 107 female athletes, 41 collegiate track and field, and 66 international rowers.

Participants tracked their intake through meal recording including pictures of meals, analysis by dietitians, and the Japan National Nutrient Database or other product-specific nutrition fact panels. Average intakes of the athletes including calories, macronutrients, and micronutrients were determined as well as body mass, body fat percentage, and menstrual cycles. Additionally, mental wellbeing was measured via the State and Trait Anxiety Inventory (STAI). The mean dietary intake levels were 2,487.6 calories, 108.5 g protein, 321.1 g carbohydrates, 12.4 mg iron, 786.2 mg calcium, and 8.8 ug vitamin D. The female athletes had normal body mass indexes and body fat percentages. Outcomes of the STAI demonstrated that 75 female athletes exhibited mental anxiety. Through a generalized linear mixed model (GLMM), a significant association was found among menstrual irregularities, vitamin D intake, and anxiety ( $p = .049$ ). As a result, the research concludes that vitamin D consumption of 8.8 ug or greater may be effective to reduce mental anxiety and decrease the incidence of menstrual irregularities for female athletes at the collegiate and professional level.

Though the outcomes are influential for medical professionals working with female college athletes to consider when associating nutrient intake to mental health status, the study does not comment on the various other components of the women's diets that may influence these health outcomes. For example, the researchers conclude that the vitamin D was the most effective component to mitigate mental distress and regulate menstrual function while other existing literature points to iron as an effective nutrient. This could pose an argument as to why dietary patterns provide a more holistic view of nutrition status based on interactions of multiple nutrients in the diet. Ultimately, there

are limited details of the results and analysis provided. Therefore, future longitudinal studies that assess both dietary and blood levels may be beneficial to better understand the impact of vitamin D on mental health status. The study does, however, point to the importance of vitamin D in a well-rounded dietary approach that will require education from interprofessional medical teams for female student athletes to see advantageous improvements in their overall health.

### Discussion

This review of current literature provides evidence of associations between diet quality and mental health outcomes in female college athletes and understanding this association has the potential to improve the overall health and wellbeing for the population. Notably, de Souza et al. revealed that attention to nutrition, unhealthy dietary habits, and lower alcohol consumption increase psychological distress for the population. Because student-athletes are more likely to withhold signs of mental illness and women are more prone to disordered eating, body or weight dissatisfaction, and body image stressors, support in the areas of nutrition and mental health are crucial. As Christensen et al. found, this strict focus on food, body, and weight concerns could explain why female college athletes report with improved HEI scores that are in turn associated with higher levels of mental distress. Together, both dietary pattern studies point to the need for an interprofessional approach comprised of healthcare professionals such as registered dietitians and psychologists or licensed counselors/therapists to address the significant relationship that exists between eating patterns and mental health status. Ideally, the inclusion of best practices through greater resources can be established to educate and improve the lifelong health of female college athletes.

Individualized nutrient intake studies also demonstrate relationships between healthy dietary practices and improved mental health. Wilson and Madrigal uncovered the preventative effects of both dietary and serum omega-3 PUFA status on mental health outcomes, pointing to the inclusion of foods rich in EPA, ALA, and DHA or the use of supplements to improve anxiety for female college athletes. Furthermore, Miyamoto et al. found that vitamin D is protective against both mental and physical health for female college athletes. As such, it is suggestive that food sources high in vitamin D such as egg yolks, fatty fish, fortified beverages, or the use of supplementation may be advantageous to alleviate anxiety. Again, assistance from professionals on the NCAA sports medicine teams will be vital to assist with the dissemination of the education to assist in reaping long-term outcomes. While the results of the literature included in this review provide important insights for advances in the field, it is worth noting how prospective studies could strengthen the argument for an interprofessional team among the female college athlete population. Suggestions for future research involve the development of randomized control

trials to effectively assess discrete relationships among diet and mental health outcomes.

At the very least, more rigorous observational research designs that control residual confounding should be implemented, a key limiting factor in the literature reviewed. Larger sample sizes and longer study timelines will also be helpful in effectively identifying conclusions in either research design. Nevertheless, the results of the studies included in this review are helpful to provide suggestions for the governing NCAA body to consider in initiating better care for female student athletes' total health. The evidence makes an overarching call to action for the inclusion of an interprofessional medical team, with specific consideration to registered dietitians and psychologists or licensed counselors/therapists, who have been formally trained on the education and counseling needed for routine interactions with female college athletes. If female collegiate athletes are better supported regarding their diet and mental health, it is evident that their improved health can make lasting impacts for their lifelong health.

## References

- McCabe E, Ketcham C, Hall E (2021) Good Food, Good Mood: Perspectives on the Relationship Between Nutrition and Mental Health with Division I Collegiate Athletic Programs. *Front Sports Act Living* 3: 692601.
- Wilson P, Madrigal L (2017) Associations among Omega-3 Fatty Acid Status, Anxiety, and Mental Toughness in Female Collegiate Athletes. *J Am Coll Nutr* 36(8): 602-607.
- Christensen N, Van Woerden I, Aubuchon Endsley N, Fleckenstein P, Olsen J, et al. (2021) Diet Quality and Mental Health Status among Division 1 Female Collegiate Athletes during the COVID-19 Pandemic. *Int J Environ Res Public Health* 18(24): 13377.
- Miyamoto M, Hanatani Y, Shibuya K (2022) Increased vitamin D intake may reduce psychological anxiety and the incidence of menstrual irregularities in female athletes. *PeerJ* 10: e14456.
- De Souza N, Esopenko C, Conway F, Todar S, Buckman J (2021) Patterns of health behaviors affecting mental health in collegiate athletes. *J Am Coll Health* 69(5): 495-502.
- Yau Y, Potenza M (2013) Stress and Eating Behaviors. *Minerva Endocrinol* 38(3): 255-267.
- Hill D, Conner M, Clancy F, Rachael M, Wilding S, et al. (2022) Stress and eating behaviours in healthy adults: a systematic review and meta-analysis. *Health Psychol Rev* 16(2): 280-304.
- Głąbska D, Guzek D, Groele B, Gutkowska K (2020) Fruit and Vegetable Intake and Mental Health in Adults: A Systematic Review. *Nutrients* 12(1): 115.
- ONeil A, Berk M, Itsiopoulos C, Castle D, Opie R, et al. (2013) A randomised, controlled trial of a dietary intervention for adults with major depression (the "SMILES" trial): study protocol. *BMC psychiatry* 13: 114.
- Rao T, Asha M, Ramesh B, Rao K (2008) Understanding nutrition, depression, and mental illnesses. *Indian Journal of Psychiatry* 50(2): 77-82.
- Lai J, Hiles S, Bisquera A, Hure A, McEvoy M, et al. (2014) A systematic review and meta-analysis of dietary patterns and depression in community-dwelling adults. *Am J Clin Nutr* 99(1): 181-197.
- (2022) Poor Nutrition. National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP), USA.
- Nattiv A, Puffer J, Green G. Lifestyles and health risks of collegiate athletes: a multi-center study. *Clinical journal of sport medicine* 7(4): 262-272.
- Kroshus E (2016) Variability in Institutional Screening Practices Related to Collegiate Student-Athlete Mental Health. *J Athl Train* 51(5): 389-397.
- Parks R, Helwig D, Dettmann J, Taggart T, Woodruff B, et al. Developing a Performance Nutrition Curriculum for Collegiate Athletics. *J Nutr Educ Behav* 48(6): 419-424.
- (2022) Athletics Health Care Administration Best Practices. NCAA, USA.
- Buckley G, Hall L, Lassemillante A, Ackerman K, Belski R (2019) Retired Athletes and the Intersection of Food and Body: A Systematic Literature Review Exploring Compensatory Behaviours and Body Change. *Nutrients* 11(6): 1395.
- Plateau C, Petrie T, Papatthomas A (2017) Learning to eat again: Intuitive eating practices among retired female collegiate athletes. *Eating Disorders* 25(1): 92-98.
- Stamatis A, Deal P, Morgan G, Forsse JS, Papadakis Z, et al. (2020) Can athletes be tough yet compassionate to themselves? Practical implications for NCAA mental health best practice no. 4. *PLoS One* 15(12): e0244579.
- Perry C, Champ F, Macbeth J, Spandler H (2021) Mental health and elite female athletes: A scoping review. *Psychology of Sport and Exercise* 56: 101961.
- Lubarsky O (2022) The Invisible Competition: Athletics and Mental Health.
- Putukian M (2014) Mind, Body, and Sport: How being injured affects mental health. NCAA Sport Science Institute.
- Ward P, Shiyko M (2016) Identifying Stress Unique to College Athletes: Health Outcomes & Interventions. RISE.
- McFadden B, Walker A, Bozzini B, Hofacker M, Russell M, et al. (2022) Psychological and Physiological Changes in Response to the Cumulative Demands of a Women's Division I Collegiate Soccer Season. *J Strength Cond Res* 36(5): 1373-1382.
- (2022) Female Athletes at Risk for Nutritional Deficiencies. Rutgers, USA.
- Wells E, Chin A, Tacke J, Bunn J (2015) Risk of Disordered Eating Among Division I Female College Athletes. *Int J Exerc Sci* 8(3): 256-264.
- Carson T, Tournat T, Sonnevill K, Zernicke R, Karvonen-Gutierrez C (2021) Cultural and environmental associations with body image, diet and well-being in NCAA DI female distance runners: a qualitative analysis. *Br J Sports Med* 55(8): 433-437.
- Santo André H, Pinto A, Mazzolani B, Smaira FI, Ulian MD, et al. (2021) Can A Ballerina Eat Ice Cream?: A Mixed-Method Study on Eating Attitudes and Body Image in Female Ballet Dancers. *Front Nutr* 8: 665654.
- Riviere AJ, Leach R, Mann H, Robinson S, Burnett DO, et al. (2021) Nutrition Knowledge of Collegiate Athletes in the United States and the Impact of Sports Dietitians on Related Outcomes: A Narrative Review *Nutrients* 13(6): 1772.
- Gastrich M, Quick V, Bachmann G, Moriarty A (2020) Nutritional Risks Among Female Athletes. *Journal of women's health* 29(5): 693-702.
- Wolanin A, Hong E, Marks D, Panchoo K, Gross M (2016) Prevalence of clinically elevated depressive symptoms in college athletes and differences by gender and sport. *Br J Sports Med* 50(3): 167-171.

32. Fukushima K, Fukushima N, Sato H, Yokota J, Uchida K (2020) Association between nutritional level, menstrual-related symptoms, and mental health in female medical students. *PLoS One* 15(7): e0235909.
33. Carson T, West B, Sonnevile K, Zernicke RF, Clarke P, et al. (2023) Identifying latent classes of Relative Energy Deficiency in Sport (RED-S) consequences in a sample of collegiate female cross-country runners. *Br J Sports Med* 57(3): 153-159.
34. Swann C, Moran A, Piggott D (2015) Defining elite athletes: Issues in the study of expert performance in sport psychology. *Psychology of Sport and Exercise* 16: 3-14.
35. Hu F (2002) Dietary pattern analysis: a new direction in nutritional epidemiology. *Current Opinion in Lipidology* 13(1): 3-9.
36. Newby P, Tucker K (2004) Empirically derived eating patterns using factor or cluster analysis: a review. *Nutr Rev* 62(5): 177-203.
37. Bailey R (2021) Overview of Dietary Assessment Methods for Measuring Intakes of Foods, Beverages, and Dietary Supplements in Research Studies. *Curr Opin Biotechnol* 70: 91-96.



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