Report: FAN Study

Relationship of Finances, Nutritional Support, and Knowledge on Blood Health Indicator, Dietary Intake, and Quality of Life Among A Diverse Female Student-Athlete Population

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Abstract

Female athletes are more susceptible to nutritional inadequacies, compromising performance and health. Nutrition knowledge is associated with better dietary intake, yet lacking financial support and nutritional resources may serve as barriers to a wholesome diet. Direct finances and resources towards nutrition at various sport levels has yet to be examined within female athletics. This study examined 1) the relationship of finances, nutritional resources, and nutrition knowledge on blood health indicators, dietary intake, and quality of life among female athletes at the NCAA DI, NJCAA, and Club sport levels and 2) the role racial/ethnic background had in receiving financial support was also examined via predictive model, binary logistic regression. After approval of ASU IRB 124 participants (NCAA DI, n= 51; NJCAA, n= 36; Club, n= 37) provided blood health indicators (n= 78) and questionnaires (n= 120). The proportion of those receiving financial support were similar, though NJCAA female athletes 1) reported not having sufficient funds for food and had fewer meal options [$\chi_2(2)= 12.482$, $p= 0.002$, V= 0.321], 2) had poorer nutrition knowledge [H(2)= 16.935, $p< 0.001$, $\eta_2= 0.16$], 3) fewer nutritional resources [$\chi_2(2)= 99.944$, $p< 0.001$, V= 0.643], and 4) more likely recommended to see a dietitian in comparison to Club-Athletes and NCAA athletes at a Division I University. Differences in blood health indicators were not significantly different. Physical, mental and environmental health was significantly lower for NJCAA athletes compared to NCAA DI and Club athletes, $p< 0.005$. Minimal relationship between finances and nutritional resources were found, with expectation of nutritional resources positively impacting quality of life. One's race/ethnicity did not predict the type of aid being received. Efforts are need to improve the nutritional resources at the NJCAA sport level to best support performance and health.

Objectives/Purpose of Research

A lack of proper nutrition could lead to insecurity of health, impair training, and diminish optimal performance and well-being.[2-5,11,15] Athletes competing at the collegiate level report a lesser quality of life compared to non-athletes.[15] A deficiency in nutritious foods contributes to poor physiological health based on questionnaire and blood health findings,[2,16] however more research is needed about overall quality of life in relation to nutrition. Previous research has examined nutrition knowledge and dietary intake of athletes, yet have failed to include a diverse female athlete population.[5,13,15] Impaired financial situations may also contribute to an inadequate diet. Athletes have stated financial situations are a barrier in purchasing (high quality) foods,[6] potentially leading to poor dietary intake and health. While it is known differences exist in the amount of support college athletic divisions receive, such as the National Collegiate Athletic Association (NCAA), National Junior College Athletic Association ([NJCAA), and Club, direct insight in athlete finances towards nutrition is lacking.[7]

The **objective** of this study was to determine the relationship of finances, nutritional resources, and nutrition knowledge on blood health indicators, dietary intake, and quality of life among female athletes at the NCAA DI, NJCAA, and Club sport levels. The role racial/ethnic background had in receiving financial support was also examined via predictive model, binary logistic regression.

The success of this study could result in 1) detecting gaps of nutrition knowledge among all female athletes to develop education programs and resources, 2) promoting equity in allocating wholesome foods to all athletes, 3) increasing diversity in nutrition research

within female athlete populations, and 4) bringing awareness to athletic departments on the distribution of financial support to underserved and in-need athletes. The study's notion on equity of financial support to access wholesome nutrition goes beyond college level athletics, but to all programs globally promoting sports to athletes in need of proper nutrition.

Participants

After approval from the ASU IRB (STUDY00009976), the study was conducted between June through November of 2019. The study aimed to include N=100 female athletes from the NCAA DI, NCJAA, and Club sport levels (≥ 18 years old). One participant identified as a non-athlete and the data was dismissed. An equally distributed number of female athletes per sport level was targeted, with the distribution of race/ethnicity reflecting the 2016-2017 percentages seen within NCAA Divisions.[9]

Once approved, female athletes and their coaches/club presidents participating in the NCAA Division I, NJCAA, and Club sport levels at ASU and Mesa Community College received an e-mail from authorized athletic personnel, providing a brief description of the study and an invitation to review the informed consent. This allowed all female athletes and coaches/club presidents to have the study information and ensured all athletes had an equal opportunity in knowing a study was taking place. With a link to the informed consent or at a requested information meeting, participants were able to review and sign the informed consent if she chose. After informed consent was obtained, laboratory sessions were scheduled through Calendly (online scheduling software). For their time and efforts, participants were provided individual health profile information documents

to be given to their primary physician after signing an acknowledgment release form and received a $50.00 electronic gift card.

Research Design

The study was cross-sectional in design, entailing one 45-minute visit to the Athl*ea*t Field Lab at Sun Devil Stadium, Tempe or athletic training room at Mesa Community College, Mesa. Participants' height, weight, body max index (BMI), resting blood pressure, and fasted lipid and glucose levels (optional) were collected prior to four questionnaires; personal demographics, nutrition knowledge, dietary intake, and quality of life via web-based platform (Qualtrics).

Procedures

Physiological measurements

Fasted lipid and glucose levels (mg/dl) (i.e., total cholesterol, LDL, HDL, total cholesterol-HDL, triglycerides, fasted glucose) were collected in the early morning hours between 7:00-10:00 A.M. A finger prick was utilized to draw blood via straw, which was fed to a portable device to read lipid and glucose levels within eight minutes (CHOLESTECH LDX, Abbot, Hayward, CA, USA). BMI (%) and weight (Kg) were derived from a mobile device to provide an instant measurement (Omron Mobile BIA, Kyoto, Japan) and height (cm) with a mobile stadiometer (SECA 213 portable stadiometer, Hamburg, Deutschland). Resting blood pressure (mmHg) was conducted with participants seated and resting quietly for two minutes prior to measurement (Omron 907 portable automatic monitor, Kyoto, Japan).

Personal demographics

Age, race/ethnicity, sport involvement, competition level, training hours per week, years playing sport were gathered. Financial questions regarded aid type (i.e., University/Other Scholarship, FAFSA/Pell Grant/Loans, Athletic, Family, Books, Housing), aid amount, employment status and hours worked per week, and perceptions of being sufficiently financed. Nutritional resources included access to a dietitian and nutrition information, sources offering nutritional advice to the athletes, nutritional sources athletes sought, and provided meals and quantity per week. Perceptions of which nutritional resources should be offered were also gathered.

Sport Nutrition Knowledge Questionnaire [NSKQ]

The NSKQ consisted of knowledge related to weight-management (n= 13), macronutrients (n= 30), micronutrients (n= 13), and alcohol (n= 8). The subscales can be scored separately or tallied for a total knowledge score. The internal reliability (Kuder-Richardson-20+) for each subscale is reported as the following: weight-management 0.62, macronutrients 0.78, micronutrients 0.71, and alcohol 0.0.51. Using the Pearson's correlation formula, the test-retest reliability was found for weight-management r=0.0.81, macronutrients r= 0.0.81, micronutrients r= 0.76, and alcohol r= 0.66. A Cronbach's alpha was calculated for this study and found total knowledge score to be 0.85, revealing good internal consistency. A Cronbach's alpha for each subscale was found weight-management 0.51, macronutrients 0.70, micronutrients 0.69, and alcohol 0.59. Item deletion of each subscale was examined and deemed not to increase the reliability of the subscales, therefore all answers were used to calculate reported totals.[14]

Rapid Eating Assessment for Patients [REAP]

The REAP consists of n= 31 items regarding food frequency of meals (n= 2), grains (n= 1), fruits and vegetables (n= 2), dairy (n= 3), meats (n =5), fried foods (n= 1), snacks (n= 1), fats and oils (n= 3), sweets (n= 3), soft drinks (n= 1), sodium (n= 2), alcohol (n= 1), activity (n=1), and cooking behaviors (n= 3) per week along with attitudes toward behavior change (n= 1). Questions are formatted as yes/no or frequency categories of usually/often, sometimes, rarely/never, or does not apply to me. Answering five more times in the "usually/often" category scored an individual to be recommended a dietitian. For additional sport level comparisons, the answers were coded as usually/often and sometimes = 1, rarely/never and does not apply to me = 0, and blank answers as missing. The questions are phrased so "0" answers indicate healthier eating behaviors. The attitude question, "How willing are you to make changes in what, how, or how much you eat in order to eat healthier?" was on Likert-scale ranging from not at all willing (one) and very willing (five). REAP has previously shown to have good construct validity with NCAA DI athletes.[8]

World Health Organization Quality of Life Questionnaire Brief [WHOQOL-BRE]

The WHOQOL-BREF consists of 26 items regarding mental health (6 items), physical health (7 items), social relationships (3 items), and environmental health (8 items). Questions are formatted on a 5-point Likert-scale inquiring 'how much', 'how completely', how often', 'how good' or 'how satisfied' the participant felt in the last four weeks relative to the above domains. The WHOLQOL-BREF has a reported Cronbach's alpha for mental health 0.87, physical health 0.87, social relationships 0.69, and environmental health 0.84. A Cronbach's alpha was calculated for this study and found mental health 0.75,

physical health 0.72, social relationships 0.68, and environmental health0.82, revealing acceptable internal consistency.[12]

Statistical Analysis

For statistical analyses, SPSS version 25 was used. Personal demographics, finances, and nutritional resources were given as frequencies (n), percentages (%), mean ± standard deviation, and median (IQR). Blood health indicators (total cholesterol, LDL, HDL, total cholesterol-HDL, triglycerides [natural log], fasted glucose), nutritional knowledge, and quality of life (mental health, physical health, social relationships and environmental health) outcomes were checked for normal distribution. Results for blood health indicators were normally distributed and are presented as mean ± standard deviation. Nutritional knowledge and quality of life outcomes were not normally distributed, thus median and interquartile range (IQR) are given. Dietary intake outcomes are given as frequencies (n) and percentages (%) due to the categorical nature of the data. Chi-squares were conducted to examine proportional sport level differences in types of financial aid received, employment hours, nutritional resources available, and consumption of foods/drink items, with Cramer's V given as effect sizes for significant findings. Kruskal-Wallis tests examined sport level differences in monetary values, nutrition knowledge scores, and quality of life outcomes. One-Way ANOVAs were conducted to examine sport level differences in blood health. If a significant finding was found, Mann-Whitney U tests with a Bonferroni post-hoc analysis were used to determine which sport levels were significantly different. To determine relationships of finances, nutritional resources, and nutrition knowledge on blood health, dietary intake, and quality of life Spearman's correlation were examined, due to categorical and non-normal distributed data. Binary

logistic regression models were used to determine whether race/ethnicity predicted receiving types of financial support. All statistical analyses were performed with significance levels set at $p \leq 0.05$.

Results

A total of N= 124 female athletes (NCAA DI, n= 51; NJCAA, n= 36; Club, n= 37) participated in the study from the Phoenix area. Not all athletes delivered full measurement components. Of the 124 female athletes, N= 78 blood samples (NCAA DI, n= 21; NJCAA, n= 29; Club, n= 28), N= 121 demographic profiles NCAA DI, n= 51; NJCAA, n= 33; Club, n= 37), and N= 120 questionnaires (NCAA DI, n= 51; NJCAA, n= 32; Club, n= 37) were collected. Sport level group sizes were found not to be significantly different, $\chi_2(2)= 3.136$, $p< 0.208$. As expected, the group sizes for race/ethnicity were not equal, $\chi_2(5)= 184.107$, $p< 0.001$. Few identified as Asian/Pacific Islander (6%), Native American/American Indian (3%), and Other (3%) which number differed significantly from those identifying as White, Hispanic, and Black. Additional personal and physical demographics and sport participation can be seen in Tables1-3, respectively.

The data will be presented in the following order:

1) Sport Level Comparison on Nutritional Resources, Finances, Blood Health Indicators, Nutrition Knowledge, Dietary Intake, and Quality of Life.

2) Relationships of Finances, Nutritional Resources, and Nutrition Knowledge on Blood Health, Dietary Intake, and Quality of Life.

3) Relationship of Race/Ethnicity on Finances Received

Table 1. Athlete Personal Demographics

	All (N= 121)	NCAA DI (n= 51)	Club (n= 37)	NJCAA (n= 33)
Age	19.6±1.3	19.1±1.3	20.1±1.2	18.7±0.8
Race/Ethnicity (*n*)				
White	74 (61%)	38 (75%)	25 (68%)	11 (33%)
Black	13 (10%)	5 (10%)	1 (3%)	7 (21%)
Hispanic	21 (17%)	5 (10%)	5 (13%)	11 (33%)
Asian/Pacific Islander	7 (6%)	1 (2%)	5 (13%)	1 (3%)
Native American/American Indian	3 (3%)	0 (0%)	0 (0%)	3 (9%)
Other	3 (3%)	2 (3%)	1 (3%)	0 (0%)
Training Hours (hours/week)	14.6±7.6	15±6.1	11.3±6.9	17.7±8.9
Sport Years (playing current sport)	8.96±4.8	10.6±3.7	5.3±5.2	9.6±3.9

Note. (M±SD). *N*= 121. Missing questionnaires from two NJCAA athletes. Training hours are dependent competition seasons.

Table 2. Athlete Physical Demographics

	All (N= 124)	NCAA DI (n= 51)	Club (n= 37)	NJCAA (n= 36)*
Height (cm), *n*= 124	166.4±6.6	169.3±6.3	164.4±6.2	164.7±6.2
Weight (kg), *n*= 122	65.6±11.8	64.6±9.3	66.4±15.1	66.3±11.3
BMI, *n*= 122	23.5±4.4	22.6±2.4	24.5±5.3	24.0±5.4
Systolic BP (mm), *n*= 124	112.9±10.4	111.6±10.1	110.5±10.8	117.1±9.1
Diastolic BP (Hg), *n*= 124	71.9±9.1	68.8±8.0	73.2±10.5	74.9±7.7
Pulse (beats/min), *n*= 124	72.1±12.8	68.9±13.4	77.2±11.0	71.25±12.2

Note. (M±SD). N= 124. Missing values for weight and BMI from two NJCAA athletes.

Table 3. Athlete Sport Participation

	All (N= 121)	NCAA DI (n= 51)	Club (n= 37)	NJCAA (n= 33)
Sport (*n*)				
Basketball	5 (4%)	2 (4%)	0 (0%)	3 (9%)
Cheerleading	3 (2%)	1 (2%)	2 (5%)	0 (0%)
Cross Country	6 (5%)	5 (10%)	0 (0%)	1 (3%)
Dance	8 (7%)	2 (4%)	6 (16%)	0 (0%)
Dragon Boat	1 (1%)	0 (0%)	1 (3%)	0 (0%)
Fencing	2 (2%)	1 (2%)	1 (3%)	0 (0%)
Gymnastics	2 (2%)	1 (2%)	1 (3%)	0 (0%)
Hockey	2 (2%)	0 (0%)	2 (5%)	0 (0%)
Lacrosse	8 (7%)	7 (14%)	1 (3%)	0 (0%)
Marching Band	1 (1%)	1 (2%)	0 (0%)	0 (0%)
Quidditch	3 (2%)	0 (0%)	3 (8%)	0 (0%)
Rugby	7 (6%)	3 (6%)	4 (11%)	0 (0%)
Sailing	1 (1%)	0 (0%)	1 (3%)	0 (0%)
Soccer	**17 (14%)**	0 (0%)	9 (24%)	8 (24%)
Softball	**13 (11%)**	1 (2%)	1 (3%)	11 (33%)
Swimming	5 (4%)	6 (12%)	0 (0%)	0 (0%)
Track and Field	**20 (16%)**	12 (23%)	0 (0%)	8 (24%)
Triathlon	6 (5%)	4 (7%)	2 (5%)	0 (0%)
Ultimate Frisbee	1 (1%)	1 (2%)	0 (0%)	0 (0%)
Volleyball	6 (5%)	2 (4%)	2 (5%)	2 (6%)
Water Polo	3 (2%)	2 (4%)	1 (3%)	0 (0%)

Note. N= 121. **Bold**; top three participating sports total. Underline: top three participating sports per level. Missing demographic questionnaires from two NJCAA athletes.

Sport Level Comparison on Nutritional Resources, Finances, Blood Health Indicators, Nutrition Knowledge, Dietary Intake, and Quality of Life

Nutritional Resources

Access to Dietitian and Nutritional Information. All (100%) NCAA DI athletes had access to the internal sport nutrition department within the athletic department holding a team of registered dietitians delivering nutritional information compared to 8% of NJCAA and 8% Club athletes, $\chi_2(2)= 99.944$, $p< 0.001$, V= 0.643. Differences at the NJCAA and Club sport levels may be due to certain sports having unique arrangements to seek nutritional information and a dietitian that is not provided by the organization. Club athletes have access to ASU health services and can make an appointment to see a dietitian and request nutritional information. Mesa Community College has no health service, thus a dietitian and information is not readily available for NJCAA athletes. When asked whether their sport organization should provide access to a registered dietitian and nutritional information, a majority of all athletes (91%) were in favor. Few (7%) believed only nutritional information be available and 3% said their sport organization should provide neither (see Tables 4-5).

Table 4. Access to Current Nutritional Resources

	All (N= 121)	**NCAA DI (n= 51)**	**Club (n= 37)**	**NJCAA (n= 33)**
Nutrition Info	20 (17%)	0 (0%)	12 (32%)	8 (24%)
Nutrition Info & Registered Dietitian	57 (47%)	51 (100%)**	3 (8%)	3 (8%)
Neither	44 (36%)	0 (0%)	22 (59%)	22 (67%)

Note. N= 121. Missing questionnaires from two NJCAA athletes.
** Significant at $p< 0.001$.

Table 5. Access to Perceived Nutritional Resources

	All (N= 121)	**NCAA DI (n= 51)**	**Club (n= 37)**	**NJCAA (n= 33)**
Nutrition Info	8 (7%)	1 (2%)	5 (14%)	2 (6%)
Nutrition Info & Registered Dietitian	110 (91%)	50 (98%)	30 (81%)	30 (91%)
Neither	3 (2%)	0 (0%)	2 (5%)	1 (3%)

Note. N= 121. Missing questionnaires from two NJCAA athletes.

Sources Offering Nutritional Advice. The top three sources offering nutritional advice to all athletes (N= 121) were Coaches/Trainers (73%), Family members (68%), Registered Dietitians (46%), and Doctors (46%). Coaches/Trainers and Family members remained as top sources offering nutritional advice within each sport level. Yet, NCAA DI athletes received information from Registered Dietitians (73%), Club athletes from Friends (65%), and NJCAA athletes from Doctors (33%). Overall, those in close proximity to athletes appear to be offering the most nutritional advice (See Table 6).

Table 6. Sources Offering Nutritional Advice to Athletes

	All (N= 121)	**NCAA DI (n= 51)**	**Club (n= 37)**	**NJCAA (n= 33)**
Teammates	45 (37%)	19 (37%)	17 (46%)	9 (27%)
Coach/Trainer	**88 (73%)**	42 (82%)	23 (62%)	23 (70%)
Registered Dietitian	**46 (48%)**	37 (73%)	8 (22%)	1 (3%)
Doctor	**46 (38%)**	20 (39%)	15 (41%)	11 (33%)
Friends	45 (37%)	12 (24%)	24 (65%)	9 (27%)
Family	**82 (68%)**	34 (67%)	23 (62%)	25 (76%)
No one	7 (6%)	0 (0%)	5 (14%)	2 (6%)

Note. N= 121. **Bold**; top three sources of information received total. Underline: top three sources of information received per level. Missing questionnaires from two NJCAA athletes.

Sources of Nutritional Information Sought. The top three sources all athletes (N= 121) sought nutritional information from was the Internet (51%), Athletic Trainer/ Strength & Conditioning Coaches (48%), and Family/Friends (42%). Athletic Trainer/ Strength &

Conditioning Coaches and Internet searches remained as top sources for athletes to seek nutritional information from within each sport level. More NCAA DI athletes sought nutritional information from Registered Dietitians (64%) whereas Club and NJCAA athletes relied on Family/Friends, 38% and 55%, respectively. Similar to the sources offering advice to athletes, proximity and ease plays a role in searching for nutritional information (see Table 7).

Table 7. Sources of Nutritional Information Sought by Athletes

	All (N= 121)	**NCAA DI (n= 51)**	**Club (n= 37)**	**NJCAA (n= 33)**
Academic Journal	27 (22%)	8 (16%)	12 (32%)	7 (21%)
Athletic Trainer/ Strength & Conditioning Coach	**58 (48%)**	29 (57%)	15 (41%)	14 (42%)
Coach	39 (32%)	18 (35%)	8 (22%)	13 (40%)
Dietitian	46 (38%)	33 (64%)	8 (22%)	5 (15%)
Doctor	36 (30%)	12 (24%)	11 (30%)	13 (39%)
Family/Friends	**52 (42%)**	20 (39%)	14 (38%)	18 (55%)
Internet Search	**62 (51%)**	22 (18%)	26 (70%)	14 (42%)
Mass Media	7 (6%)	1(1%)	4 (11%)	2 (6%)
Social Media	13 (11%)	5 (10%)	4 (11%)	4 (12%)
Teammates	20 (17%)	9 (18%)	7 (19%)	4 (12%)
Other	5 (4%)	1 (1%)	2 (5%)	2 (6%)
None	3 (2%)	0 (0%)	1 (3%)	2 (6%)

Note. *N*= 121. **Bold**; top three sources of information sought total. Underline: top three sources of information sought per level Missing questionnaires from two NJCAA athletes. Other: Podcast (n= 1), Nutrition Labels (n= 1), Professor (n= 1), Not listed (n= 2).

Finances

Financial Aid. The perception of feeling financially equipped to support education, living expenses, and food was not significantly different between sport levels, $\chi_2(2)= 4.115$, $p= 0.128$ (see Table 8). Likewise, no significant differences in the proportion of athletes receiving financial aid from FAFSA/Pell Grants/Loans and Family were found, p> 0.05. NCAA DI athletes were more likely to receive financial aid for books [$\chi_2(2)= 20.324$, $p< 0.001$, V= 0.41] and Housing [$\chi_2(2)= 7.179$, $p= 0.028$, V= 0.244] than NCJAA and Club

athletes. Significant differences were seen in the proportion of athletes receiving University scholarships, $\chi_2(2)= 23.510$, $p< 0.001$, V= 0.441. NJCAA athletes are less likely to receive University scholarship compared to NCAA DI and Club athletes, as 73% NJCAA athletes did not receive any. Only half of all athletes reported monetary values, as forty-three percent was not able to provide an estimated value for the received amount of scholarship. For those (n= 69) who provided an estimated financial aid value, a Kruskal-Wallis test found monetary amount to be significant between sport levels, H(2)= 22.799, $p< 0.001$, $\eta= 0.16$. After using a Mann-Whitney U test, a post-hoc Bonferroni found NCAA DI and Club athletes to have greater financial aid value compared to NJCAA athletes, $p<0.001$. Financial aid monetary values are expected to differ, as the average in-state tuition rate to attend Arizona State University is approximately $10,104 a year compared to $2,094 at Mesa Community College.[1,9] Tables 9-10 show displays the type of aid and monetary values. Athletes of all levels may be lacking awareness of the cost of tuition and compensation given, an important responsibility to harness for emerging adults.

Table 8. Perceptions of Being Sufficiently Financed

	All (n= 121)	NCAA DI (n= 51)	Club (n= 37)	NJCAA (n= 33)
Yes	63 (52%)	32 (63%)	17 (46%)	14 (42%)
No	58 (48%)	19 (37%)	20 (54%)	19 (58%)

*Note. n= 121. Missing questionnaires from two NJCAA athletes.

Table 9. Proportion of Athletes Receiving Finances

	All (N= 121)	NCAA DI (n= 51)	Club (n= 37)	NJCAA (n= 33)
University Scholarship	72 (60%)	36 (71%)	28 (76%)	8 (24%)**
FAFSA	36 (30%)	13 (25%)	13 (35%)	10 (30%)
Pell Grant	9 (7%)	1 (2%)	4 (11%)	4 (12%)
Other- Aid	11 (9%)	2 (4%)	6 (16%)	3 (9%)
Books	34 (28%)	24 (47%)**	2 (5%)	8 (29%)

Housing	12 (10%)	9 (18%)*	3 (8%)	0 (0%)
Family	74 (61%)	29 (57%)	26 (70%)	19 (57%)

Note. N= 121. Missing questionnaires from two NJCAA athletes. Other: Work Study (n= 2), University Other (n= 4), Loans (n= 3), Military Scholarship (n = 1), Other Scholarships (n = 1).
** Significant at $p< 0.001$.
* Significant at $p< 0.005$.

Table 10. Value of Athlete's Finances

Aid Per Academic Year	**All (N= 69)**	**NCAA DI (n= 23)**	**Club (n= 29)**	**NJCAA (n= 17)**
Scholarship, FAFSA, Pell Grant, Loan, etc.)	$8,000 ($8,500)	$8,000 ($9,500)	$10,000 ($8,500)	$1,500 ($4,000)**
	All (N= 74)	**NCAA DI (n= 29)**	**Club (n= 26)**	**NJCAA (n= 19)**
Books	$600 ($600)	$800 ($1,480)	$700 ()	$400 ($675)
	All (N= 12)	**NCAA DI (n= 9)**	**Club (n= 3)**	**NJCAA (n= 0)**
Housing	$6,130 ($7,500)	$5,000 ($7,200)	$10,000 ()	N/A
	All (N= 74)	**NCAA DI (n= 29)**	**Club (n= 26)**	**NJCAA (n= 19)**
Family	$5,000 ($7,000)	$5,000 ($8,600)	$6,000 ($8,500)	$1,000 ($1,100)

Note. N= 121. Median (IQR). Missing questionnaires from two NJCAA athletes. Numbers reflect those who 1) receive aid from these sources and 2) provided an estimated value.
** Significant at $p< 0.001$.

Athletic Scholarship. Club athletes are not eligible for athletic scholarships, thus not included in this analysis section, other scholarships received are noted in the above section. No significant difference in the proportions of receiving an athletic scholarship were found between NCAA DI and NJCAA athletes (see Table 11), yet more NCAA DI athletes were given full scholarships compared to NJCAA athletes, $\chi_2(2)= 5.194$, $p= 0.042$, V= 0.289 (see Table 12). Within the NCAA DI and NJCAA, full and partial athletic scholarship is dependent on the number available assigned to each sport. The popularity and roster size of the sport influences scholarship availability.

Table 11. Proportion of Athletes Receiving Athletic Scholarships

	All (N= 121)	NCAA DI (n= 51)	Club (n= 37)	NJCAA (n= 33)
Yes	62 (51%)	38 (75%)	0 (0%)	24 (73%)
No	59 (49%)	13 (25%)	37 (100%)	9 (27%)

Note. N= 121. Missing questionnaires from two NJCAA athletes.

Table 12. Proportion of Athletes Receiving Full and Partial Athletic Scholarships

	All (N= 62)	NCAA DI (n= 38)	NJCAA (n= 24)
Full	18 (29%)	15 (39%)*	3 (13%)
Partial	44 (71%)	23 (61%)	21 (87%)

Note. N= 121. Missing questionnaires from two NJCAA athletes. Numbers reflect those receiving an athletic scholarship seen in Table 11.
* Significant at $p< 0.005$.

Provided Meals and Quantity. Thirteen percent of all athletes (N= 121) were receiving meals, with a majority coming from NCAA DI athletes (77%), $\chi_2(2)= 9.837$, $p= 0.007$, V= 0.285. Two Club athletes received meals and none at the NJCAA level. The number of provided meals per week were variable, ranging from three to 24 meals a week (see Tables 13-14). A possible explanation for the variation in meals provided could be dependent on sport participation and misinterpretation of the question. Within ASU's NCAA DI athletics, all athletes are provided food via an open fuel station located at weight room facilities. On Monday and Tuesday evenings, "grab-and-go" and Wednesday evening "training table" meals are provided. Additionally, depending on an athlete's status and sport team budget, travel and pre-post game meals are given. Fuel stations and "grab-and-go" meals are not available at the Club and NJCAA sport levels; it is not known whether travel and pre-post game meals are provided.

Table 13. Provided Meals

Meal Financial Aid	All (N= 121)	NCAA DI (n= 51)	Club (n= 37)	NJCAA (n= 33)
Yes	13 (11%)	10 (20%)*	2 (5%)	0 (0%)
No	108 (89%)	41 (80%)	35 (95%)	33 (100%)

Note. N= 121. Missing questionnaires from two NJCAA athletes.
* Significant at $p< 0.001$.

Table 14. Meals Provided Per Week

Sponsored Meals Per Week	All (N= 13)	NCAA DI (n= 10)	Club (n= 2)
3 Meals	3	3	0
4 Meals	1	1	0
5 Meals	2	2	0
8 Meals	1	1	0
10 Meals	1	1	0
16 Meals	1	0	1
21 Meals	2	1	1
24 Meals	1	1	0

Note. N= 13. Reflects results seen in Table 8.

Monthly Food and Sport Food Budgets. There were no significant sport level differences in monthly budgets for food and sport foods. However, a significant amount of NJCAA athletes perceived not to have sufficient finances for purchasing foods compared to NCAA DI and Club athletes, $\chi_2(2)= 12.482$, $p= 0.002$, V= 0.321 (see Table 15). The median monthly food and sport budgets were similar, yet NCAA DI athletes received more meals options and perhaps had additional funds for purchasing foods on remaining days. Additionally, there were more NCAA DI athletes having a larger food budget, and may be due to meal purchasing eligibility. Figure 1 illustrates the median (IQR) of the monthly food and sport food budgets per sport level.

Table 15. Perceptions of Sufficient Finances for Purchasing Food

	All (n= 121)	NCAA DI (n= 51)	Club (n= 37)	NJCAA (n= 33)
Yes	87 (72%)	42 (82%)	29 (78%)	16 (48%)
No/Not Sure	34 (28%)	9 (18%)	8 (22%)	17 (52%)*

Note. N= 121. Missing questionnaires from two NJCAA athletes.
* Significant at $p< 0.005$.

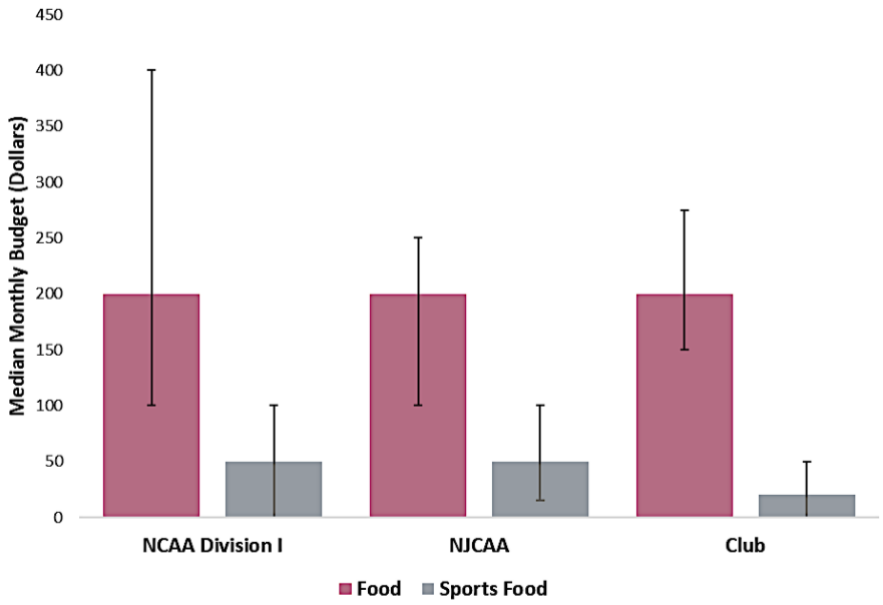

Figure 1. Monthly food and sport food budgets for NCAA DI, NJCAA, and Club athletes.

Monthly food budget median (IQR): NCAA DI $250($300); NJCAA $200($138); Club $200($125).

Monthly sports food budget median (IQR): NCAA DI $50($100), NJCAA $50($85); Club $20 ($50).

Employment status. NCAA DI athletes were less likely to be employed compared to NJCAA and Club athletes, $\chi_2(2)= 51.514$, $p< 0.001$, V= 0.652 (see Table 16). For those who were employed (N= 46), hours worked per week were not significantly different across sport levels, H(2)= 0.924, $p= 0.630$. The median (IQR) of hours worked per week are as follows: NCAA DI athletes (n= 2) 15(.); NJCAA (n= 15) 15(17); and Club (n= 29) 20(16). NCAA DI athletes may work less than Club and NJCAA athletes due to athletic scholarship, monetary amount of athletic scholarship, and time constraints of being a DI athlete.

Table 16. Athlete Employment Status

	All (n= 121)	**NCAA DI (n= 51)**	**Club (n= 37)**	**NJCAA (n= 33)**
Yes	46 (38%)	2 (39%)*	29 (78%)	15 (45%)
No	75 (62%)	49 (61%)	8 (22%)	18 (55%)

Note. *n*= 121. Missing questionnaires from two NJCAA athletes.
* Significant at $p< 0.005$.

Blood Health Indicators

One-Way ANOVAs were conducted to compare total cholesterol, LDL, HDL, total cholesterol-HDL, triglycerides [natural log, ln], fasted glucose across sport levels, which revealed no significant group differences. Differences may not be seen due to all athletes being similar in age and physical activity level. The mean ± standard deviation for blood health indicators can be seen in Table 17.

Table 17. Blood Health Indicators

	All (*N*= 78)	**NCAA DI (n= 21)**	**Club (n= 28)**	**NJCAA (n= 29)**
Total Cholesterol *n*= 78	166.2±33.4	171.2±31.0	171.1±252	159.6±40.0
LDL *n*= 66	84.6±25.9	88.7±25.2	85.7±30.0	81.6±23.2
HDL *n*= 75	62.8±15.0	64.9±14.8	64.8±14.7	62.3±15.1
Total Cholesterol:HDL *n*= 75	2.8±0.6	2.7±0.5	2.8±0.8	2.8±0.06
Triglycerides *n*= 68	103.5±57.2	88.7±48.9	102.6±47.8	112.3±67.6
Fasted Glucose *n*= 78	89.0±7.1	90.3±7.3	87.7±5.9	89.4±8.0

Note. (M±SD). Values based on fasted morning samples. Sport training sessions were not controlled for.

Nutrition Knowledge [NSKQ]

The mean rank on total nutrition knowledge scores for NCAA DI, NJCAA, and Club sport levels are 70, 39, and 65 percent, respectively. Conducting Kruskal-Wallis test found nutrition knowledge scores to be significant between sport levels, $H(2)= 16.935$, $p< 0.001$, $\eta= 0.16$. Performing Mann-Whitney U tests with post-hoc Bonferroni analyses, results found NCAA DI ($p<0.001$) and Club ($p= 0.006$) athletes to have higher nutrition knowledge scores than NJCAA athletes. Availability of nutritional resources at a four-year university differs from that at the community college setting and could contribute knowledge variations. (see Figure 2).

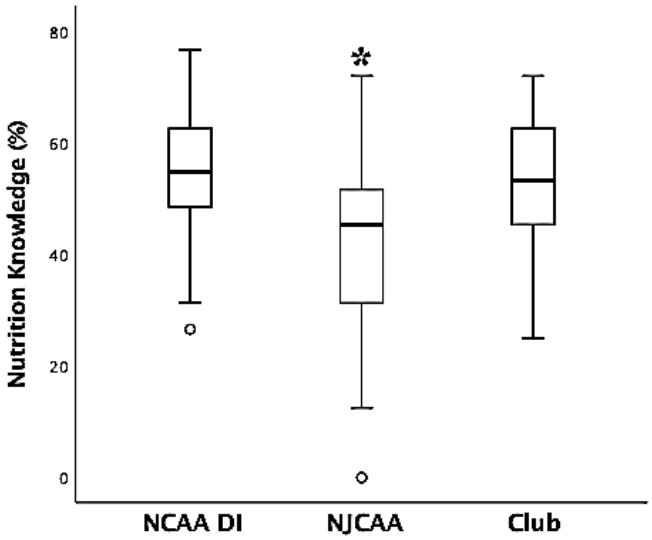

Figure 2. Nutrition knowledge scores. NJCAA athlete's nutrition knowledge scores significantly lower than NCAA DI and Club athletes. Median (IQR); NCAA DI 55.7(14.1), NJCAA 45.3 (21.1), Club. 53.4(17.2).

Dietary Intake [REAP]

After scoring the REAP, 75% of NJCAA athletes were recommended to see a dietitian compared to 50% of NCAA DI and Club athletes, $\chi_2(2)= 6.020$, $p= 0.049$, V= 0.224. These results are cautioned, as some of the food/drink statements regarding fat in dairy products and sweets, meat proportions, and choice of juices may have been recommended by a dietitian at the NCAA DI and Club levels, yet are not known at the NJCAA level due to no dietitian access. Chi-square analyses were conducted to determine frequency is consuming meals, grains, fruits and vegetables, dairy, meats, fried foods, snacks, fats and oils, sweets, soft drinks, sodium, and alcohol per week. Sedentary behavior of television activity, shopping for and preparing meals were also examined.

In a given week, NJCAA athletes were more likely to consume processed meats [χ_2 (2)= 7.979, $p= 0.017$, V= 0.268], fried foods [χ_2 (2)= 18.876, $p< 0.001$, V= 0.403], chips [χ_2 (2)= 10.421, $p= 0.005$, V= 0.298], eat sweets not fat-free/low-fat [χ_2 (2)= 6.044, $p= 0.049$

V= 0.226], and eat sweets two or more times per day [χ_2 (2)= 13.174, p< 0.001, V= 0.337] than the other athletes. NJCAA athletes were also less likely to purchase and prepare their own food compared to NCAA DI and Club athlete, [χ_2(2)= 9.427, p= 0.009, V= 0.280]. An observation was noted that two NJCAA athletes consumed 1-2 alcoholic beverages daily while none did at the NCAA DI and Club sport levels. A greater proportion of Club athletes followed a special diet or limited foods for health or other reasons, [χ_2 (2)= 6.985, p= 0.030, V= 0.241]. All athletes expressed that they were willing to make changes in what, how, or how much they ate in order to eat healthier, H(2)= 0.557, p= 0.757. Those differences were not seen in blood health, the non-high-quality foods consumed at the NJCAA athletes could negatively impact performance, and if continued, health concerns later in life.

Table 18 displays athletes answering "yes" to the following statements, indicating negative dietary habits according to REAP. The bold numbers at the top of the table represents the number of athletes per sport level. Next to each statement, an "n" total is given for those who responded to that particular statement. The frequency and percentages in the table correspond with the "n" of each dietary statement.

Table 18. Athletes' Weekly Dietary Behaviors and Attitudes

	All (n= 120)	NCAA DI (n= 51)	Club (n= 37)	NJCAA (n= 32)
Skip Breakfast, n= 120	22(18%)	5(10%)	9(24%	8(25%)
Eat takeout/restaurant meal 4+ times per week, n= 120	14 (12%)	5 (10%)	2 (5%)	7 (22%)
Eat less than 3 servings of whole grains per day, n= 117	23(20%)	7(14%)	9(24%)	7(23%)
Eat less than 2-3 servings of fruit per day, n= 118	18(15%)	7(14%)	7(19%)	4(13%)
Eat less than 3-4 servings of vegetables per day, n=118	16(14%)	6(12%)	5(14%)	5(17%)
Eat less than 2-3 servings of dairy per day, n= 111	36(32%)	15(32%)	13(38%)	8(27%)
Use 2% or whole milk over 1% and fat-free, n= 95	43(45%)	19(46%)	10(3%)	14(52%)
Use regular cheese over low-fat and skim, n= 107	61(57%)	27(54%)	18(58%)	16(55%)
Eat beef, pork, or dark meat chicken 2+ time per week, n= 113	51(45%)	26(54%)	11(32%)	14(45%)
Eat more than 6 oz of meat, chicken, or fish per day, n= 113	40(35%)	21(44%)	8(24%)	11(36%)
Choose higher fat red meats over lean red meats, n = 110	16(15%)	5(11%)	5(16%)	6(19%)
Eat skin on chicken/turkey or fat of meat, n= 110	27(25%)	13(28%)	7(22%)	7(23%)
Eat regular processed meats over low-fat processed meats, n= 111	11(10%)	3(6%)	1(3%)	7(23%)*
Eat fried foods, n= 116	13(11%)	2(4%)	1(3%)	10(32%)**
Eat regular chips over low-fat chips/crackers, air popcorn, and pretzels, n= 117	34(29%)	10(20%)	8(22%)	16(52%)
Use regular dressing over low-fat and fat-free dressings, n= 110	40(36%)	21(43%)	7(22%)	12(41%)
Add butter, margarine, or oil to foods at the table, n= 115	37(32%)	15(30%)	11(31%)	11(38%)
Cook with oil, butter, or margarine over non-stick fat-free sprays, n= 115	56(49%)	25(53%)	18(49%)	13(42%)
Eat regular sweets over low-fat and fat-free sweets, n= 118	21(18%)	6(12%)	5(14%)	10(32%)*
Eat regular ice cream over fat-free ice creams, yogurts, and sherbet, n= 113	29(26%)	13(27%)	6(18%)	10(33%)
Eat sweets 2+ time per day, n= 116	11(10%)	2(4%)	1(3%)	8(26%)*
Drink 16 oz of non-diet soda, fruit drink, or Kool-Aid per day, n= 113	9(8%)	3(6%)	3(8%)	3(10%)
Eat high sodium processed foods, n= 118	13(11%)	3(6%)	4(11%)	6(19%)
Add salt to foods at table or during cooking, n= 118	48(41%)	19(38%)	19(51%)	10(32%)
Drink more than 1-2 alcoholic drinks per day, n= 89	2(2%)	0(0%)	0(0%)	2(11%)*
Watch 2+ hours of television/videos per day, n= 118	27(23%)	11(22%)	10(27%)	6(20%)
Usually shop and prepare own food, n= 120	88(73%)	40(78%)	31(84%)	17(53%)*
Have trouble shopping or cooking, n= 120	60(50%)	22(43%)	19(51%)	19(59%)
Follow a special diet, eat or limit certain foods for health or other reasons, n= 120	51(43%)	16(31%)	22(60%)*	13(41%)

Note. *N*= 120. Missing questionnaires from three NJCAA athletes.
** Significant at $p< 0.001$.
* Significant at $p< 0.005$.

Quality of Life [WHOQOL-BRE]

Physical Health. Physical health entails one's mobility, medical needs, sleep, and daily functionality. The mean rank on physical health for NCAA DI, NJCAA, and Club sport levels are 73.50, 38.86, and 61.30, respectively. A Kruskal-Wallis found physical health scores to be significant between sport levels, $H(2)= 19.692$, $p< 0.001$, $\eta= 0.15$. A Mann-Whitney U test with a post-hoc Bonferroni found NCAA DI ($p<0.001$) and Club ($p= 0.022$) athletes to have higher physical health scores than NJCAA athletes (see Table 19).

Mental Health. Mental health pertains to personal satisfaction with appearance, happiness, and emotional state. The mean rank on mental health for NCAA DI, NJCAA, and Club sport levels are 74.22, 50.66, and 50.11, respectively. A Kruskal-Wallis found mental health scores to be significant between sport levels, $H(2)= 13.887$, $p= 0.001$, $\eta= 0.10$. Mann-Whitney U test post-hoc Bonferroni found NCAA DI to have higher mental health scores than Club ($p= 0.004$) and NJCAA ($p= 0.008$) athletes (see Table 19).

Social Relationships. Social relationships concern personal interactions, sexual satisfaction and support from friends. The mean rank on social relationships for NCAA DI, NJCAA, and Club sport levels are 60.95, 62.05, and 58.54, respectively. A Kruskal-Wallis found social relationship scores to be not significant between sport levels, $H(2)= 0.193$, $p= 0.908$. Social health is relatively similar across the sport levels (see Table 19).

Environmental Health. Satisfaction with living conditions, mode of transportation, access to health services and information, work areas, leisure activities, and surrounding built community. The mean rank on environmental health for NCAA DI, NJCAA, and

Club sport levels are 71.59, 50.64, and 53.74, respectively. A Kruskal-Wallis found environmental health scores to be significant between sport levels, H(2)= 9.191, p= 0.010, η= 0.09. Mann-Whitney U test with a post-hoc Bonferroni found NCAA DI to have higher environmental health than NJCAA athletes, p= 0.022 (see Table 19).

Table 19. Athlete Quality of Life

	All (n= 120)	**NCAA DI (n= 51)**	**Club (n= 37)**	**NJCAA (n= 32)**
Physical	75(17.9)	78.6 (17.9)	75(10.7)	67.9(20.5)**
Mental	70.8(20.8)	75(20.8)	66.7(22.9)	62.5(33.3)*
Social Relationships	75(33.3)	75(25)	75(16.7)	79.2(33.3)
Environmental	75(18.8)	78.1(15.6)	71.9(17.2)	67.2(34.4)*

Note. N= 120. Median (IQR). Missing questionnaires from three NJCAA athletes
** Significant at p< 0.001.
* Significant at p< 0.005.

Relationship of Finances, Nutritional Resources, and Nutrition Knowledge on Blood Health Indicators, Dietary Intake, and Quality of life

Finances

Finances and Blood Health Indicators. Spearman's correlations were conducted to examine the relationship between finances received (i.e., University/Other Scholarship, FAFSA/Pell Grant/Loans, Athletic, Family, Books, Housing) and blood health indicators (i.e., total cholesterol, LDL, HDL, total cholesterol-HDL, triglycerides, fasted glucose); no significant relationships were found. No significant relationship between total monthly income and blood health indicators was found. Likewise, athlete's monthly food budget and blood health yielded no correlation.

Finances and Dietitian Recommendation. Spearman's correlations were conducted to examine the relationship between finances received (i.e., University/Other Scholarship, FAFSA/Pell Grant/Loans, Athletic, Family, Books, Housing) and needing to be recommended a dietitian; no significant relationships were found.

Finances and Quality of Life. Spearman's correlations were conducted to examine the relationship between finances received (i.e., University/Other Scholarship, FAFSA/Pell Grant/Loans, Athletic, Family, Books, Housing) and quality of life (i.e., mental health, physical health, social relationships, and environmental health); no significant relationships were found for aid type. A small positive relationship was found between financial aid amount and physical health, $r_s = 0.289$, $p = 0.017$. Those with more monetary means had better physical health, which was seen for NCAA DI athletes.

Nutritional Resources

Nutritional Resources and Blood Health Indicators. Spearman's correlations were conducted to examine the relationship between nutritional resources (i.e., access to nutrition information or dietitian) and blood health indicators (i.e., total cholesterol, LDL, HDL, total cholesterol-HDL, triglycerides, fasted glucose). A small positive relationship was found between access to nutritional information and triglyceride levels, $r_s = 0.242$, $p = 0.047$. A small positive relationship was found between access to a dietitian and fasted glucose levels, $r_s = 0.241$, $p = 0.038$. These increased triglyceride and fasted glucose levels were not clinically relevant.

Nutritional Resources and Dietitian Recommendation. Spearman's correlations were conducted to examine the relationship between nutritional resources (i.e., access to nutrition information or dietitian) and needing to be recommended a dietitian; no significant relationships were found.

Nutritional Resources and Quality of Life. Spearman's correlations were conducted to examine the relationship between nutritional resources (i.e., access to nutrition information or dietitian) and quality of life (i.e., mental health, physical health, social relationships, and environmental health). Small positive relationships were found between access to a nutritional resources and physical health (r_s= 0.295, p= 0.001), mental health (r_s= 0.321, p< 0.001), and environmental health (r_s= 0.257, p= 0.005). NCAA DI athletes have access to numerous reliable sources and scored high in these quality of life areas.

Nutrition Knowledge

Nutrition Knowledge and Blood Health Indicators. Spearman's correlations were conducted to examine the relationship between nutrition knowledge and blood health indicators (i.e., total cholesterol, LDL, HDL, total cholesterol-HDL, triglycerides, fasted glucose). A small negative relationship was found between nutrition knowledge and HDL levels, r_s= -0.267, p= 0.024. These decreased HDL levels were not clinically relevant.

Nutrition Knowledge and Dietary Recommendation. A Spearman's correlation was conducted to examine the relationship between nutrition knowledge and needing to be recommended a dietitian; no significant relationships were found.

Nutrition Knowledge and Quality of Life. A Spearman's correlation was conducted to examine the relationship between nutrition knowledge and quality of life (i.e., mental health, physical health, social relationships, and environmental health). Small positive relationships were found between access to a dietitian and physical health (r_s= 0.323, p< 0.001), mental health (r_s= 0.190, p= 0.038), and environmental health (r_s= 0.311, p= 0.001). As witnessed with access to nutritional resources, dietitians may be beneficial beyond nutritional recommendations.

Relationship of Race/Ethnicity on Finances

Race/Ethnicity & Finances

Binary logistic regression models were conducted to determine whether an individual's race/ethnicity predicted receiving athletic scholarships, financial aid (i.e., University/Other Scholarship, FAFSA/Pell Grant/Loans, Books, Housing), and family monetary support. An individual's racial/ethnic background was not predictive of receiving an athletic scholarship, financial aid, or family monetary support. Yet, given the unequal distribution included race/ethnic backgrounds, these results may not reflect accurate allocations.

Conclusions

The proportion of receiving finances from various sources were similar, though monetary value differed due to costs of attending a two-year and four-year university and many athletes were not aware of the monetary values she received. Racial/ethnic backgrounds were not shown to be underserved in receiving aid, yet were unequally distributed and may not reflect actual occurrences. While racial/ethnic inequity cannot be addressed in this given sample, sport level concerns can.

Regarding differences at the sport levels, NJCAA female athletes reported not having sufficient funds for food, had poorer nutrition knowledge, fewer nutritional resources, and were more likely recommended to see a dietitian while not having onsite access available in comparison to Club-Athletes and NCAA athletes at a Division I University. Blood health indicators was not significantly different, though certain foods items are being consumed that may hinder performance for NJCAA athletes, as evident more were likely to need a dietitian. Physical, mental, and environmental quality of life was also low among NJCAA athletes compared to NCAA DI and Club athletes. This brings concerns when NJCAA athletes are looking to transition to the NCAA athletic levels. Being nutritionally deficit performance-wise and overall lagging health could be hurt recruiting opportunities or be able to thrive in such at a four-year university setting. Nutrition needs to be a priority at the NJCAA level to best meet their athletic and overall well-being needs. Efforts are needed to bring forth nutrition education curriculums, food programs, and access to dietitians for athletes at the NJCAA.

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