



ADVANCE SOCIAL SCIENCE ARCHIVE JOURNAL

Available Online: <https://assajournal.com>

Vol. 05 No. 01. Jan-March 2026. Page# 8398-8410

Print ISSN: [3006-2497](#) Online ISSN: [3006-2500](#)Platform & Workflow by: [Open Journal Systems](#)<https://doi.org/10.5281/zenodo.23507240>

Sports Nutrition, Dietary Practices, and Supplement Use Among University Athletes in Pakistan: A Quantitative Cross-Sectional Study

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Abstract

Background: Sports nutrition plays an important role in supporting athletic performance, recovery, training adaptation, and general health. However, athletes may experience difficulties translating nutritional knowledge into appropriate dietary practices.

Objective: This study aims to examine sports nutrition knowledge, dietary practices, and supplement use among university athletes in Pakistan and investigate the association between nutritional knowledge and dietary practices.

Methods: A quantitative cross-sectional research design is proposed. The illustrative analysis uses a simulated dataset representing 200 university athletes aged 18–27 years. A structured questionnaire is proposed to assess demographic characteristics, sports nutrition knowledge, dietary practices, previous nutrition education, and dietary supplement use. Descriptive statistics, Pearson's correlation, an independent-samples t-test, and multiple linear regression are used to demonstrate the planned statistical analysis.

Results: In the simulated dataset, the mean sports nutrition knowledge score was 10.81 ± 3.60 out of 20, while the mean dietary practices score was 15.22 ± 5.02 out of 30. Approximately 35.0% of participants fell into the low-knowledge category, 48.5% into the moderate-knowledge category, and 16.5% into the high-knowledge category. A positive correlation was observed between sports nutrition knowledge and dietary practices ($r = 0.583$, $p < 0.001$). Participants reporting previous nutrition education had higher mean knowledge scores than those without such education. Simulated supplement use was reported by 24.0% of participants.

Conclusion: The illustrative findings demonstrate how nutritional knowledge and dietary practices can be investigated among university athletes. If comparable patterns are observed in actual data, the results would support the introduction of structured sports nutrition education, access to qualified sports nutrition professionals, and athlete-focused dietary counselling.

Keywords: Sports nutrition; nutritional knowledge; dietary practices; university athletes; dietary supplements; physical education; Pakistan.

1. Introduction

Nutrition is a fundamental component of athletic preparation because it supports energy production, muscle function, recovery, training adaptation, and general health. Athletes require dietary strategies that reflect their sport, training intensity, body composition goals, competition schedule, and individual physiological needs.

Sports nutrition involves more than consuming food before and after exercise. It includes appropriate energy intake, carbohydrate availability, protein consumption, hydration, micronutrient adequacy, recovery nutrition, and the safe use of dietary supplements.

Athletes who participate in regular training may have greater nutritional demands than individuals who engage in limited physical activity. Nevertheless, the ability to meet these demands depends on several factors, including nutritional knowledge, food availability, financial resources, coaching practices, training schedules, and access to qualified professionals.

A systematic review of athletes' nutrition knowledge and dietary intake identified considerable variation in nutritional knowledge and reported generally weak-to-moderate positive associations between knowledge and selected dietary behaviours. The findings also highlighted the need for appropriate measurement tools and better-quality research (Capling et al., 2017).

Similarly, the International Olympic Committee consensus statement on dietary supplements emphasizes that supplements should be considered within a comprehensive nutritional strategy. Potential benefits must be weighed against safety concerns, contamination risks, and the possibility of anti-doping violations (Maughan et al., 2018).

University athletes represent an important population for sports nutrition research. During university life, athletes must balance academic responsibilities, training sessions, competitions, and personal commitments. These circumstances may affect their ability to maintain consistent dietary routines.

In Pakistan, university sports programmes provide opportunities to investigate how athletes understand and implement sports nutrition recommendations. Research can help identify educational needs and inform interventions delivered through departments of Physical Education and Sports Science.

However, a research gap should not be assumed solely because a study is conducted in Pakistan. A focused literature search is necessary to establish the extent of existing evidence, particularly regarding sports nutrition knowledge, dietary practices, and supplement use among university athletes in the selected geographical and sporting context.

The present study therefore proposes an investigation of these variables using a quantitative cross-sectional design.

2. Problem Statement

Athletic performance depends on multiple interacting factors, including physical conditioning, technical skills, psychological preparation, recovery, and nutrition. Even when athletes possess general nutritional knowledge, they may not consistently apply appropriate dietary practices.

Limited understanding of carbohydrate requirements, protein intake, hydration, recovery nutrition, and supplement safety may contribute to inappropriate nutritional decisions.

Within university sports programmes, coaches and physical education professionals may provide general dietary advice without having access to specialist sports nutrition services. This creates a need to assess athletes' nutritional knowledge and practices before developing targeted educational interventions.

The proposed study addresses the following problem:

To what extent are university athletes' sports nutrition knowledge and dietary practices associated, and what role might previous nutrition education and training exposure play in these outcomes?

The actual extent of this problem in the selected Pakistani university population must be established through empirical data collection.

3. Research Objectives

The study has six objectives:

1. To assess sports nutrition knowledge among university athletes.
2. To examine athletes' dietary practices related to training, recovery, and hydration.
3. To determine the prevalence of self-reported dietary supplement use.
4. To investigate the relationship between sports nutrition knowledge and dietary practices.
5. To compare sports nutrition knowledge between athletes who have and have not received previous nutrition education.
6. To examine whether nutritional knowledge, training exposure, and previous nutrition education are associated with dietary practices.

4. Research Questions

1. What is the level of sports nutrition knowledge among university athletes?
2. What dietary practices do university athletes report?
3. What proportion of university athletes report using dietary supplements?
4. Is sports nutrition knowledge significantly associated with dietary practices?
5. Do athletes with previous nutrition education demonstrate different nutrition knowledge scores from those without such education?
6. Are nutrition knowledge, training exposure, and previous nutrition education associated with dietary practices when examined together?

5. Research Hypotheses

H1: Sports nutrition knowledge is positively associated with dietary practices among university athletes.

H2: Athletes who have received previous nutrition education have higher sports nutrition knowledge scores than athletes who have not received such education.

H3: Sports nutrition knowledge, training exposure, and previous nutrition education jointly explain a statistically significant proportion of the variation in dietary practices.

These hypotheses should be tested using the actual collected dataset.

6. Literature Review

6.1 Sports Nutrition and Athletic Performance

Sports nutrition provides the nutritional foundation for training, competition, and recovery. Energy intake should be appropriate for the athlete's workload, while carbohydrate availability, protein intake, hydration, and micronutrient adequacy should be considered in relation to individual needs.

Carbohydrates contribute to exercise fuel availability, particularly during prolonged or intense exercise. Protein supports tissue maintenance and repair and contributes to adaptation following resistance and other demanding training sessions.

Hydration is also important because fluid requirements vary according to exercise intensity, environmental temperature, duration, sweat rate, and individual characteristics.

Nutritional recommendations should therefore be individualized rather than applied identically to all athletes.

6.2 Sports Nutrition Knowledge

Sports nutrition knowledge refers to an athlete's understanding of nutrition principles relevant to sport and exercise.

Important areas include:

- Carbohydrate sources and exercise fuel.
- Protein intake and recovery.
- Hydration before, during, and after exercise.
- Pre-exercise and post-exercise meals.
- Micronutrient adequacy.
- Dietary supplements and their potential risks.
- Nutrition strategies for different training demands.

A systematic review of sports nutrition knowledge questionnaires found that measurement approaches differ considerably across studies. Questionnaire development and validation are important because an assessment may produce misleading results if its questions do not adequately measure the intended knowledge domain (Trakman et al., 2017).

Accordingly, the proposed study should use a suitable established questionnaire where possible or develop and validate an instrument before the main data collection.

6.3 Dietary Practices Among Athletes

Dietary practices refer to the behaviours through which athletes implement nutritional knowledge in everyday life.

These behaviours may include eating regular meals, consuming appropriate foods before training, including protein-containing foods in recovery meals, maintaining hydration, and selecting nutrient-rich foods.

Knowledge alone does not guarantee appropriate behaviour. An athlete may understand nutritional recommendations but struggle to follow them because of financial limitations, limited access to suitable foods, irregular schedules, cultural preferences, or insufficient support.

The relationship between knowledge and dietary behaviour should therefore be examined empirically rather than assumed.

6.4 Dietary Supplement Use

Athletes may use dietary supplements for convenience, to address diagnosed deficiencies, or in pursuit of performance and recovery benefits.

However, supplements differ substantially in their evidence base, safety profile, and suitability for individual athletes.

Maughan et al. (2018) emphasize that decisions about supplements should be made following an assessment of the athlete's nutritional needs and potential risks. Athletes should not assume that a product is effective or safe simply because it is marketed for sports performance.

The proposed research should assess supplement use without assuming that supplement consumption necessarily improves performance.

6.5 University Athletes and Nutrition Education

University athletes face the combined demands of education, training, and competition. Nutrition education may help athletes understand the relationship between dietary choices and sports participation.

Nevertheless, educational interventions should address practical barriers as well as knowledge. Appropriate programmes may include workshops, individualized counselling, educational materials, and collaboration between sports scientists, coaches, and qualified nutrition professionals.

The effectiveness of such programmes requires evaluation through appropriately designed intervention studies.

6.6 Research Gap

The proposed study focuses on the relationship between sports nutrition knowledge and dietary practices among university athletes in Pakistan.

Before claiming that the study is the first of its kind, the researcher should search relevant databases, including PubMed, Scopus, Web of Science, and SPORTDiscus, for Pakistani studies examining university athletes, nutrition knowledge, dietary behaviour, and supplement use.

The final manuscript should identify what existing studies have established, which populations they investigated, how their measurements were conducted, and what unanswered questions justify the present study.

The intended contribution is to provide context-specific evidence that can inform nutrition education and support services within university sports programmes.

7. Conceptual Framework

The study proposes the following relationships:

Independent variables

- Sports nutrition knowledge.
- Previous nutrition education.
- Weekly training exposure.

Primary dependent variable

- Dietary practices score.

Additional outcome

- Self-reported dietary supplement use.

Potential background variables

- Age.
- Gender.
- Type of sport.
- Competitive level.
- Academic year.
- Access to nutrition counselling.
- Financial and food-access constraints.

The central proposed relationship is:

Sports nutrition knowledge → Dietary practices

Previous nutrition education and training exposure are examined as additional explanatory variables.

Because the proposed study is cross-sectional, any observed relationships should be interpreted as associations rather than proof of causation.

8. Methodology

8.1 Research Design

A quantitative, cross-sectional, observational design is proposed.

This design allows the researcher to collect information about nutritional knowledge, dietary practices, and supplement use at one point in time.

The design is suitable for describing participants' responses and examining statistical associations. It cannot establish whether nutrition knowledge causes changes in dietary behaviour.

8.2 Study Population

The target population will consist of university athletes enrolled in higher education institutions in Pakistan.

Eligible participants should:

1. Be aged 18 years or older.
2. Be currently enrolled in a participating university.
3. Participate in organized university sports or structured athletic training.
4. Provide informed consent.

Individuals who do not meet the eligibility criteria or submit substantially incomplete questionnaires may be excluded according to predefined rules.

The precise geographic and institutional scope should be determined before recruitment.

8.3 Sample Size

For the illustrative analysis, a sample of 200 participants is used.

For an actual cross-sectional study estimating a population proportion, a conventional initial sample-size calculation can be performed using:

$$n = Z^2 p(1 - p) / d^2$$

Where:

- n = required sample size.
- $Z = 1.96$ for a 95% confidence level.
- p = anticipated proportion, set at 0.50 when reliable prior information is unavailable.
- d = desired margin of error, set at 0.07.

Using these assumptions:

$$n = (1.96^2 \times 0.50 \times 0.50) / 0.07^2$$

$$n \approx 196$$

Thus, approximately 196 completed responses would be required for this particular proportion-estimation scenario, before allowing for nonresponse or applying any design-effect adjustment. A target of 220–230 invitations could be considered to obtain approximately 196–200 complete responses, depending on the anticipated response rate.

This calculation is illustrative. The final sample-size justification should reflect the primary research hypothesis, the intended statistical test, expected effect size, desired power, and sampling design.

8.4 Sampling Technique

A feasible approach would be stratified sampling across participating universities or sports, followed by random selection within the relevant groups where participant lists are available.

If access to a complete sampling frame is not possible, convenience or purposive recruitment may be used, but the resulting limitations in representativeness must be acknowledged.

The final paper should report the actual recruitment procedure rather than describing a sampling method that was not implemented.

8.5 Research Instrument

A structured questionnaire is proposed, comprising five sections.

Section A: Demographic and sporting characteristics

- Age.
- Gender.
- University.
- Academic year.
- Primary sport.
- Competitive level.
- Years of training.
- Average weekly training hours.

Section B: Sports nutrition knowledge

Twenty multiple-choice questions will assess knowledge of:

- Carbohydrates and exercise.
- Protein and recovery.
- Hydration.
- Pre-exercise nutrition.
- Post-exercise nutrition.
- Micronutrients.
- Dietary supplements and safety.

Each correct answer will receive one point, while incorrect and unanswered items will receive zero points under a predefined scoring protocol.

The total score will range from 0 to 20.

Section C: Dietary practices

Thirty items will assess behaviours such as:

- Meal regularity.
- Pre-training eating practices.
- Recovery nutrition.
- Hydration habits.
- Fruit and vegetable consumption.
- Use of sports supplements.
- Access to suitable food around training sessions.

The actual questionnaire should specify response options, item wording, scoring direction, and treatment of missing responses.

For the illustrative analysis, the dietary practices score ranges from 0 to 30, with higher scores representing more favourable practices.

This scoring system is a proposed analytical structure, not an established or validated scale.

Section D: Nutrition education

Participants will report whether they have received previous formal sports nutrition education, such as a course, workshop, seminar, or structured counselling session.

Section E: Supplement use

Participants will report whether they currently use dietary supplements for sporting or exercise-related purposes.

Where feasible, follow-up questions should identify the type of product, frequency of use, reason for use, and source of advice.

8.6 Instrument Validity and Reliability

The researcher should preferably select an existing questionnaire with appropriate evidence of validity and reliability for the intended population.

If a new instrument is developed, the following procedures are recommended:

1. Review the relevant literature and current sports nutrition recommendations.
2. Obtain content review from qualified sports nutritionists, sports scientists, and research-methodology experts.
3. Conduct cognitive interviews to check whether participants understand the questions.
4. Pilot-test the questionnaire with participants similar to the target population.
5. Evaluate appropriate reliability measures.
6. Assess construct validity where the sample size and instrument design permit.

Cronbach's alpha should not be applied indiscriminately to a factual knowledge test containing different types of questions. Reliability assessment should be appropriate to the instrument's purpose and item structure.

The final paper must report the actual validation procedures and reliability estimates obtained.

8.7 Data Collection Procedure

Following ethical approval and institutional permission, eligible participants will be invited to participate.

The researcher will explain the purpose of the study, the voluntary nature of participation, confidentiality protections, and the right to withdraw.

After informed consent, participants will complete the questionnaire electronically or on paper. Responses will be checked for completeness, assigned identification codes, and entered into a statistical dataset.

The researcher should not collect identifiable information unless it is necessary and appropriately protected.

8.8 Ethical Considerations

The study should receive approval from the appropriate institutional research ethics committee before recruitment begins.

Participation must be voluntary, and informed consent must be obtained.

The study should protect participant confidentiality and store research data securely.

Any reporting of supplement use should avoid identifying individual athletes or making unsupported medical claims.

No claim of ethical approval or completed data collection should be made until these activities have actually occurred.

8.9 Statistical Analysis

The actual data can be analysed using SPSS, R, Stata, or another suitable statistical package.

The planned analysis is as follows:

Research purpose	Statistical procedure
Describe participant characteristics	Frequencies, percentages, means, and standard deviations
Summarize nutrition knowledge	Mean, standard deviation, and score distribution
Summarize dietary practices	Mean, standard deviation, and score distribution
Estimate supplement use	Frequency and percentage
Examine the relationship between knowledge and practices	Pearson's correlation or Spearman's correlation, as appropriate
Compare knowledge by previous nutrition education	Independent-samples t-test or a suitable nonparametric alternative
Examine several predictors of dietary practices	Multiple linear regression, if model assumptions are adequately met
Report statistical uncertainty	95% confidence intervals and exact p-values where feasible

The significance level will be set at $p < 0.05$.

Statistical significance should be interpreted alongside effect sizes, confidence intervals, measurement quality, and the limitations of the research design.

9. Results:

Illustrative Statistical Analysis

Critical qualification: This section presents simulated results from a constructed dataset of 200 participants. It demonstrates how the findings could be reported after genuine data collection. None of the values below should be represented as observations from real university athletes.

9.1 Participant Characteristics

The simulated dataset contained 200 participants.

Characteristic	Illustrative result
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Total participants	200
Male participants	112 (56.0%)
Female participants	88 (44.0%)
Mean age	21.58 years
Standard deviation of age	1.99 years
Mean weekly training exposure	6.19 hours
Standard deviation of weekly training exposure	2.41 hours
Participants reporting previous nutrition education	59 (29.5%)
Participants not reporting previous nutrition education	141 (70.5%)

These figures describe the simulated dataset only. The demographic distribution should not be interpreted as representative of Pakistani university athletes.

9.2 Sports Nutrition Knowledge

The illustrative knowledge assessment contained 20 items, with a maximum score of 20.

The mean knowledge score was 10.81 (SD = 3.60).

The corresponding average percentage score was:

$$(10.805 / 20) \times 100 = 54.03\%$$

The 95% confidence interval for the simulated mean knowledge score was approximately 10.30–11.31 out of 20.

For demonstration purposes, scores were classified as follows:

- Low knowledge: below 50%.
- Moderate knowledge: 50%–74.9%.
- High knowledge: 75% or above.

Knowledge category	Score range	Frequency	Percentage
Low	0–9	70	35.0%
Moderate	10–14	97	48.5%
High	15–20	33	16.5%
Total		200	100.0%

In this illustrative dataset, 83.5% of participants fell into the low or moderate categories.

These thresholds are provisional analytical choices. They must be justified before use in a real study and should not be treated as universally accepted clinical or sports nutrition classifications.

9.3 Dietary Practices

The illustrative dietary practices score ranged from 0 to 30.

The mean score was 15.22 (SD = 5.02), equivalent to approximately 50.73% of the maximum possible score.

The 95% confidence interval for the simulated mean was approximately 14.52–15.92.

For demonstration purposes, the scores were classified into three categories:

- Poor practices: below 50%.
- Fair practices: 50%–74.9%.
- Good practices: 75% or above.

Dietary practices category	Frequency	Percentage
Poor	83	41.5%
Fair	107	53.5%
Good	10	5.0%
Total	200	100.0%

These findings illustrate how a scoring system can identify groups potentially requiring nutrition education.

The categories are provisional and should be revised if a validated dietary practices instrument provides established scoring guidance.

9.4 Dietary Supplement Use

In the simulated dataset, 48 participants reported supplement use, while 152 did not.

Supplement-use status	Frequency	Percentage
Reported use	48	24.0%
No reported use	152	76.0%
Total	200	100.0%

This result represents the proportion classified as supplement users in the constructed dataset. A real study should distinguish between different products and reasons for use. Supplement consumption should not automatically be interpreted as beneficial, harmful, or indicative of poor nutritional knowledge.

9.5 Association Between Sports Nutrition Knowledge and Dietary Practices

Pearson's correlation was used in the simulated analysis to examine the relationship between the knowledge and dietary practices scores.

Variables	Correlation coefficient	p-value	Interpretation
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Nutrition knowledge and dietary practices	$r = 0.583$	< 0.001	Positive association
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The simulated correlation was positive and statistically significant.

This indicates that participants with higher knowledge scores tended to have higher dietary practices scores within the constructed dataset.

The coefficient represents a moderate-to-strong positive relationship in this example. Its practical importance would need to be considered alongside the instrument's validity, possible confounding variables, and the distribution of actual study data.

The association does not establish that increasing knowledge necessarily causes improved dietary practices.

9.6 Comparison by Previous Nutrition Education

An independent-samples t-test compared knowledge scores among participants who reported previous nutrition education and those who did not.

Group	n	Mean knowledge score	Standard deviation
Previous nutrition education	59	12.37	3.42
No previous nutrition education	141	10.15	3.48

The simulated difference between group means was approximately 2.22 points out of 20.

The independent-samples t-test produced:

- $t(198) = 4.14$.
- $p < 0.001$.

The result illustrates how a researcher can compare knowledge scores between two independent groups.

In a real study, this association would not prove that education caused the difference. Athletes who choose nutrition education may differ from other athletes in motivation, sporting experience, access to resources, or other relevant characteristics.

9.7 Multiple Linear Regression

A multiple linear regression model was fitted to examine the association of sports nutrition knowledge, weekly training exposure, and previous nutrition education with the dietary practices score.

The model included:

1. Nutrition knowledge score.

2. Weekly training hours.
3. Previous nutrition education, coded 1 for yes and 0 for no.

The illustrative model results were as follows:

Predictor	Regression coefficient (B)	Standard error	t-value	p-value
Constant	5.414	1.007	5.375	< 0.001
Nutrition knowledge	0.721	0.092	7.810	< 0.001
Weekly training hours	0.312	0.133	2.352	0.020
Previous nutrition education	0.293	0.670	0.437	0.663

Overall model statistics

Statistic	Result
Sample size	200
R ²	0.358
Adjusted R ²	0.349
F-statistic	36.48
Model p-value	< 0.001

The model explained approximately 35.8% of the variation in dietary practices scores in the simulated dataset.

Nutrition knowledge was positively associated with dietary practices after accounting for the other variables in the model ($B = 0.721$, $p < 0.001$).

Weekly training exposure also showed a positive association ($B = 0.312$, $p = 0.020$).

Previous nutrition education was not statistically significant after adjustment for the other included variables ($B = 0.293$, $p = 0.663$).

This last finding illustrates why unadjusted group comparisons and multivariable analyses may produce different results. It does not demonstrate that nutrition education is ineffective.

Before interpreting a real regression model, the researcher should assess linearity, residual behaviour, influential observations, multicollinearity, and other relevant assumptions. Additional potential confounders should be included when justified by the research question and sample size.

10. Discussion

The simulated findings produced an average knowledge score of approximately 54% of the maximum possible score.

If a similar result emerged from actual data collected using an appropriate instrument, it could suggest that athletes would benefit from targeted nutrition education.

However, a score cannot be classified as inadequate without considering the validity of the questionnaire, its scoring rules, and the knowledge required for the athletes' particular sports.

A well-designed educational programme should prioritize areas in which actual participants demonstrate misunderstandings rather than relying on a general assumption that all athletes have poor nutritional knowledge.

The illustrative dataset showed a mean dietary practices score of approximately 51% of the maximum.

Such a result, if reproduced in real data using a validated measure, would justify examining the specific behaviours contributing to lower scores.

Potential areas for investigation include irregular meals, inadequate planning around training, limited access to suitable foods, inconsistent hydration, and insufficient recovery nutrition.

These explanations remain hypotheses until the actual questionnaire responses are examined.

The simulated analysis indicated a positive relationship between sports nutrition knowledge and dietary practices.

This pattern is consistent with the broader research question addressed in previous reviews of athletes' nutritional knowledge and dietary intake (Capling et al., 2017).

Nevertheless, the relationship between knowledge and behaviour is unlikely to be determined by knowledge alone.

Food affordability, availability, family practices, coaching advice, academic commitments, and access to nutrition professionals may also influence dietary decisions.

Future studies should measure these factors where feasible.

11. Recommendations

Based on the proposed research framework, the following recommendations can guide future work:

1. Conduct a multicentre study involving university athletes from different regions of Pakistan.
2. Use an appropriately validated sports nutrition knowledge questionnaire.
3. Examine nutritional knowledge across different sports, genders, and competitive levels.
4. Measure dietary practices with a clearly defined and reliable instrument.
5. Investigate financial, educational, and environmental barriers to appropriate nutrition.
6. Record the types and sources of dietary supplements used by athletes.
7. Develop and evaluate evidence-based sports nutrition education programmes.
8. Conduct longitudinal or intervention research to determine whether improvements in knowledge are followed by changes in dietary practices.
9. Include qualified sports nutrition professionals in university athlete-support programmes.
10. Share findings with university administrations, coaches, sport's governing bodies, and Physical Education and Sports Science departments.

13. Conclusion

Sports nutrition is an important component of athlete preparation, health, and recovery. Assessing nutritional knowledge and dietary practices can help universities identify educational needs and design more effective athlete-support programmes.

The proposed quantitative study provides a framework for examining sports nutrition knowledge, dietary practices, previous nutrition education, and supplement use among university athletes in Pakistan.

The simulated analysis demonstrates the application of descriptive statistics, correlation, group comparison, and multiple linear regression. It also illustrates how results can be interpreted without confusing statistical association with causation.

The central empirical question is whether athletes with greater sports nutrition knowledge report more favourable dietary practices and whether this relationship persists after accounting for other relevant characteristics.

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