



Gender Differences in Sports Nutrition Knowledge Among Recreational Gym Users in Al-Marj, Libya: A Comparative Cross-Sectional Study

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Abstract

Background: Sports nutrition knowledge supports appropriate food, fluid, and supplement decisions, yet evidence from Libyan recreational exercise settings is scarce. Objective: To compare sports nutrition knowledge between male and female recreational aerobic and resistance practitioners in Al-Marj, Libya, and identify educational priorities. Methods: This comparative cross-sectional analysis integrated two convenience samples. The male cohort comprised 100 adults from five gyms; the female cohort comprised 26 adults from three fitness centers in the same locality. Both completed an Arabic-adapted Nutrition for Sport Knowledge Questionnaire (NSKQ). Aggregate means were compared using pooled-variance independent-samples t tests, with Cohen's d as the standardized effect. Results: Mean total knowledge was $57.2 \pm 12.8\%$ among men and $35.0 \pm 11.5\%$ among women (difference 22.2 percentage points; $t(124) = 8.04$, $p < .001$; $d = 1.77$). Men scored higher across all reported domains. Poor knowledge characterized 28.0% of men and 88.5% of women. In men, micronutrients were the weakest domain ($48.7 \pm 14.8\%$); 68% reported supplement use, most frequently protein powder. Education and qualified professional guidance were positive predictors of male knowledge. Conclusions: Both groups demonstrated actionable knowledge gaps, with especially low female scores and weak micronutrient knowledge. The sex comparison remains exploratory because of non-probability sampling, unequal cohorts, missing adjusted female data, and lack of formal local validation of the Arabic questionnaire. Culturally tailored, dietitian-led education and a concurrently recruited replication are recommended.

Keywords: sports nutrition knowledge; gym users; sex differences; Libya; NSKQ; dietary supplements

1. Introduction

Nutrition influences training capacity, recovery, health, and adaptation through the appropriate quantity, quality, and timing of food and fluid intake [1]. However, athlete nutrition knowledge remains inconsistent. A systematic review update found wide score variation, limited use of validated contemporary instruments, and only weak-to-moderate positive associations between knowledge and favorable dietary behaviors [2]. Knowledge is therefore important but should not be treated as a direct measure of dietary intake or health.

The 89-item NSKQ assesses weight management, macronutrients, micronutrients, sports nutrition, supplements, and alcohol. Original validation demonstrated high total internal consistency and test–retest reliability [3]; selected items were later updated as recommendations evolved [4]. Transparent translation, cultural adaptation, and local psychometric testing remain necessary when the instrument is used in a new language or setting.

The Libyan context warrants focused study. Obesity affected 42.4% of a Benghazi adult sample and was associated with unhealthy dietary habits [5]. Across four Arab countries, 73.1% of respondents had inadequate general nutrition knowledge, and younger adults relied heavily on social media [6]. Gym environments add specific concerns because supplement consumption is common, while trainers, peers, retailers, and online content may replace qualified advice [7,8].

Sex-specific interpretation requires caution. International reviews do not establish a consistent male advantage in nutrition knowledge [2,9]. Female exercisers may additionally face low energy availability and concerns involving iron, calcium, and vitamin D, yet evidence for many sex-specific supplement claims is limited [10]. Local differences should consequently be viewed as contextual associations rather than inherent biological effects.



1.1 Objectives

The study aimed to compare total and domain-specific sports nutrition knowledge between male and female recreational gym users in Al-Marj; describe knowledge-category distributions; examine male-cohort correlates, information sources, and supplement use; and identify practical educational priorities. The primary hypothesis was that total NSKQ score differed by sex. Because the cohorts were recruited independently, all between-sex findings were treated as exploratory.

2. Materials and Methods

2.1 Design and Setting

This comparative cross-sectional study integrated two independently recruited cohorts of recreational aerobic and resistance practitioners in Al-Marj, northeastern Libya. The male cohort was recruited from five fitness centers during September-December 2025. The female cohort included women recruited from three fitness centers during the reported 2025-2026 study period. Aggregate common outcomes were consolidated; participant-level datasets were not available for adjusted pooled analyses.

2.2 Participants and Recruitment

The male sample included 100 adults aged at least 18 years who attended a participating gym at least twice weekly and had at least one month of participation. Recruitment used gym posters, verbal announcements, direct approaches by trained assistants, and peer referral. Of 113 questionnaires distributed, 108 were returned and 100 met completeness and quality criteria. The female sample comprised 26 regular aerobic and/or resistance practitioners recruited by convenience sampling. Incomplete questionnaires and responses indicating poor comprehension were excluded. Non-probability recruitment limits population generalizability.

2.3 Measures

Sports nutrition knowledge was measured with an Arabic-adapted NSKQ. The source protocols retained weight management, macronutrients, micronutrients, sports nutrition, and supplement domains, while alcohol content was abbreviated for cultural sensitivity. Correct responses received one point and scores were converted to percentages. Internal interpretive bands were poor (0–49%), average (50–65%), knowledgeable (66–74%), and excellent (75–100%). These bands are descriptive and are not universal clinical cut-offs. Demographic and training variables included age, education, occupation, marital status, exercise characteristics, supplement use, and information source where available.

2.4 Data Collection

Participants received study information and provided reported informed consent before completing online or paper questionnaires in Arabic. Male questionnaires were completed in quiet gym areas with research assistants available only to clarify instructions. Numeric identifiers were used, and consent documents were stored separately. Female data were collected using an online or paper Arabic questionnaire distributed through fitness centers.

2.5 Statistical Analysis

Descriptive statistics are presented as mean $\pm$ standard deviation or n (%). Sex comparisons were recalculated from aggregate sample sizes, means, and standard deviations with pooled-variance independent-samples *t* tests. Cohen's *d* used the pooled standard deviation. Two-sided $p < .05$ indicated statistical significance. Four-category chi-square inference was not emphasized because several expected female counts were below five. Male-cohort ANOVA, correlations, *t* tests, and regression estimates are reported from the supplied results. No values were fabricated or imputed.

2.6 Ethical Considerations

The supplied studies reported voluntary participation, informed consent, confidentiality safeguards, and aggregate analysis.

3. Results

3.1 Participants

The combined sample comprised 126 participants: 100 men and 26 women. Men had a mean age of 27.4 ± 6.8 years; women had a mean age of 31.19 ± 7.16 years (range 21–48). In the male cohort, 48% had university or college education, 58% primarily performed resistance training, and 68% used supplements.

Table 1. Selected Characteristics of the Study Cohorts

Characteristic	Men (n = 100)	Women (n = 26)
Age, years	27.4 ± 6.8	31.19 ± 7.16
Age range, years	21–48	21–48
Recruitment sites	5 fitness centers	3 fitness centers
University/college education	48 (48.0%)	Not reliably reported
Resistance-primary training	58 (58.0%)	Not reliably reported
Current supplement use	68 (68.0%)	Not reliably reported

Note. Female demographic cells containing unresolved or internally inconsistent source values were not reproduced.

3.2 Sex Differences

Men had higher total knowledge than women ($57.2 \pm 12.8\%$ vs. $35.0 \pm 11.5\%$). The recalculated comparison produced a 22.2-point difference, $t(124) = 8.04$, $p < .001$, $d = 1.77$. Differences were statistically significant across every reported domain, ranging from 19.3 points for micronutrients to 24.3 points for supplements. The large effects may partly reflect cohort nonequivalence and uncontrolled confounding.

Table 2. Total and Domain-Specific Knowledge by Sex

Domain	Men, mean $\pm$ SD	Women, mean $\pm$ SD	Difference	t(124)	p	d
Total NSKQ	57.2 ± 12.8	35.0 ± 11.5	22.2	8.04	$< .001$	1.77
Macronutrients	62.4 ± 14.2	38.2 ± 13.8	24.2	7.79	$< .001$	1.71
Micronutrients	48.7 ± 14.8	29.4 ± 12.6	19.3	6.10	$< .001$	1.34
Weight management	58.6 ± 13.5	36.1 ± 14.2	22.5	7.49	$< .001$	1.65
Sports nutrition	54.2 ± 15.1	31.8 ± 13.9	22.4	6.84	$< .001$	1.51
Supplements	56.8 ± 16.3	32.5 ± 15.1	24.3	6.87	$< .001$	1.51

Note. Recalculated pooled-variance independent-samples t tests based on aggregate n , mean, and SD. Scores are percentage correct. d = Cohen's d .

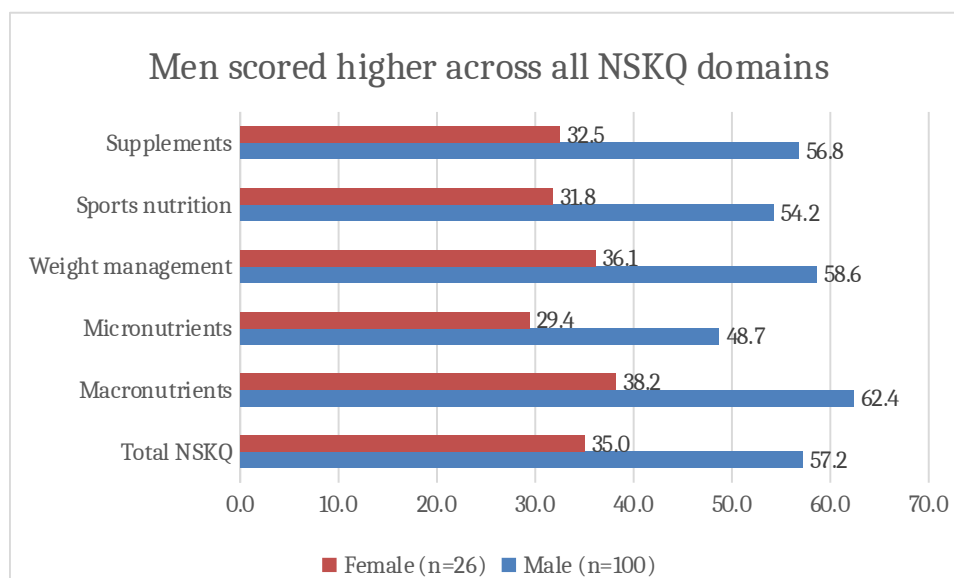


Figure 1. Mean total and domain-specific sports nutrition knowledge scores by sex. Dispersion is reported in Table 2.

3.3 Knowledge Categories

Poor knowledge characterized 28 men (28.0%) and 23 women (88.5%). Fifty-one men (51.0%) and two women (7.7%) were classified as average; 16 men (16.0%) and one woman (3.8%) were knowledgeable; and five men (5.0%) and no women were excellent. Inferential four-level chi-square results were withheld because sparse female cells violated conventional expected-count assumptions.

Table 3. Knowledge Categories by Sex

Category	Range	Men, n (%)	Women, n (%)
Poor	0–49%	28 (28.0)	23 (88.5)
Average	50–65%	51 (51.0)	2 (7.7)
Knowledgeable	66–74%	16 (16.0)	1 (3.8)
Excellent	75–100%	5 (5.0)	0 (0.0)

Note. Female percentages are based on $n = 26$ and may not total exactly 100% because of rounding.

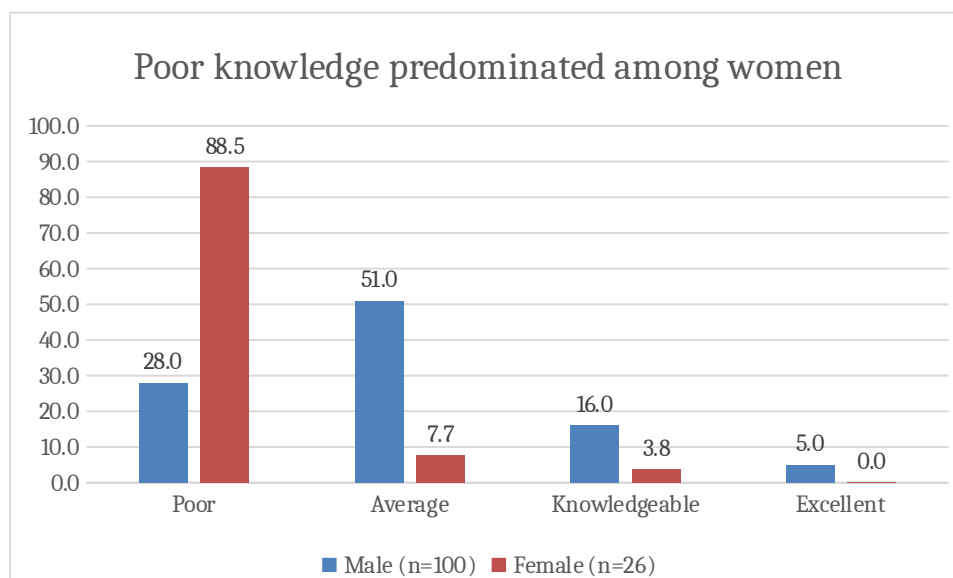


Figure 2. Distribution of knowledge categories within each sex.

3.4 Male Knowledge Correlates

Among men, macronutrients were the strongest reported domain ($62.4 \pm 14.2\%$), while micronutrients were weakest ($48.7 \pm 14.8\%$). Scores increased across preparatory ($47.3 \pm 13.6\%$), secondary ($53.8 \pm 12.1\%$), and university/college education ($64.2 \pm 11.4\%$); $F(2, 97) = 22.14$, $p < .001$, $\eta^2 = .31$. Years of gym membership ($r = .09$, $p = .38$), weekly frequency ($r = .12$, $p = .24$), and session duration ($r = .06$, $p = .56$) were not associated with knowledge.

Table 4. Male Knowledge Scores by Education

Education	n	Mean $\pm$ SD (%)	95% CI
Preparatory	14	47.3 $\pm$ 13.6	39.4–55.2
Secondary	38	53.8 $\pm$ 12.1	49.8–57.8
University/college	48	64.2 $\pm$ 11.4	60.9–67.5

Note. $F(2, 97) = 22.14$, $p < .001$, $\eta^2 = .31$.

Only 12% of men identified a registered dietitian/nutritionist or physician as their primary information source; 85% relied on a coach, internet/social media, or peers. Those consulting dietitians/nutritionists had the highest mean score ($71.2 \pm 9.3\%$). In the reported regression model, education ($B = 6.82$, $p < .001$), qualified information source ($B = 11.37$, $p = .002$), and supplement use ($B = 4.21$, $p = .028$) explained 42% of score variance (adjusted $R^2 = .40$). Given the stepwise model and small qualified-source subgroup, these estimates require external validation.

3.5 Supplement Use

Among 68 male supplement users, protein powder was reported by 61 (89.7%), multivitamins by 38 (55.9%), creatine by 34 (50.0%), and pre-workout formulas by 29 (42.6%). Users scored slightly higher overall than non-users ($58.9 \pm 12.1\%$ vs. $53.7 \pm 13.8\%$; $p = .047$, $d = 0.40$), with a larger difference in supplement knowledge ($61.2 \pm 15.1\%$ vs. $47.3 \pm 15.9\%$; $p < .001$, $d = 0.89$).

Table 5. Supplements Reported by Male Users (n = 68)

Supplement	n	% of users
Protein powder	61	89.7
Multivitamins	38	55.9
Creatine monohydrate	34	50.0
Pre-workout formulas	29	42.6



BCAAs	24	35.3
Vitamin D	21	30.9
Fat burners/thermogenics	18	26.5
Omega-3/fish oil	15	22.1
Testosterone boosters	9	13.2
Other	12	17.6

Note. Multiple responses were allowed. BCAAs = branched-chain amino acids.

4. Discussion

4.1 Principal Findings

Both cohorts demonstrated important knowledge deficits, with markedly lower scores in the female sample. Men outscored women in every available domain, and poor knowledge characterized almost nine in ten women. This difference should not be attributed automatically to biological sex. Recruitment was independent, groups were unequal, female covariate data were incomplete, and education, information access, testing conditions, and training culture could not be controlled.

International evidence does not show a consistent male advantage. Earlier and updated systematic reviews describe heterogeneous methods and equivocal sex patterns [2,9]. The large local difference therefore needs replication using concurrent recruitment, identical procedures, a validated Arabic measure, and adjusted analysis.

4.2 Educational Priorities

Micronutrients were the weakest male domain and also low among women. Education should address iron, calcium, vitamin D, food sources, deficiency risk, and the limitations of unsupervised supplementation. For women, these topics should be integrated with adequate energy availability and menstrual and bone health; for both sexes, qualified assessment should precede targeted supplementation [1,10].

Macronutrient scores were relatively stronger among men but remained only average. Education should correct carbohydrate avoidance and excessive-protein narratives. Most exercising adults can meet protein needs with approximately 1.4–2.0 g/kg/day, appropriately distributed, while carbohydrate intake should reflect training volume and intensity [1,11]. Individual prescription still requires dietary and clinical assessment.

4.3 Supplements and Information

The high supplement prevalence among men is consistent with international gym-user evidence [7,8]. Product users showed stronger supplement-specific knowledge but only a small overall advantage, suggesting narrow familiarity rather than comprehensive competence. Education should use a food-first framework, distinguish evidence-supported products from marketing claims, and discuss dose, interactions, contamination, adverse effects, and anti-doping risks. The IOC recommends nutritional assessment before use and trialing performance products under expert supervision [12].

The positive association with professional advice supports integrating trained nutrition personnel into gyms. However, cross-sectional data cannot establish that professional consultation caused higher scores; more knowledgeable participants may have been more likely to seek professional advice. Coaches should receive basic evidence-based training, clear scope-of-practice limits, and referral pathways rather than functioning as substitutes for dietitians.

4.4 Practical Intervention

A feasible local program would combine brief Arabic-language group sessions, visual materials, culturally familiar food examples, individual counseling, and coach engagement. Priority modules should cover energy availability, carbohydrate fueling, protein distribution, micronutrients, hydration, labels, and supplement risk. Behavior-change methods-including goal setting, meal planning, self-monitoring, and environmental support-should accompany knowledge teaching because information alone does not ensure dietary change. Athlete intervention evidence suggests education often improves knowledge, while dietary outcomes are more variable [13].



4.5 Strengths and Limitations

Strengths include use of a recognized sports nutrition instrument, direct evidence from an under-researched Libyan setting, multi-site male recruitment, and analysis of education, information sources, and supplements. The integration also exposes sex-specific educational needs that may otherwise be overlooked.

Limitations are substantial. Convenience sampling restricts representativeness; the female sample was small; cohorts were independently recruited and unequal; no adjusted pooled analysis was possible. Female demographic and inferential results were incompletely documented, and participant-level data were unavailable. Alcohol items were culturally abbreviated, potentially affecting comparability with the complete NSKQ. No dietary intake, biomarkers, adverse effects, or performance outcomes were measured. Cross-sectional associations cannot establish causality. Finally, an ethics approval identifier was absent from the supplied records and must be verified institutionally.

5. Conclusion

Recreational gym users in Al-Marj demonstrated important sports nutrition knowledge deficits. Female participants had substantially lower total and domain scores than men, micronutrient knowledge was a major weakness, and supplement use was common among men. These results support culturally tailored, dietitian-led education within fitness settings, but do not establish that sex caused the observed difference. Future work should recruit larger male and female samples concurrently, formally validate the Arabic NSKQ, capture dietary intake and supplement exposure, and apply multivariable models to separate sex from education and information-access effects.

Declarations

Ethics and Consent

This study was not submitted to a formal institutional ethics committee. Administrative approval was obtained from the head of the institution, and permission to conduct the study was also granted by the participating clubs/fitness centers. Participation was voluntary, informed consent was obtained from all participants before questionnaire completion, confidentiality safeguards were maintained, and the results were analyzed and reported in de-identified aggregate form.

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Conflict of Interest

The author declares no conflict of interest.

Data Availability

Aggregate data supporting the findings are presented in this article. De-identified participant-level data may be available from the corresponding author upon reasonable request, subject to ethical and confidentiality requirements.

Author Contributions

Seraj Abaas: Conceptualization, methodology, investigation, data curation, formal analysis, visualization, writing-original draft, and writing-review and editing.

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