Libyan Journal of Public Health Practices (LJPHP)

Journal home page: https://journals.uob.edu.ly/LJPHP
ISSN (Online) 3008-1467

Research article

Prevalence of multi-ingredient pre-workout ergogenic and protein supplement use and effect on kidney function among university students and athletes in Benghazi, Libya

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ARTICLE INFO

Article history:
Received 20/5/2025
Revised 25/5/2025
Accepted 30/5/2025
Available online June 2025

Keywords:
Multi-Ingredient Pre-Workout Ergogenic Supplements
Athletes
University students
Kidney function
Protein

ABSTRACT

The use of multi-ingredient pre-workout supplements (MIPS) is becoming increasingly common among university students and athletes, driven by the perceived benefits of increased energy, endurance, and muscle performance. However, the overuse of protein, particularly in this context, raises concerns regarding renal health. Few studies have addressed this issue in North African populations. A cross-sectional study was conducted among 244 students and athletes in Benghazi (56.6% males, 43.4% females). Data were collected via online questionnaire and analyzed using SPSS v22. A subgroup (n=30) underwent renal function testing, including serum urea, creatinine, uric acid, and electrolytes. Chi-square tests and Pearson correlations were used ($P < 0.05$).

Male participants reported significantly higher supplement use (71.02%) than females (41.51%, $P < 0.001$). Nevertheless, (37.68%) of males compared to females (42.45%) reported that they would consume ergogenic supplements if they were encouraged by their coaches. Protein supplement use was positively associated with income ($r = 0.229$, $P = 0.001$). As for the detrimental effects on kidney function, renal testing indicated elevated urea and uric acid among MIPS users, suggesting potential kidney strain.

MIPS are widely used among students and athletes in Benghazi, with notable gender differences in usage and perception. MIPS potential detrimental effects on kidney function raise concerns about safety and health risks among younger users. A deeper understanding of these supplements' risks and benefits is crucial for informed decision-making. This study is among the first in Libya to examine the physiological effects of MIPS use, offering critical insight into an under-researched population.

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1. Introduction

Multi-ingredient pre-workout Ergogenic supplements (MIPS) are dietary supplements that are taken before a workout and consist of stimulants, amino acids, creatinine, beta-alanine, nitric oxide precursors, electrolytes and vitamins to enhance performance during training or competition. For this reason, these supplements are commonly referred to as "ergogenic," which translates to means they enhance the strength, endurance,, and concentration levels of the human body [1]. However, there are concerns regarding the efficacy and safety of MIPS especially for the categories of users that are adolescents and young adults [2]. The application of MIPS can be decided by the athlete's tolerance level, training, and general health. At the same time, there is a high variability of the effectiveness of these supplements depending on the composition and concentration of additives in them [3]. Such nutrients as caffeine and creatine have been known to boost muscular force, power and endurance [2, 3], but it comes with the risk of using prohibited ergogenic agents that are unhealthy and against the ethics of competitions [1].

Caffeine is widely used in MIPS because they have been scientifically confirmed to improve performance during tasks. It acts mostly by blocking adenosine receptors in the brain which causes increased wakefulness and decrease in the feeling of tiredness [4]. Also, a review in 2016 clarified that caffeine has the effect of acting on the central nervous system and providing an increase in the levels of concentration, reaction, and overall mental activity [5]. In 2023 another review was conducted to clarify how stimulating the emission of dopamine and norepinephrine neurotransmitters are associated with improved mood and attention [6]. It was also reported that Caffeine ingestion (5–6 mg/kg) significantly increased endurance time and fat oxidation in both rats and athletes during exercise ($p < 0.05$). Furthermore, It also elevate blood FFA and lactate levels while reducing glycogen utilization, enhancing performance efficiency [7]. Additionally, it enhances muscle contractility, calcium release in muscle fibers [8], and increases metabolic rate, thermogenesis thus raises calorie utilization levels [9]. Effective use of caffeine in MIPS requires careful consideration of dosage and timing, tailored to individual tolerance and specific training needs [10]. While generally safe in moderate amounts, excessive caffeine intake can lead to side effects such as jitteriness, increased heart rate, gastrointestinal discomfort, and insomnia [11]. Athletes should monitor their intake to avoid adverse effects.

Beta-alanine is a naturally occurring amino acid that elevates muscle carnosine levels, acting as an intracellular buffer to maintain pH balance during high-intensity exercise [12]. This buffering effect is particularly beneficial for delaying muscle fatigue. Beta-alanine is commonly included in MIPS for performance enhancement by increasing carnosine levels, thus extending periods of high-intensity activity [12]. It is often combined with other ingredients like caffeine and creatine to synergistically improve overall performance [13, 14]. Another scientific studies as the one conducted in 2019 supported the beta-alanine's role in enhancing exercise capacity and muscle power output [15]. A systematic review and meta-Analysis in 2020 showed that athletes use MIPS containing beta-alanine to optimize their training and competitive performance [16]. However, Beta-alanine supplementation typically involves daily doses of 3 to 6 grams over several weeks to achieve optimal muscle carnosine levels [12]. Common side effects include paresthesia, a temporary tingling sensation, which is generally harmless [17]. To investigate the individual responses a GRADE-assessed systematic review and meta-analysis was done and found out that the responses may vary, necessitating adjustments in dosage for different athletes [18].

A single-blind, placebo-controlled, crossover trial concluded that creatine monohydrate is renowned for its ability to enhance athletic performance by increasing muscle phosphocreatine levels, which are crucial for rapid ATP replenishment during high-intensity activities [19]. Research indicates that creatine supplementation can also buffer lactic acid buildup, thereby delaying fatigue [20]. In MIPS formulations, creatine enhances muscle strength and power output, supports anaerobic performance, and promotes muscle cell hydration and volume [21-23] When combined with other ingredients, creatine can provide a synergistic effect on performance by targeting different aspects of energy metabolism and muscle function [24]. To optimize these performance-enhancing effects, creatine supplementation typically involves a loading phase—consuming approximately 20 grams per day for 5–7 days—followed by a maintenance phase of 3–5 grams per day to sustain elevated muscle creatine stores [24], athlete's knowledge in this area might be very limited in this area . This protocol has been widely adopted across various athletic disciplines to improve training adaptations and competitive performance [25]. When included in MIPS, creatine's efficacy may be further amplified through synergistic interactions with other active compounds; however, attention to dosage, safety, and individual tolerance remains essential [20, 26].

BCAAs, comprising leucine, isoleucine, and valine, are essential for muscle protein synthesis (MPS) and the reduction of muscle protein breakdown (MPB) [26, 27]. BCAAs stimulate MPS through the mTOR pathway and help reduce MPB by inhibiting the ubiquitin-proteasome pathway, which is critical for muscle maintenance [28, 29]. They also provide an additional energy source during prolonged exercise, reduce central fatigue, and support immune function [30-32]. In MIPS, BCAAs are often combined with other ingredients to enhance performance and recovery [2]. They also contribute to cell volumization and hydration, which support muscle size and appearance [33]. To fully harness these benefits, BCAAs are commonly consumed before, during, or after exercise to support MPS, reduce MPB, and enhance recovery [34]. Their combination with other nutrients is frequently employed to maximize their physiological impact [26]. However, adherence to recommended dosages and timing strategies is essential for optimizing their effectiveness in athletic and training contexts.

MIPS can present several health risks due to their complex formulations. Potential side effects include gastrointestinal issues, cardiovascular effects, adverse interactions with medications, mislabeling and contamination, long-term health effects, insomnia, dehydration, nervousness, dependency, and strain on kidneys and liver [34-37]. These risks underscore the importance of careful use and consideration of individual health conditions.

Knowledge of MIPS ingredients and risks varies, with many users unaware of proper usage [38, 39]. Attitudes range from strong belief in benefits to concerns over safety and credibility [40-42]. Practices are inconsistent, with users often misusing dosage or timing [43, 44]. Poor dietary habits and low physical activity, especially among university students, further impact supplement use [45-47].

The use of MIPS among student-athletes warrants investigation due to mixed evidence on their efficacy and safety. While some studies report benefits such as increased endurance and strength, others present contradictory results and highlight potential health risks, especially for young users [2, 3, 48]. Additionally, there are concerns about the regulatory oversight of these supplements and their impact on kidney function and overall health [1]. The prevalence of MIPS use, the motivations behind their consumption, and their effects on kidney function and overall health are crucial areas for further research.

Therefore, the objective of this study was to assess the prevalence of pre-workout ergogenic and protein supplements use among university students and athletes across genders, to assess knowledge, attitudes, and practices related to protein and supplement use among both genders in the target group and to evaluate their association with changes in kidney function.

The results of this study could assist universities and athletic programs in crafting customized nutritional guidelines and interventions. Knowing the extent and consequences of the use of supplements among this population group will help in interventions in the areas of public health, nutrition and education with regard to safe use of supplements.

3. Methodology

3.1. Study Design and Participants
This study employed a cross-sectional, observational design to assess the use of multi-ingredient pre-workout supplements (MIPS) among students and athletes in Benghazi, Libya. Data collection was conducted over a four-week period using an online questionnaire distributed via Google Forms. The study aimed to explore the prevalence and patterns of MIPS usage, as well as associated attitudes and practices within this population.

3.2. Study Participants
To determine the appropriate sample size, a confidence interval of 95% and a margin of error of 5% were used. The calculation indicated that a sample of 230 participants would provide sufficient statistical power to detect meaningful variations and represent the student population at the University of Benghazi. Ultimately, 275 individuals completed the questionnaire, of which 244 responses were valid and used for analysis. Participants were required to be between 17 and 35 years old and either enrolled at the University of Benghazi or regular attendees at gyms in Benghazi. Both male and female participants were included in the study.

3.3. Data Collection
Data were gathered through an internet-based validated questionnaire (Google Forms), which was designed to be accessible and user-friendly. The survey included sections on demographic characteristics, sports participation, and MIPS usage. Supplement use was evaluated by asking participants if they had used any dietary or ergogenic supplements in the past six months. For those who reported supplement use, additional questions explored the types of supplements used, reasons for use, and sources of information regarding the supplements. The questionnaire link was disseminated among students and gym-goers in Benghazi.

3.4. Kidney Function Assessment
A subsample of participants (n=30) who regularly attended gyms was invited to undergo renal function testing. These included measurements of serum creatinine, albumin, electrolytes (sodium, potassium), and uric acid to investigate potential relationships between MIPS use and any association with adverse effects on kidney function.

3.5. Knowledge, Attitudes, and Practices (KAP) Framework
The study utilized the Knowledge, Attitudes, and Practices (KAP) framework to evaluate participants' understanding, perceptions, and behaviors regarding MIPS. A structured questionnaire was developed to assess the following:
Knowledge: Awareness of MIPS components, benefits, risks, and appropriate usage.
Attitudes: Perceptions of the effectiveness and safety of MIPS.
Practices: Actual usage patterns, adherence to guidelines, and perceived outcomes.

3.6. Data Analysis
Data analysis was conducted using SPSS version 22. Descriptive statistics, cross-tabulations, and Pearson correlations were employed to describe the patterns of MIPS use and examine relationships between variables. Chi-square tests were used to assess differences between male and female participants. A p-value of less than 0.05 was considered to be statistically significant.

3.7. Ethical Statement
Approval for the study was obtained from the Research and Studies Department of the University of Benghazi. Informed consent was secured from all participants, who were provided with detailed information about the study's purpose, procedures, potential risks, and benefits. Participants had the option to withdraw from the study at any time. Confidentiality was maintained by anonymizing personal information and securely storing data to prevent unauthorized access. Data were reported in aggregate form to ensure participant anonymity.

4. Results

4.1. Demographical characteristics

Table 1 shows the demographic characteristics of the study participants relative to gender. The study collected data from 275 students. Data from only 244 participants was used for the study analysis. 36 participants were excluded either because of repeated data or uncompleted questionnaires. Out of the 244 participants, where 56.6% of the participants were males and 43.4% were females.

Age distribution: The distribution of males and females among the age groups were as following: Group-1: (17-20 years) represented 7.38% of the sample, 7.97% of them were males and 6.6% were females. Age group-2 (21-25 years) represented 7.38% of the sample, 31.95% of them were males and 58.5% were females. Age group-3 (26 – 30 year) represented 24.6% of the sample, 27.5% of them were males and 20.8% were females. Age group-4 (above 30 years) represented 23.8% of the sample, 31.95% were males and 13.2% were females as shown in table-1. Females were significantly younger than the male participants (P=0.001).

Marital status: table -2 shows the marital status of participant. The majority of participants were single (82%) and higher proportion of males were married compared to the females (P=0.001).

Income: Males had significantly higher income compared to females (P=0.001). The income was divided into five categories:- Category 1, (no income) 9.8% of the participants were in this category, 15.9% were males and 1.9% were females. Category 2, (income less than 500) 11.5% of the participants were in this category, 5.8% were males and 20.8% were females. Category 3 (500- 1000) 23.4% of the participants were in this category, 25.4% were males and 20.8% were females. Category 4, (1000- 2000) 28.3% of the participants were in this category, 30.4% were males and 25.5% were females. As for the last category 5, (greater than 2000) only 26.2% of the participants were in this category, 32.6% were males and 17.95% were females.

Body mass index (BMI): no significant differences in BMI between males and females (P=0.08). Eighty two percent of the participants has a BMI < 18.5 (0.72% of males 0.96% of the female). The BMI among participants age (18.5 – 24.9) was 47.9%, (43.48% of the males and 53.77% of the females). 35.25%, of the participants had a BMI (25 – 29.9) (21.74% of males and 52.83% of female. 15.98% of the participants had a BMI (≤ 30) (10.87% of males and 22.6 of females). 22.64% of females and 10.85% of males were classified as obese according to their BMI.

Table 1. Demographic characteristics of study participants relative to gender

	Variable	All	Male	Female	P. Value*
	Gender	244 (100%)	138 (56.6%)	106 (43.4%)	0.001
Age groups	1 (17-20)	18 (7.38%)	11 (7.97%)	7 (6.6%)	
	2 (21-25)	106 (73.6%)	44 (31.95)	62 (58.5%)	0.001
	3 (26-30)	60 (24.6%)	38 (27.5%)	22 (20.8%)	
	4 (>30)	58 (23.8%)	44 (31.95)	14 (13.2%)	
Marital status	Single	200 (82%)	110 (79.7%)	91 (85.9)	
	Married	44 (18%)	28 (20.3%)	15 (14.1%)	0.001
Income	No income	24 (9.8%)	22 (15.9%)	2 (1.9%)	0.001
	< 500	30 (11.5%)	8 (5.8%)	22 (20.8%)	
	500-1000	57 (23.4%)	35 (25.4%)	22 (20.8%)	
	1000-2000	69 (28.3)	42 (30.4%)	27 (25.5%)	
	>2000	64 (26.2%)	45 (32.6%)	19 (17.95)	
BMI	1 (<18.5)	2 (0.82%)	1 (0.96%)	1 (0.72%)	
	2 (18.5-24.9)	117 (47.9%)	57 (53.77%)	60 (43.48%)	0.08
	3 (25-29.9)	86 (35.25%)	56 (52.83%)	30 (21.74%)	
	4 (30 and above)	39 (15.98%)	24 (22.64%)	15 (10.87%)	

(*) Chi squares test for the proportion between males and females

4.2. Uses of nutritional/ ergogenic supplements

Figure 1 shows the number of participants that used nutritional supplements to improve their sport performance. 71.02% of males and 41.51% of females and percentage of people who didn't consume nutritional supplements was 28.98% of males and 58.49% of females (P<0.001).

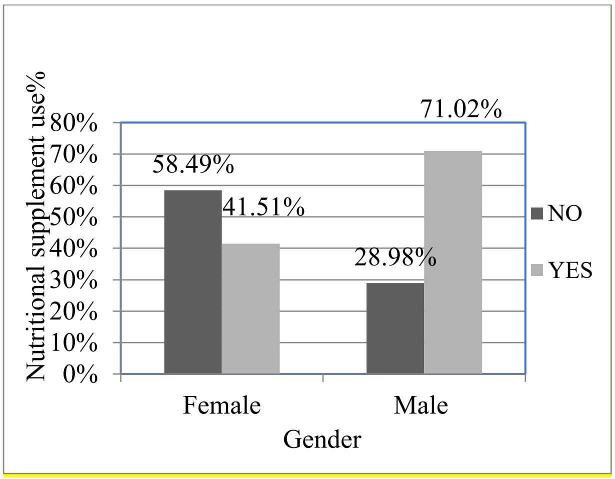

Figure 1. Nutritional supplement use across genders

Figure 2 shows the number of participants that used ergogenic supplements to improve their performance was 2.83% of females and 15.94% of males from 244 of total pooled data. 97.16% of female and 84.05% of males who never consumed ergogenic supplements

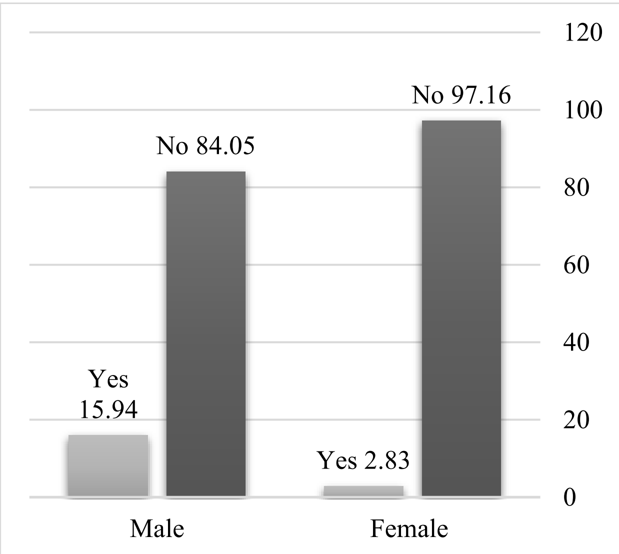

Figure 2. Use of ergogenic supplements by gender

4.3. Opinion of participants towards pre-workout supplements

Figure 3 shows attitude of participants towards pre-workout supplements. 9.43% of females and 12.31% of males strongly agree that pre-workout supplements enhance their athlete performance. 50% of females and 71.73% of males agrees and 32.07% of female and 13.76% of males disagree and 6.60% of female and 2.17 % of males strongly disagree agree that pre-workout supplements enhance their athlete performance, as shown below: significant differences between male and females who agrees on that pre-workout supplements enhances their athlete performance (P<0.001), where a larger proportion of males (71.73%) compared to females (50%) agreed on his statement.

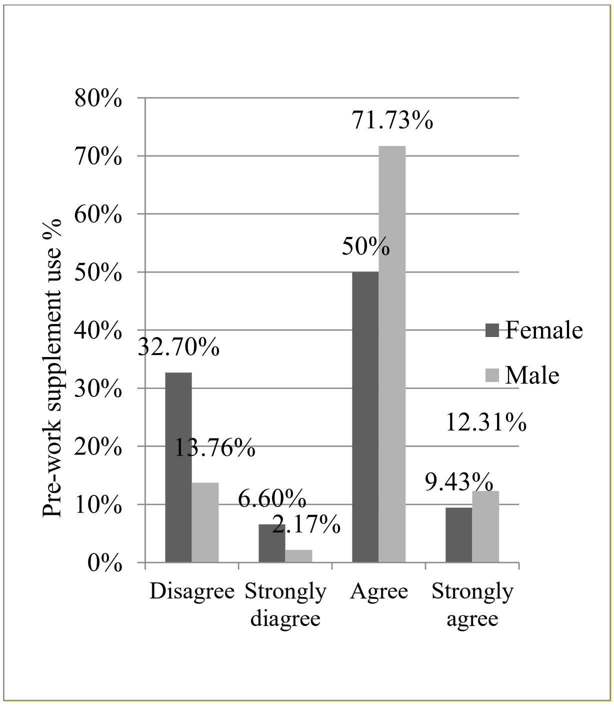

Figure 3. Attitude of participants towards pre-workout supplements

4.4. Participants food practice rate

Figure 4 shows the total participants that assessed the rate of their healthy food from 1- 5 was (n=243) people, which was the majority of answers for females 55.2% and 57.2% for males choose rate 3, And the least of male 2.17% and 1.90% of females choose rate 1, and 21.90% for females and 21.73% for males choose rate 4, and 17.14% of females and 11.59% of males choose rate 2, and 7.24% of males and 3.80% of females choose rate 5. No significant differences between males and females (p >0.05) as shown below:

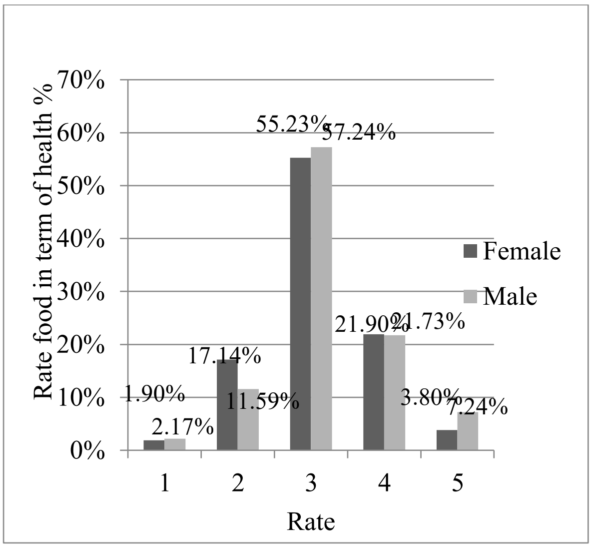

Figure 4. Rate your food practice response

4.5. Consuming ergogenic supplements based on coaches' encouragement

Figure 5 shows that lower proportion of males (37.68%) compared to females (42.45%) (P<0.05) would consume ergogenic supplements if they were encouraged by their coaches, as shown below:

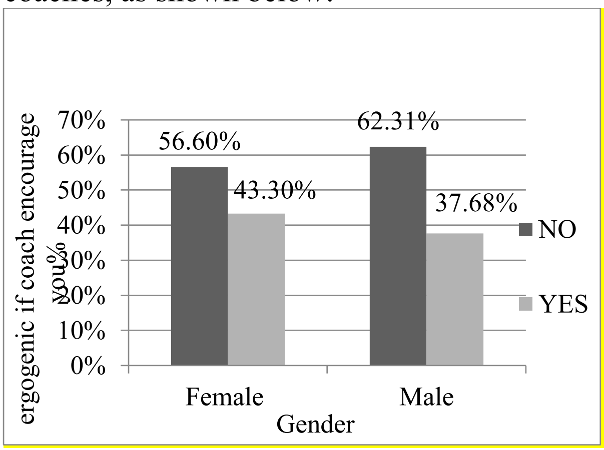

Figure 5. Would you take ergogenic supplements if your coach encouraged you (practice)

4.6. Knowledge question about ergogenic supplements and muscle building /fat loss

Figure 6 a larger proportion of males (55.79%) compared to females (29.24%) agreed that ergogenic supplement will accelerate muscle building and fat loss (P=0.001). 42.45% of female and 28.98% of male had intermediate agreement, and 26.4% of females and 15.21% of male s disagreed. Males appeared to have higher believes and expectations regarding the effects of ergogenic and protein supplements compared to females (P=0.001).

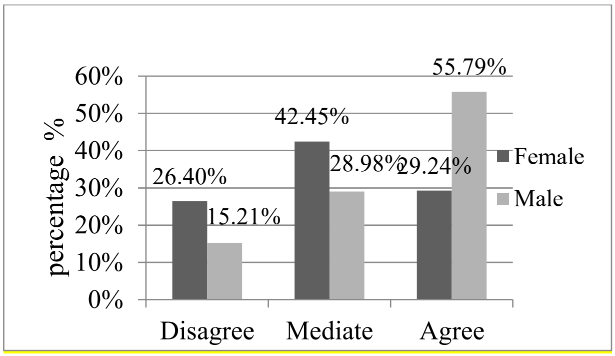

Figure 6. Opinion of participants regarding the knowledge question (Ergogenic supplements will accelerate muscle building and fat loss)

4.7. Participants believes

Figure.7 The number of people believe that nutritional supplements are necessary even if the diet is sufficient to meet nutritional needs was 35.27%, 27.35% of them were females and 41.30% were males who agreed on that. 33.37% of males and 29.24% of females had mediate of agreement and 42.45% of females and 24.63% of males disagreed with the statement, significant differences between males and females in responding to this question (P=0.001) as show below.

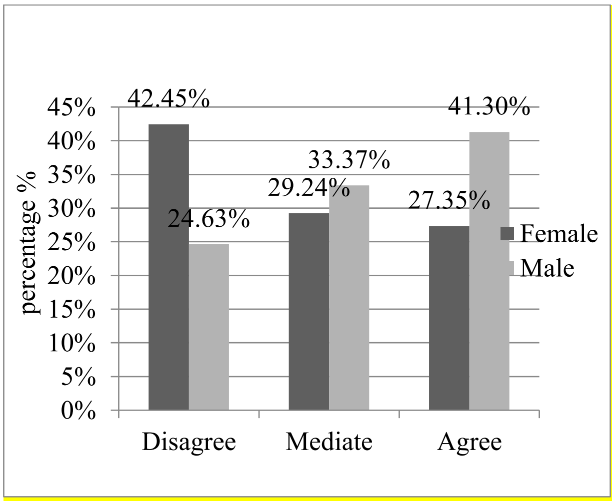

Figure 7. Believes of participants that supplements would be necessary even if that diet was sufficient

4.8. Income and protein supplements intake

Table- 2 shows that there a weak positive but significant correlations (r=.229) between income and protein supplements consumption (P=0.001). The higher the income the more proteins supplement were used among participants.

Table 2. Correlation between income score and protein supplements consumption

		Protein scoops score	Income score
Protein scoops score	Pearson Correlation	1	.229**
	Sig. (2-tailed)		.001
	N	244	220
Income score	Pearson Correlation	.229**	1
	Sig. (2-tailed)	.001	
	N	220	220

** P value less than 0.05

4.9. Participants age and protein scoops per day

Table 3 shows that there no correlation (P= 0.79) between the number of protein scoops and the age of participants (R=0.17).

Table 3. The correlation between the number of protein scoops and the age of participants

		Protein scoops score	Age
Protein scoops core	Pearson Correlation	1	.017
	Sig. (2-tailed)		.796
	N	244	242
Age	Pearson Correlation	.017	1
	Sig. (2-tailed)	.796	
	N	242	242

4.10. Hormone uses among males

Figure- 8 shows that 90.5% of male participants didn't consume hormones, while 5.1% of males were using anabolic steroids and 2.5% of males were using growth hormones and 1.8% of males were using Dianabol and 4% were using androlic and only 0.7% of male were using insulin hormone during the time of the study.

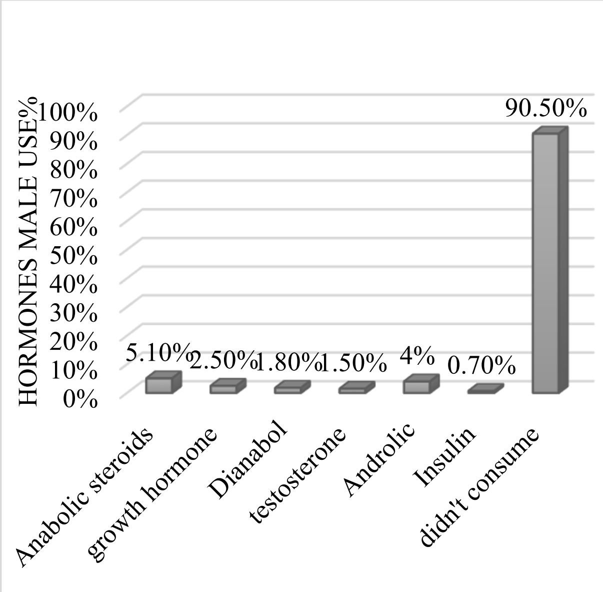

Figure 8. The use of hormones among male participants

4.11. Biomarkers of kidney function

Table 4 shows function compared to normal value among sub-sample (n=30) gym users taking different Multi-Ingredient Pre-Workout Ergogenic and protein supplements

Table 4. Changes in biomarkers of kidney

Kidney function biomarker	Mean for participants	Normal value	P value
Urea(Mg\dl)	31.78	5 to 20	**
Creatinine(Mg\dl)	0.87	0.74 to 1.35	
Sodium(mmol\L)	140.95	135 to 145	
Potassium(mmol\L)	4.454	3.5-5.2	
Chloride(meq\L)	100.14	96-106	
Uric Acid(Mg\dl)	6.30	2. 4 to 6. 0	**
ALBUMIN(g\dl)	5.17	3.5 to 5.5	

** P value less than 0.05

Table 5. Frequency of protein intake

Score (number of scoops/day)	Frequency	Percent (%)	Valid Percent	Cumulative Percent
0 (not taking protein)	147	60.2	60.2	60.2
1.0 (taking one scoop/day)	31	12.7	12.7	73.0
2.0 (taking two scoops/day)	53	21.7	21.7	94.7
3.0 (taking 3 scoops/day)	13	5.3	5.3	100.0
Total	244	100.0	100.0	

4.12. Frequency of protein supplements intake
Table- 5. Shows the number of proteins scoops used among participants. 60% of participants didn't use protein supplement. 12.7% reported that they consumed 1 scoop/day. 21.7% consumed scoops/day and only 5.3% consumed 3 scoops/day of proteins supplement

5. Discussion

This study aimed to assess the prevalence of pre-workout ergogenic and protein supplements use among university students and athletes across genders, to assess knowledge, attitudes, and practices related to protein supplement use among both genders in the target group and to evaluate their association with changes in kidney function. With a sample of 244 participants (56.6% males and 43.4% females), the study provided a balanced representation of both genders, essential for achieving the research objectives.

1. Perceived Differences concerning supplements and supplement use between male and female athletes

This study revealed that men and women used supplements differently. Protein and nutritional supplement intake show a higher intake for males than for females with a difference of 10.8 %. Specifically, 71. 02% male used nutritional supplement when compared to 41. 51% of females. These findings are similar to other research conducted in Saudi Arabia and Canada which also reported that there was a higher consumption of protein and ergogenic supplement among males [49-51]. The higher intake in protein supplement consumption among male consumers has been supported by data in other populations in which consumption of many performance-enhancing substances is higher among males [49-51].

The study also found that a larger proportion of males (71.73%) agreed that pre-workout supplements enhance athletic performance, compared to 50% of females ($P < 0.001$). Additionally, 55.79% of males believed that ergogenic supplements accelerate muscle building and fat loss, while only 29.24% of females shared this belief. This difference highlights a gender-specific perception of the benefits of these supplements. However, lack of knowledge around the proper use of these supplements was very evident throughout the group and further education programs around the safe use of supplements among university students are needed.

2. Potential Risks and Health Concerns

A significant portion of the study's participants (40%) used protein supplements, with 26% consuming more than the recommended two scoops per day. Excessive protein intake has been associated with potential health risks, including kidney damage. The current study noted elevated serum urea and uric acid levels among users of Multi-Ingredient Pre-Workout Supplements (MIPS) and protein supplements, corroborating findings that suggest increased risks of micro-albuminuria and interference with thyroid medication [52, 53].

While our study indicated a higher serum urea and uric acid values among MIPS users and protein supplement users as indicators of potential risks like kidney stress or kidney damage, these increases could be due to other causes other than supplement for instant dehydration could increase in athletes who lose fluid as sweat, potentially concentrating blood components and transiently increasing urea and uric acid levels [54]. Both dehydration and reduced renal filtration efficacy decrease the effectiveness of kidney filtration, causing spurious increases in renal markers without injury. the exercise intensity can lead to prolonged muscle breakdown and waste nitrogen production, transiently elevating blood levels of urea and creatinine on blood work [55]. It also could be increased d as a result of nutritional Intake by consuming a high-protein foods, particularly purine-rich foods (seafood, red meat, or legumes), can raise the level of uric acid [56]. Similarly, high salt or processed food consumption can affect markers of kidney function [57, 58]. These factors of diet may independently result in biochemical changes as described. Moreover, there some certain drugs / medication such NSAIDs and diuretics drug used by athletes can has a huge impact on the kidney function and this will affect the biomedical parameters [59]. In terms of hormone use, approximately 10% of male participants reported consuming hormones, including anabolic steroids, growth hormones, and other substances. This prevalence is lower but still notable compared to a study conducted in Riyadh, Saudi Arabia, where 47.9% of gym members used nutritional supplements and 7.9% used hormones [60]. This suggests a broad spectrum of supplement and hormone use among gym-goers, with potential implications for health and performance.

3. Perceptions and Implications

Gender differences were also evident in perceptions of supplement effectiveness. Males were more likely to view pre-workout supplements as beneficial for performance enhancement compared to females. This discrepancy indicates that males may be more inclined to use supplements based on their perceived benefits, while females may be more skeptical or cautious. Similar patterns were observed in a 2022 study of NCAA student-athletes, where males reported higher rates of supplement use compared to females and showed greater disordered eating attitudes and behaviors associated with supplement use [61]. These findings underscore the need for targeted educational and intervention strategies to address the specific attitudes and behaviors related to supplement use among different genders.

4. Recommendations for Practice and Future Research

Given the widespread use of MIPS and protein supplements, it is crucial for student-athletes and gym-goers to consult healthcare professionals before starting any supplements use.

The results of the research targeted health policy, particularly in the university setting. Educational programs that raise awareness about the risks of high-level supplement use, with particular emphasis on male students who recorded higher supplement use rates, need to be established. University guidelines that render medical consultation mandatory prior to supplement use must be established. Gender-sensitive awareness raising and periodic health checkups can alleviate health risks, especially those associated with kidney function. Finally, there is a need for more studies to provide evidence-based policy regarding supplement use among young adults. Control of the advised dosages and knowledge of potential side effects must be ensured to avoid health risk. Education regarding the risks and advantages of the supplements must be in advance and alternative interventions to performance improvement through nutrition and sleep optimization must be promoted. Further research is needed to explore the long-term health effects of MIPS and to develop safe and effective supplement formulations. Continued investigation into the gender-specific attitudes and health outcomes associated with supplement use will help tailor educational interventions, clinical guidelines, and policy recommendations that address the distinct needs and behaviors of male and female users more effectively.

6. Conclusion

This study highlights the prevalent use of MIPS among students and athletes in Benghazi, with a notable gender disparity in supplement use patterns and perceptions. While MIPS offers potential performance benefits, concerns about safety and health risks persist, particularly for younger users. A deeper understanding of these supplements' risks and benefits is crucial for informed decision-making. The authors recommended that before taking MIPS, people must visit a healthcare provider or sports dietitian to assess individual needs, risk, and interactions with medication or medical conditions. Take as directed and not exceeding the daily guideline. Monitor for any adverse effects and discontinue if symptoms are observed. Educate student-athletes on MIPS benefits and risks, side effects, so they can make informed choices about supplementation. Compare performance and recovery optimization alternatives with healthcare providers and certified sport nutritionists, including nutritional optimization, hydration, and rest. Encourage student-athletes to prioritize nutrition, hydration, and adequate rest as a baseline to optimize performance. Offer ongoing support for research to continue building our understanding of how MIPES affects.

Study limitation

Cross-sectional studies frequently depend on self-reported data, which can be prone to errors and inconsistencies, thus compromising the reliability of the findings.

The lack of longitudinal data makes it challenging to account for confounding variables that might influence both the exposure and the outcome, resulting in potentially misleading associations. The kidney function in this study required significant financial investment and are time-intensive. The stages of planning, recruitment, execution, and data analysis can take long time and demand considerable resources.

Acknowledgements:
The authors would like to thank Dr.Ghada Elgadi and all the participants who generously volunteered their time and effort to take part in this study.

Conflict of Interest and Financial Disclosure The author(s) declare no conflict of interest regarding the publication of this paper. Additionally, no financial support, grants, or funding was received from any organization or individual that could influence the outcomes or interpretations of this study

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