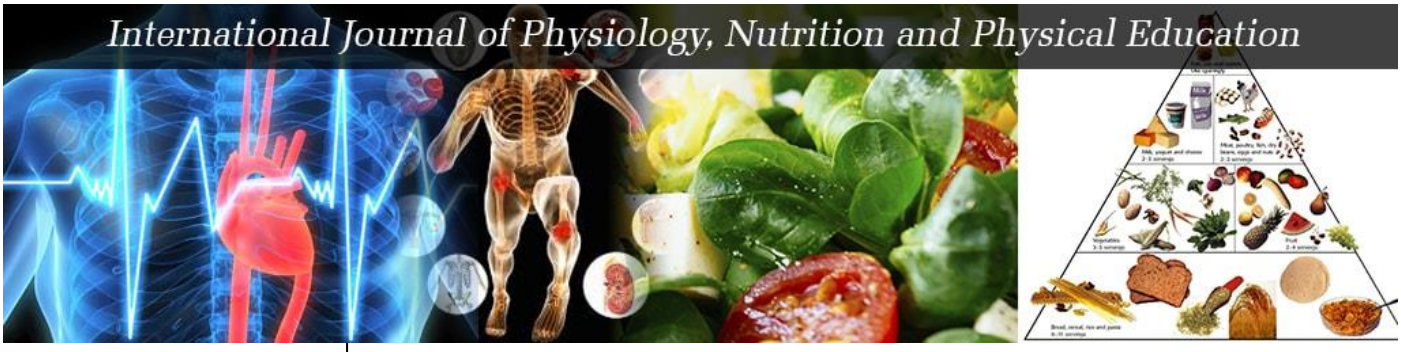

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Comparison of the adequacy of energy and macronutrient intakes of athletes involved in martial arts vs. football pre, during, and post-competition phase

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Abstract
Introduction: Proper nutrition periodization optimizes athletic performance through strategic nutrient adjustments. Off-season focuses on balanced macronutrients for recovery, while pre-competition and competition phases emphasize timing, increased carbs, and optimized protein intake for exercise fueling, recovery, and enhanced performance. This study aimed to compare the adequacy of energy and macronutrient intakes of athletes involved in martial arts vs. football during, pre and post-competition phases.
Methodology: An observational study with 85 Indian athletes aged 15 to 25 from football and martial arts academies utilized personal interviews, questionnaires, and measurements to gather data on training, diet, and physical activity. Four detailed 24-hour diet recall was taken throughout the entire study. Data analysis involved statistical methods such as ANOVA, t-tests, independent tests, and Chi-square testing in SPSS, using a standardized kit and WhatsApp for dietary recall.
Results: Martial arts athletes had higher body fat percentages (20.2±7.4) (p=0.062), significantly lower total body water percentages (58.3±5.4) (p=0.007), and higher exercise energy expenditure (2382±1204.5) (p=0.000) compared to football players. Martial arts athletes exhibited lower energy availability (-7.0±26.6) (p=0.001) compared to football players. Only mixed martial arts from the martial arts group had a positive energy balance (2.2±29.8) and the goalkeeper from the football group had a negative energy balance (-12±39.5). The adequacy of carbohydrates was very low in both groups.
Conclusion: Football athletes had better adequacy as compared to martial arts athletes pre, during, and post-competition phases.

Keywords: Macrocyle, nutrition periodization, macrocyle, off-season, competition phase

1. Introduction
Martial arts and football, both highly popular sports, demand exceptional levels of physical fitness, skill, and endurance (Oliveira *et al*. 2017) [45]. To excel in these sports, athletes must carefully consider their nutrition and employ effective nutrition periodization strategies. Nutrition periodization is a strategic approach that manipulates nutrient intake to optimize athletic performance and training adaptations based on the specific demands of different training phases (ISSN). This approach involves adjusting macronutrient distribution, energy intake, and nutrient timing to align with the goals and requirements of each phase within a training cycle, such as the off-season, pre-competition, competition, and recovery periods.
Martial arts, encompassing various combat sports and self-defense practices, require athletes to possess explosive power, agility, flexibility, and mental focus. High-intensity intermittent activities, rapid movements, and intense muscular exertion are characteristic of martial arts training and competition (Ranchordas *et al*., 2017) [47]. On the other hand, football, a team sport known as soccer in some countries, involves high-intensity aerobic and anaerobic activities, including sprinting, jumping, and frequent changes of direction (Bradley *et al*., 2016) [5]. Football athletes need excellent cardiovascular fitness, muscular strength, and endurance.
Research by Oliveira *et al*. (2017) [45] emphasizes the significance of nutrition periodization in optimizing the performance of athletes in both football and martial arts.

The effectiveness of nutrition periodization has been demonstrated in various studies, including Lambert *et al*. (2019) [33], which studied rugby players, and Mendes *et al*. (2017) [45], which focused on taekwondo athletes. These studies highlight the importance of aligning nutrient intake with training goals, emphasizing appropriate carbohydrate and protein timing, and individualizing nutrition plans to meet the specific needs of each athlete.

Macrocycle planning within nutrition periodization, as highlighted by Burke *et al*. (2018) [8], provides a framework for manipulating nutrient intake to support different training phases. This approach is vital to ensure that athletes can cope with the physiological demands of their respective sports, maximize their performance, and promote efficient recovery.

The training phases within nutrition periodization encompass the preparatory phase (Pre-competition phase), where the main task is to increase performance by ensuring adequate calorie intake and balanced macronutrient distribution (Mujika, I., *et al*. (2019) [60]. The transition phase (Off-season) allows for physical and mental recovery, with a focus on maintaining a balanced diet and overall health (Mujika, I., *et al*. (2019) [60]. The competition phase aims for peak performance during events, emphasizing nutrient timing, carbohydrate loading, and hydration strategies to optimize energy availability (Mujika, I., *et al*. (2019) [60].

It is essential to educate athletes and coaches on the significance of nutrition in sports performance during nutrition periodization. There is a pressing need to conduct studies on Indian athletes to assess their dietary adequacy levels during nutrition periodization. These findings will contribute significantly to the field of sports nutrition, enhancing the understanding of dietary habits and requirements specific to Indian athletes. Therefore, this study aimed to compare the adequacy of energy and macronutrient intakes of athletes involved in martial arts vs. football during, pre and post-competition phases.

2. Methodology

2.1 Participants

This observational study targeted martial arts and football athletes aged 15 to 25 years from professional and semi-professional youth teams in various Indian academies. The selection was based on the purposive method. The study included 85 athletes who met specific criteria: a minimum of 1 to 2 years of experience, active participation in competitions and training, and no chronic illnesses. Written consent was obtained from the participants.

2.2 Anthropometric Measurements

Height was measured with a standardized stadiometer, using three consecutive measurements, with an average value considered. A Tanita Body Fat Analyzer (BC 541 Weighing Scale) assessed weight, lean muscle mass, total body water, and body fat percentages (Visceral and total fat percentage).

2.3 Dietary Assessment

A detailed 24-hour diet recall was conducted four times during the study: pre-competition, competition, and post-competition seasons, using a standardized food kit. Diet recalls included two during the pre-competitive phase (7 days and 1-2 days before competition), one during the competition phase (On the day of competition), and one in the post-competition phase (post the end of competition). Nutrient intake was computed using the IFCT book's nutritional values. The International Physical Activity Questionnaire (IPAQ) Short Form assessed participants' physical activity, while the Harris-Benedict equation calculated total daily energy expenditure.

2.4 Statistical Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS) software. Statistical tests included ANOVA, independent sample t-tests, and Chi-square tests to determine significance ($p < 0.05$). Data were presented as means and standard deviations for each parameter, including energy, macronutrient, and micronutrient requirements met. Independent sample t-tests compared nutritional intake adequacy between the two groups. Pearson Chi-square tests examined differences in gender, allergies, and energy availability. ANOVA calculated mean values for each parameter in the martial arts and football groups.

2.5 Ethical Considerations

The study received approval from the Inter-System Biomedical Ethics Committee (ISBEC). Participation was voluntary, and informed consent was obtained from participants and parents of athletes under 18. The collected data were securely stored and password-protected, with restricted access to researchers, and no compensation was provided to participants.

3. Results

A total of 85 athletes agreed to take part in the study and provided their consent. There were 49 football players and 36 martial arts athletes. There were 11 (22.4%) females and 38 (77.6%) males among the 49 football players, and 15 (41.7%) females and 21 (58.3%) males among the 36 martial arts participants. The mean age of the martial arts athletes was 20±2.8 years and football athlete was 18±2.0 years. Martial arts athletes train for 3.2 hours/day and football athletes for 2.3 hours/day.

Table 1: Anthropometric measurement, estimates of exercise energy expenditure and energy expenditure and energy availability in martial arts vs. football athletes

Characteristics	Martial Arts	Football	p-value
Height (cm)	163 ±9.5	168 ±8.3	0.013*
Weight (kg)	59.1±10.1	59.1 ±11.597	0.995
Body fat percentage (%)	20.2±7.4	17.1 ±7.7	0.062
Total body water (%)	58.3±5.4	62 ±6.3	0.007*
Muscle mass (kg)	44.7±9.4	47.12 ±7.918	0.219
Fat-free mass (kg)	47.2±10	48.6 ±8.1	0.486
Bone mass (kg)	2.5±0.561	2.65±0.522	0.199
Visceral fat	3.9±2.4	3.29 ±3.021	0.283
Energy Expenditure (kcal/day)	2670±456.1	2586±528.6	0.446
Exercise Energy expenditure (kcal)	2381.7±1204.5	1348.8±735.1	0.000**
Energy Availability (kcal)	-7±26.6	11.10±20.8	0.001*

All the values in the table are mean ± SD and a statistically significant value is placed at $p \leq 0.05$, ** represents $p<0.001$, and * represents significance at $p<0.05$

Martial arts athletes had higher body fat percentages (20.28±7.444), lower total body water percentages (58.33±5.467), and higher exercise energy expenditure (2381.72±1204.563) compared to football players. However, the differences in visceral fat, muscular mass, fat-free mass, bone mass, and energy expenditure throughout the day were not statistically significant between the two groups. Additionally, martial arts athletes exhibited lower energy availability (-7.00±26.649) compared to football players.

Table 2: Comparison of body composition among martial arts athletes on the basis of type of martial arts

Characteristics	MMA	Taekwondo	Judo	Karate	p-value
Body fat percentage (%)	18.2±5.8	18.7±6.2	18.3±7.7	25.3±7.4	0.091
Total body water (%)	59.9±4.14	59±4.7	59.8±5.7	54.7±5.4	0.096
Muscle mass (kg)	44.6±7.8	43.2±11.3	48.1±9.4	41.5±10.3	0.434
Fat-free mass (kg)	46.9±8.1	46±11.6	10.08±2.91	11.180±3.5	0.464
Bone mass (kg)	2.4±0.5	2.5±0.5	2.67±0.65	2.40±0.51	0.656
Visceral fat	3.5±1.9	3.50±1.73	4.33±2.60	4.10±2.9	0.853
Energy Expenditure (kcal/day)	2856±328.1	2221±178.1	2861±530.5	2434±329	0.010*
Exercise Energy expenditure (kcal)	2578±1194.6	2126.5±1399.8	2766±1230.3	1828±1050.8	0.295
Energy Availability (kcal)	2.2±29.8	-8.5±38.72	-11±16.4	-10.7±30.1	0.660

All the values in the table are mean ± SD and a Statistically significant value is placed at $p \leq 0.05$, ** represents $p<0.001$, and * represents significance at $p<0.05$

Table 2 findings showed no significant differences in body composition, including body fat percentage, total body water percentage, muscle mass, fat-free mass, bone mass, visceral fat, and energy availability between MMA, Taekwondo, Judo, and Karate.

Table 3: Comparison of body composition among football athletes on the basis of their position

Characteristics	Midfielder	Defender	Forwarder	Goalkeeper	p-value
Body fat percentage (%)	17.5±8.4	19±8	14.5±5.6	13.5±12	0.437
Total body water (%)	61.8±6.5	60.1±6.6	64.5±5.1	63.5±9.1	0.364
Muscle mass (kg)	48.1±6.7	45.2±9.2	46.8±7.7	53±12.7	0.536
Fat-free mass (kg)	49.5±7.1	47±9.8	48±7.0	55.5±13.4	0.527
Bone mass (kg)	2.7±0.4	2.6±0.5	2.5±0.5	3±1.4	0.715
Visceral fat	3.5±2.9	3.2±3.2	2.5±2.7	5±5.6	0.707
Energy Expenditure (entire day in kcal)	2555±537.1	2533±577.1	2603±451.1	3194±477.2	0.422
Exercise Energy expenditure (kcal)	1185±609.9	1406±665.9	1356±573.3	2510±2402	0.105
Energy Availability (kcal)	15.3±21.7	8±17.9	11.67±19.43	-12±39.5	0.311

All the values in the table are mean ± SD and a Statistically significant value is placed at $p \leq 0.05$, ** represents $p<0.001$, and * represents significance at $p<0.05$

Table 3 shows that there were no significant variations between midfielders, defenders, forwards, and goalkeepers in terms of body composition characteristics and there was no significant difference found. Only goalkeepers had a negative energy availability.

Table 4: Macronutrient and micronutrient intake in martial arts vs. football athletes

Variables	Sports	Pre-competition		During Competition	Post competition
		1 week before	1-2 days before		
Energy (kcal/kg body weight)	Martial Arts	31.8±17.5	28.47±24.47	30.53±12.3	35.8±19.5
	Football	32.8±14.9	34.9±17.8	32±14.8	32.16±15.3
	p-value	0.785	0.172	0.625	0.340
Carbs (g/kg body weight)	Martial Arts	3.9±2.4	2.8±1.8	3.6±1.7	4.03±4
	Football	3.6±1.8	4±2.3	3.8±1.9	3.63±3.6
	p-value	0.599	0.009*	0.643	0.422
Protein (g/kg body weight)	Martial Arts	1.3±0.6	1.1±0.7	1.2±0.6	1.36±1.3
	Football	1.1±0.8	1.33±0.8	1.1±0.7	1.2±1.2
	p-value	0.128	0.259	0.809	0.454
Fat (g/kg body weight)	Martial Arts	1.2±0.7	0.9±0.6	1.1±0.5	1.5±1.5
	Football	1.2±0.7	1.3±0.8	1.2±0.7	1.27±1.2
	p-value	0.924	0.023*	0.328	0.100
Fibre (g/day)	Martial Arts	24.2±14.3	19.8±12.4	19.6±10	24.3±14.9
	Football	23.2±13.8	25.1±15.6	23.1±11.1	22.7±13.8
	p-value	0.733	0.096	0.139	0.596
Calcium (mg/day)	Martial Arts	512.1±368.1	353±206.8	376.4±250.3	615.8±478.6
	Football	500.8±347.1	486.1±405.0	437.3±239.4	458.86±363.9
	p-value	0.885	0.075	0.259	0.090
Iron (mg/day)	Martial Arts	16.6±14.1	13±13.5	13.2±19.3	24.6±57.7
	Football	15.3±16.3	17.6±19.6	15.3±15.6	14±13.4
	p-value	0.709	0.226	0.595	0.217

All the values in the table are mean ± SD and a statistically significant value is placed at $p \leq 0.05$, ** represents $p<0.001$, and * represents significance at $p<0.05$

Martial arts athlete's energy intake decreased (from 31.8+17.5 kcal/kg body weight to 28.47+24.47 kcal/kg body weight) as the competition neared and increased after the competition weigh-in (30.53+12.3 kcal/kg body weight to 35.8+19.5 kcal/kg body weight). Football athletes had a consistent energy intake, except for a slight increase before the competition (32.8+14.9 kcal/kg body weight to 34.9+17.8 kcal/kg body weight). Both groups failed to meet the recommended energy intake range. There were no significant differences in energy and macronutrient intake, except for a significant difference in fat and carbs intake just before the competition.

Table 5: Comparison of macronutrient and selective micronutrient intake among martial arts vs. football athletes

Variables	Sports	Pre-competition		During Competition	Post competition
		1 week before	1-2 days before		
Energy (%)	Martial Arts	53.8±29.5	56.2±52	52.1±22.4	59.9±33
	Football	61.2±28.9	59.6±32.1	59.3±26.1	61.83±30.9
	p-value	0.284	0.715	0.227	0.802
Carbohydrate (%)	Martial Arts	37.6±19.4	29.8±18.6	35.6±19.9	40±20.9
	Football	41±22.8	41.8±27.1	42.3±21	40.7±24.3
	p-value	0.523	0.045*	0.175	0.903
Protein (%)	Martial Arts	52.5±29.9	53.6±44	57.1±45.3	55.7±35.5
	Football	73.9±45.3	72.5±49.1	69.2±37.2	76±48.5
	p-value	0.031*	0.102	0.202	0.059
Fat (%)	Martial Arts	90.2±56	84.1±52.5	88.7±34	108.9±65.8
	Football	105.6±59.2	99.4±60.9	100.5±53.9	65.8±58.5
	p value	0.264	0.270	0.305	0.940
Fibre (%)	Martial Arts	57.9±37.5	50.4±26.3	54.2±27.7	64.9±38.5
	Football	88±47.4	88±51.5	79.7±36.2	84.1±50.3
	p-value	0.005*	0.001*	0.002*	0.087
Calcium (%)	Martial Arts	33.6±24.4	26.1±14.6	26.6±14.4	34.7±30.3
	Football	37.2±25.8	32.7±27.4	30.6±18.66	38.7±30.1
	p-value	0.551	0.251	0.327	0.576
Iron (%	Martial Arts	66.8±53.1	50±37.5	55.1±44.2	139.8±378.5
	Football	220.9±214.3	234.7±246.7	204.9±245.8	194.6±163.3
	p-value	0.001*	0.000**	0.003*	0.352

All the values in the table are mean ± SD and a Statistically significant value is placed at $p \leq 0.05$, ** represents $p<0.001$, and * represents significance at $p<0.05$

Football athletes had higher adequacy of protein and fiber intake compared to martial arts athletes throughout the nutrition periodization. However, there was no significant difference in the adequacy of energy, carbohydrates, and fats between the two groups. Both groups had low adequacy of calcium intake, both martial arts and football athletes should pay attention to their calcium consumption. The adequacy of energy, carbs, protein, and most micronutrients (except for iron) was below the recommended range, while the fat intake was within the recommended range for both groups.

Table 6: Comparison of macronutrient and selective micronutrient intake among male and female martial athletes

Variables	Sports	Pre-competition		During Competition	Post competition
		1 week before	1-2 days before		
Energy (%)	Female	60.2±36.2	65.1±64.4	53.8±23.1	65.5±38.7
	Male	56.1±29.3	42.2±24.7	56.7±22.5	64.4±34.3
	p-value	0.712	0.146	0.703	0.932
Carbohydrate (%)	Female	37.4±23.7	26.4±15.3	31.9±16.9	37±23.3
	Male	32.8±19.9	24.9±17.8	34.9±16	35.4±22.3
	p-value	0.532	0.792	0.596	0.833
Protein (%)	Female	56.9±35.1	54.7±47	52.5±33.1	60.4±42.4
	Male	61.6±33.1	48±28.7	57.3±26.4	68.7±44
	p-value	0.683	0.605	0.632	0.575
Fat (%)	Female	101.8±70.4	88.2±53.7	96.3±34.4	122.5±74.7
	Male	94±56.4	68.62±45.8	91±44.3	117.6±62.7
	p-value	0.714	0.246	0.703	0.832
Fibre (%)	Female	66.5±42.1	56.5±29.4	52.5±32.1	73.7±43.4
	Male	91.19±50.16	73.43±47.44	74.10±32.23	86.81±54.19
	p-value	0.130	0.231	0.056	0.445
Calcium (%)	Female	37.6±28.4	28.2±14	23.4±14.9	40.6±36.7
	Male	36±25.2	23.1±15.2	29.3±19.6	46.4±33
	p-value	0.860	0.312	0.329	0.623
Iron (%)	Female	73.6±58.2	58.2±46.7	49.7±40.2	207.8±494
	Male	239.1±202.7	192.6±204.9	204.9±304.4	192.6±120
	p-value	0.860	0.018*	0.059	0.892

All the values in the table are mean ± SD and a statistically significant value is placed at $p \leq 0.05$, ** represents $p<0.001$, and * represents significance at $p<0.05$

In the pre-competition 1 week before the recall, there was no significant difference between male and female athletes in terms of macronutrients and micronutrients except for iron. Males had significantly higher adequacy of iron consumption compared to females in pre-competition.

Table 7: Comparison of macronutrient and selective micronutrient intake among male and female football athletes

Variables	Sports	Pre-competition		During Competition	Post competition
		1 week before	1-2 days before		
Energy (%)	Female	45.1±14.3	44.1±26	49.8±22.4	52.3±22.8
	Male	64.11±28.7	69.2±32	60.7±28	60.3±29.3
	p-value	0.041*	0.022*	0.245	0.409
Carbohydrate (%)	Female	38±12.6	34.5±22.2	40.7±23.2	44±17.3
	Male	45.5±23.3	51.1±27	46.4±22.4	43.6±25.2
	p-value	0.315	0.070*	0.466	0.955
Protein (%)	Female	46.6±21.2	52.3±42.1	63.5±59.3	49.2±23.5
	Male	80.6±50	86±53	75.8±40.9	80±50.9
	p-value	0.034*	0.060	0.434	0.059
Fat (%)	Female	74.4±20.6	78.4±52.9	78.3±32	90.4±48.7
	Male	112.1±60.4	116.4±62.1	105.8±58.3	102.5±56.2
	p-value	0.049*	0.072	0.143	0.523
Fibre (%)	Female	46.27±27.6	42.18±19.77	56.64±21.6	52.91±28.
	Male	86.3±46.54	96±52.5	82.8±38.3	82.7±48.7
	p-value	0.009*	0.002*	0.036	0.060
Calcium (%)	Female	28.27±17.2	23.18±15.6	31±13	26.7±16.9
	Male	37.9±26.4	38±31.1	31.3±18.3	34.5±28
	p-value	0.261	0.136	0.947	0.389
Iron (%)	Female	57.7±46.3	38.7±1491	62.5±50.3	47.18±16.4
	Male	210.8±222.5	258±266.7	205±211.3	195.6±184.4
	p-value	0.029*	0.009*	0.033*	0.011*

All the values in the table are mean ± SD and a statistically significant value is placed at $p \leq 0.05$, ** represents $p<0.001$, and * represents significance at $p<0.05$

Male and female football players' adequate consumption varies slightly, according to the statistical analysis. Male athletes often ingested more calories, protein, fats, and micronutrients than female athletes did. However, it is important to note that the differences were not always statistically significant, and further research may be needed to confirm these findings.

The findings of this study suggest that both martial arts and football athletes have inadequate nutrient intake, particularly in terms of carbohydrates and calcium. This may increase their susceptibility to injury and have a negative impact on their performance. To optimize their nutritional status, athletes should focus on meeting their total energy and macronutrient requirements, as well as ensuring adequate micronutrient intake before, during, and after the competition.

4. Discussion

Martial arts athletes in this study exhibited lower energy availability (-7.00±26.649) compared to football players, indicating a potential vulnerability to low energy availability and associated health concerns. In one of the case study athletes followed a low-carbohydrate diet with daily energy intake ranging from 1500-1900 kcal and reduced it to 1300-1500 kcal along with cutting down fluid consumption as they approached competition (Kasper *et al*., 2019) [32].

Goalkeepers, despite their high energy demands during exercise, experienced negative energy availability. This may be due to factors such as potential differences in aerobic capacity when compared to outfield players (Rebelo *et al*., 2013) [49]. Goalkeepers tend to cover less distance during a game than outfield players (Mohr *et al*., 2003) [40] and often have higher body mass and fat percentages (Nikolaidis *et al*., 2013) [43] potentially elevating their energy expenditure. Their exercise pattern involves short bursts of high-intensity activity mixed with intervals of low-intensity, further affecting overall energy expenditure. In contrast, midfielders had the highest energy availability.

In the pre-competition phase, football players had higher energy, protein, and fat intake compared to martial arts athletes. Similarly, during the competition period, football players consumed more carbohydrates and iron. Weight-cutting practices, common in combat sports, including martial arts, often involve reducing food and fluid intake, including water, to meet weight class standards (Reale *et al*., 2017) [48]. This practice may explain the lower macronutrient intake observed in martial arts athletes, as they aim to cut weight by reducing overall caloric intake, a prevalent strategy among martial arts competitors.

Both groups showed low adequacy of calcium intake, with no significant difference. However, football athletes consistently demonstrated significantly higher adequacy of iron intake in all recall periods. Research by Martins *et al*. (2018) [36] on Brazilian martial arts athletes highlighted deficiencies in micronutrients, including calcium, vitamin D, and iron. Football players, on the other hand, often suffer from nutritional deficiencies, including insufficient iron, calcium, vitamin D, and protein intake, which can impact their health and performance (Toscano *et al*., 2019) [59]. Notably, this study found that iron intake was adequate in football athletes. Still, calcium intake was lower than the recommended daily amount, potentially increasing their risk of stress fractures and other bone injuries Martins *et al*. (2018) [36].

Football athletes in this study showed higher protein and carbohydrate intake compared to martial arts athletes. Protein intake fell within the recommended range for football athletes, but carbohydrate intake was lower than recommended in both groups. Research by Raizel *et al*. (2019) [46] found that the average protein consumption by football athletes was 1.7g per kg body weight/day, within the recommended range of 1.4-2.0g per kg body weight/day, with

some players consuming less. Similarly, Silva *et al*. (2019) [55] analyzed the dietary intake of 20 Brazilian professional football players, revealing an average carbohydrate intake of 5.0g per kg body weight/day, within the recommended range of 5-7g per kg body weight/day.

Gholamalizadeh *et al*. (2017) [15] studied the dietary intake of 52 male and female Iranian martial arts athletes and found their average carbohydrate and protein intake to be below the recommended levels for high-intensity exercise similar to this study's results. Moreover, the study suggests that martial arts athletes tend to have higher body fat percentages and lower total body water percentages compared to football players. These differences in body composition could potentially impact athletic performance and warrant further research into their relationship with performance in both sports.

The study evaluated the intake of the athletes in 4 different phases one of the few studies which specifically focuses on energy and macronutrient intake adequacies in Indian martial arts and football sports athletes. The study looks at macronutrient, micronutrient, and energy intake adequacy in Indian athletes which will contribute to the knowledge of the Indian sports science team/faculty. This study provides insight into the nutritional imbalance so that preventative intervention can be implemented to improve athletic performance.

Overestimation or under-estimation of nutrient intake, especially of diet recall which was taken on digital media. Small sample size in each group of sports this study is only limited to the category of martial arts and football sports. For each category of sports, the sample size was small. No Indian recommendation is given for the macronutrient and micronutrient intake and pre, during, and post-competition intake.

The findings of this study highlight the need for increased attention to nutrition education and support for both martial arts and football athletes to optimize their nutritional intake and improve their performance. Future research could investigate interventions aimed at improving the nutritional status of athletes in these sports, and explore the impact of such interventions on athletic performance and health outcomes.

5. Conclusion

This study shows that martial arts athletes have higher body fat percentages, energy expenditure, and lower total body water percentages than football players. Both groups were unable to meet their energy, carbohydrate, protein, and micronutrient (except for iron intake by football athletes) requirements. Football athletes have better nutrient adequacy as compared to martial arts athletes before, during, and after the competition. Both groups' fat intake was in the recommended range. It is important to educate athletes about the importance of nutrition and its crucial role in improving performance.

Not many similar studies have been done that compares the adequacy of nutrient intake pre, during, and post-competition phase between martial arts and football athletes. Therefore, there is a need to do more similar studies in this area with a larger sample size in other different sports to get more reliable data, broaden the knowledge and development on this topic, and with the intention to generate Indian standard recommendations.

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