Impact of Sustained Nutritional Intervention on Dietary Intake and Nutritional Status among Adolescent Soccer Players: A Comparative Study Across Age Groups

Mrs. G. Latha[1]*, Dr. Meera Raman[2]
*[1]*PhD Scholar (Part-time), Assistant Professor, Department of Foods and Nutrition, Rathnavel Subramaniam College of Arts and Science, Coimbatore, Tamilnadu, India.*
[2]Professor, Dean of BioScience, Dr.N.G.P Arts and Science College, Coimbatore, Tamilnadu, India.

Abstract

Adolescent athletes, particularly soccer players, have increased energy and nutrient demands due to rapid growth and the physical exertion involved in their sport. Proper nutrition is essential for optimal performance, growth, and development. These athletes require a well-balanced diet that provides energy, macronutrients (carbohydrates, proteins, and fats), and micronutrients (vitamins and minerals) to support their physical activities and overall health. The study aims to assess the effect of a sustained nutritional intervention on the energy and nutrient intake of adolescent soccer players across three developmental stages: pre-adolescent (10–12 years), adolescent (13–15 years), and post-adolescent (16–18 years). 300 young soccer players between 10-19 years were chosen using stratified random sampling from various soccer academies in Coimbatore District. All the samples completed the semi-structured questionnaire. Nutrient intake was assessed using a 24-hour dietary recall method over three non-consecutive days, along with data on daily nutritional consumption. A comparative analysis was conducted between control and experimental groups, with pre-and post-test measurements focusing on energy, macronutrient intake (carbohydrates, proteins, and fats), and key micronutrients (calcium, magnesium, and iron). The results highlight significant improvements in the experimental group across all age categories, particularly in protein and calcium intake, which are crucial for athletic performance and growth. The study underscores the potential benefits of tailored nutritional interventions in enhancing adolescent athletes' dietary habits and performance.

Keywords: *Adolescent soccer players, nutrition intervention, nutrient intake, energy intake, macronutrients, micronutrients, pre-and post-test analysis*

1. Introduction

Adolescence is a critical period for growth, development, and establishing lifelong health behaviors. For adolescent athletes, particularly soccer players, optimal nutrition plays a pivotal role in supporting both physical development and sports performance. Despite the increased nutritional demands during adolescence, many athletes fail to meet the recommended dietary allowances (RDA) for essential nutrients such as proteins, calcium, and iron, which can hinder performance and increase the risk of injury **(Bean, 2020)**.

Soccer is a demanding sport that requires endurance, strength, and agility, placing a high metabolic demand on players. Adequate intake of macronutrients (energy, carbohydrates, proteins, and fats) and micronutrients (such as iron, calcium, and magnesium) is essential to meet these metabolic demands and support athletic performance and recovery **(Maughan, Burke & Dvorak, 2020).**

Despite the known importance of nutrition in sports, many adolescent athletes, especially in developing countries like India, fail to meet the recommended dietary allowances (RDA) for their age and activity levels. Studies have shown that adolescent athletes often exhibit poor dietary habits, leading to inadequate nutrient intake and, consequently, suboptimal sports performance. **Beals (2019)** emphasizes that adolescent athletes frequently lack the nutritional knowledge necessary to make informed dietary choices. The Indian Council of Medical Research (ICMR) has provided specific RDAs to guide the nutritional requirements of adolescents, but adherence to these guidelines remains a challenge. Factors such as lack of nutritional knowledge, poor dietary practices, and socioeconomic constraints contribute to this problem **(Indian Council of Medical Research, 2020).**

Research indicates that the dietary behaviors of adolescents can significantly influence their health outcomes. **Deshmukh-Taskar et al. (2010)** highlight how dietary habits established during adolescence can persist into adulthood, making it essential to address these behaviors early. Furthermore, coaches play a crucial role in shaping athletes' dietary knowledge and habits; however, studies like that of **Juzwiak and Ancona-Lopez (2009)** reveal gaps in the nutrition education provided by coaches to adolescent athletes.

Nutritional interventions have been shown to positively impact the dietary intake and overall health of adolescents. Previous research has demonstrated that structured nutritional programs can significantly improve the intake of key nutrients such as energy, protein, and micronutrients like iron and calcium, which are often lacking in the diets of adolescent athletes **(Thomas, Erdman & Burke, 2016).** These improvements not only contribute to better physical development but also enhance athletic performance, endurance, and recovery **(Iglesias-Gutierrez et al., 2019).**

This study aims to evaluate the effect of a sustained nutritional intervention on the nutrient intake of adolescent soccer players in Coimbatore District, India. The intervention focuses on comparing the nutrient intake between an experimental group receiving personalized nutritional counseling and a control group with no intervention, using a pre-and post-test analysis. The primary objectives are to assess whether the intervention can bring the nutrient intake of adolescent soccer players closer to the ICMR's recommended dietary allowances and to determine the overall impact on their dietary habits and athletic performance.

By addressing these objectives, this study seeks to contribute to the growing body of literature on adolescent nutrition and sports performance, providing insights into how targeted nutritional strategies can enhance both health and athletic outcomes **(Macdermid & Stannard, 2014).**

2. Methods

Participants were divided into control and experimental groups across three age categories: pre-adolescent (10–12 years), adolescent (13–15 years), and post-adolescent (16–18 years).

2.1. Study Design

A Randomized Controlled Trial (RCT) was conducted among 300 male adolescent soccer players aged 10–19 years, categorized into pre-adolescent (10–12 years), adolescent (13–15 years), and post-adolescent (16–18 years) groups. Participants were selected from various soccer academies in the Coimbatore district. The study follows a pre-and post-test comparative design with two groups: an experimental group receiving the nutritional intervention and a control group following their usual diet. Data were collected at baseline (pre-intervention) and after the intervention period of 6 months (post-intervention).

2.2. Participants

The sample included 96 pre-adolescents in the age group of 10-12 years (n=48 control; n=48 experimental), 144 adolescents in the age group of 13-15 years (n=72 control; n=72 experimental), and 60 post-adolescents in the age group of 16-18 years (n=30 control; n=30 experimental).

- **Inclusion criteria**: Participants between 10–18 years, registered full-time in soccer academies, actively involved in soccer training at least 3 times per week, regularly practicing, and competing at least at the school level. Subjects were required to be willing to participate in the study.
- **Exclusion criteria**: Players with known medical conditions affecting nutritional status and those on medication that could influence metabolism or hydration status were excluded.

2.3. Sampling method

- Stratified random sampling method used to ensure age-specific representation.
- 300 male adolescent soccer players divided into 150 in the control group and 150 in the experimental group

2.4. Nutritional Intervention

The experimental group received a comprehensive nutritional intervention over six months, tailored to meet the specific energy and nutrient requirements for adolescent soccer players by RDA guidelines. This intervention addressed macronutrient needs (carbohydrates, proteins, and fats), nutrient timing strategies before and after training, hydration plans based on training intensity, and performance enhancement techniques. Age-specific energy and nutrient requirements were incorporated into individualized meal plans, coupled with nutritional education and regular dietary monitoring to ensure adherence. In contrast, the control group continued with their habitual diet without any additional guidance or intervention.

2.5. Data Collection

Data collection was carried out using a combined approach of face-to-face interviews and a semi-structured questionnaire. Nutrient intake was assessed using a 24-hour dietary recall method over three non-consecutive days, along with data on daily dietary consumption. The Ntuitive Calculator app was utilized to analyze nutrient intake from food records, with the results compared to the Recommended Dietary Allowances (RDA) set by the ICMR (2020). Energy intake, as well as the intake of macronutrients (carbohydrates, proteins, fats) and micronutrients (calcium, magnesium, iron), were assessed at both pre-test (baseline) and post-test phases using dietary analysis software to evaluate changes over the intervention period.

2.6. Variables of the study

The variables in this study include both independent and dependent factors. The independent variable is the nutritional intervention, which consists of tailored meal plans, macronutrient education, nutrient timing strategies, and hydration plans designed for the experimental group. The dependent variables include key outcomes such as energy intake, macronutrient intake (carbohydrates, proteins, and fats), and micronutrient intake (calcium, magnesium, and iron). Other dependent variables include hydration status, performance indicators, nutritional knowledge, attitude, and practices (KAP). Data were collected at both pre-and post-test phases to measure the impact of the nutritional intervention on these variables, comparing them between the experimental and control groups.

2.7. Duration of Study

- The length of the intervention or follow-up period (e.g., 6 months).
- Study started in December 2019 and completed in March 2024

2.8. Ethical considerations and informed consent

The study has been approved by the Institutional Human Ethics Committee (IHEC) of Avinashilingam Deemed University, Coimbatore. Written informed consent was obtained from the parents or legal guardians of all subjects before the commencement of the study. All data will be kept confidential, and participants will be debriefed at the end of the study.

2.9. Statistical Analysis

The data were analyzed using SPSS software, with results presented as mean ± standard deviation (SD). Paired t-tests were used to compare pre-and post-test values within each group, while independent t-tests were used to compare values between the control and experimental groups. A p-value of <0.05 was considered statistically significant.

3. Results

3.1. Mean Macronutrient intake of control and experimental group adolescent soccer players

A daily meal must contain foods from each of the five food groups to be healthy and well-balanced **(Srilakhsmi, 2014)**. It is significant to note that the nutrient consumption data was calculated using a 24-hour recall period. The average dietary consumption of teenage boys is shown by the RDA values recommended by the Indian Council of Medical Research.

The mean macronutrient intake of adolescent soccer players plays a critical role in their physical performance and overall health, particularly as they undergo rapid growth and development. Macronutrients, including carbohydrates, proteins, and fats, are essential for providing the energy required for both training and recovery in athletes. Studies have shown that meeting the recommended dietary allowances (RDA) for macronutrients can significantly impact athletic performance, muscle development, and recovery time (American College of Sports Medicine, 2016). Comparing the macronutrient intake of control and experimental groups in adolescent soccer players helps assess the effectiveness of nutritional interventions aimed at improving dietary intake to support their increased physical demands.

Table 1 depicts a comparison between the mean macronutrient intake of the control and experimental group (Pre and post-test) with RDA, 2024 (N=150)

<table>
<tr><th>Adolescent Stage</th><th>Groups</th><th>Variables</th><th>Energy (kcal)</th><th>CHO (g)</th><th>Protein (g)</th><th>Fat (g)</th></tr>
<tr><td rowspan="5">Pre-adolescent 10-12 years (N=96)</td><td rowspan="2">Control group (n=48)</td><td>Pre-test Mean ± SD</td><td>1278.8±278.0</td><td>73.05 ± 18.5</td><td>12.6 ±1.9</td><td>12.5±4.9</td></tr>
<tr><td>Post-test Mean ± SD</td><td>1342.9 ±291.7</td><td>76.7 ±19.5</td><td>11.9 ±1.8</td><td>11.9±4.7</td></tr>
<tr><td rowspan="3">Experimental group (n=48)</td><td>Pre-test Mean ± SD</td><td>1054.1 ± 130.7</td><td>64.9 ±12.2</td><td>11.5±0.8</td><td>12.8±2.3</td></tr>
<tr><td>Post-test Mean ± SD</td><td>2003.2 ± 172.4</td><td>114.2 ±17.64</td><td>28.8±2.0</td><td>28.4±4.73</td></tr>
<tr><td>RDA</td><td>2220</td><td>130</td><td>31.8</td><td>35</td></tr>
<tr><td rowspan="5">Adolescent 13-15 years (N=144)</td><td rowspan="2">Control group (n=72)</td><td>Pre-test Mean ± SD</td><td>1677.1±378.7</td><td>56.4±15.2</td><td>14.0±3.5</td><td>16.3±11.0</td></tr>
<tr><td>Post-test Mean ± SD</td><td>1645.6 ±367.6</td><td>59.2 ±16.0</td><td>13.3±3.3</td><td>15.5±10.5</td></tr>
<tr><td rowspan="3">Experimental group (n=72)</td><td>Pre-test Mean ± SD</td><td>1562.5 ±312.9</td><td>56.4 ±14.3</td><td>13.0 ±1.8</td><td>14.6±3.1</td></tr>
<tr><td>Post-test Mean ± SD</td><td>2552.8 ±239.0</td><td>111.0±13.9</td><td>40.6±2.8</td><td>39.7±6.7</td></tr>
<tr><td>RDA</td><td>2860</td><td>130</td><td>44.9</td><td>45</td></tr>
<tr><td rowspan="5">Post-adolescent 16-18 years (N=60)</td><td rowspan="2">Control group (n=30)</td><td>Pre-test Mean ± SD</td><td>2050.8 ±447.4</td><td>140.4 ±28.7</td><td>32.6 ±8.6</td><td>54.5±21.4</td></tr>
<tr><td>Post-test Mean ± SD</td><td>2029.4 ±341.2</td><td>147.4 ±30.1</td><td>31.0 ±8.1</td><td>52.0 ±20.6</td></tr>
<tr><td rowspan="3">Experimental group (n=30)</td><td>Pre-test Mean ± SD</td><td>2035.9 ±524.9</td><td>145.3 ±33.7</td><td>31.9±7.9</td><td>54.8 ±16.2</td></tr>
<tr><td>Post-test Mean ± SD</td><td>3020.8 ±145.1</td><td>128.5 ±4.6</td><td>50.5 ±3.2</td><td>48.1 ±12</td></tr>
<tr><td>RDA</td><td>3320.0</td><td>130</td><td>55.4</td><td>50.0</td></tr>
</table>

Note. RDA: Recommended Dietary Allowance suggested by Indian Council of Medical Research, 2024

Figure 1 depicts a comparison between the mean macronutrient intake of the control and experimental group (Pre and Post-test) with RDA, 2024 (N=150)

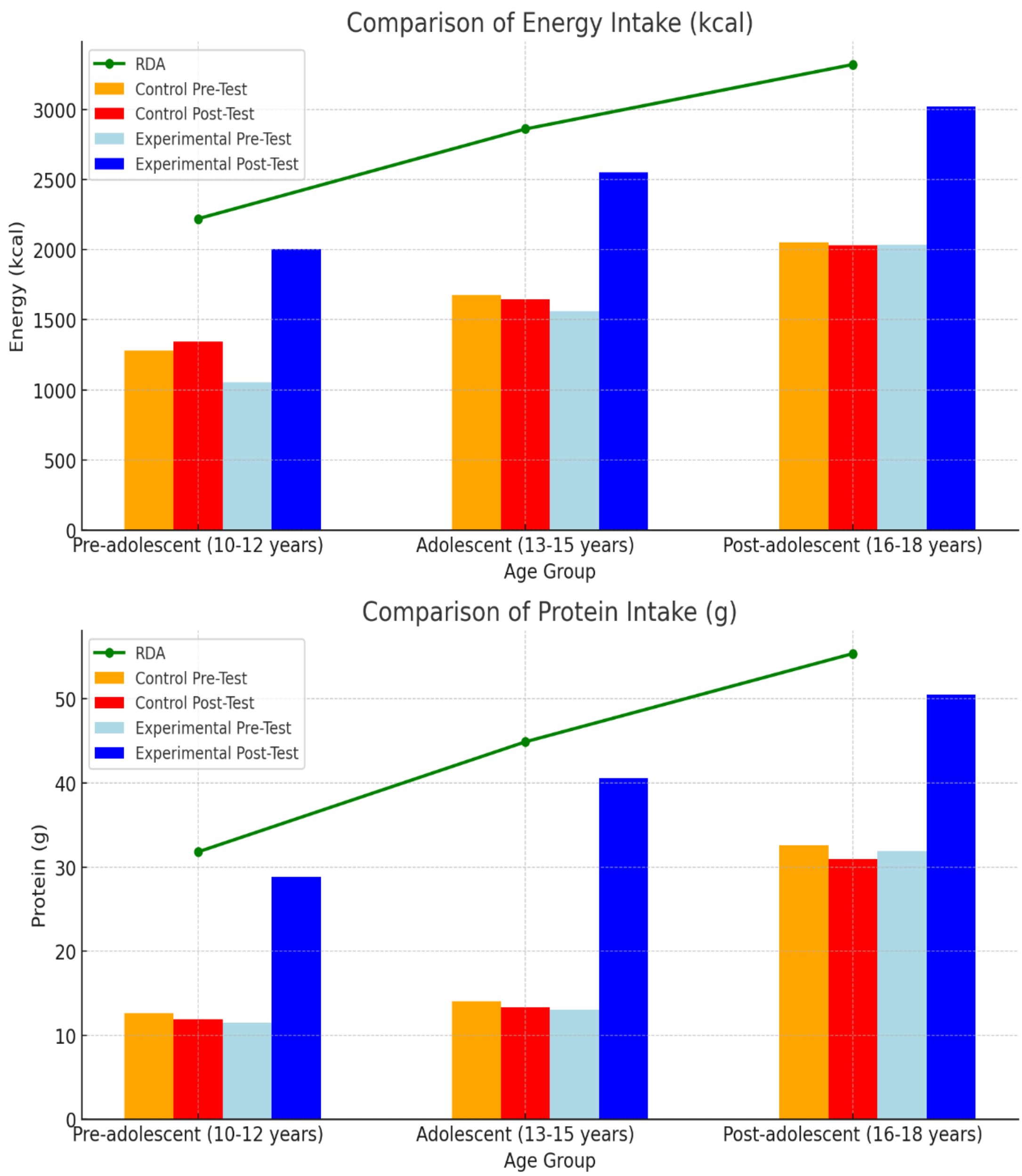

Table 1 and Figure 1 presents a comparison of the mean macronutrient intake, including energy, carbohydrates (CHO), protein, and fat, between the control and experimental groups in three different adolescent stages (pre-adolescent, adolescent, and post-adolescent), measured in pre-and post-tests and compared with the Recommended Dietary Allowance (RDA) for the year 2024.

In the **pre-adolescent group (ages 10-12)**, the control group (n=48) showed minimal changes between the pre-and post-test assessments. Energy intake increased slightly from 1278.8 ± 278.0 kcal to 1342.9 ± 291.7 kcal, still falling short of the RDA of 2220 kcal. Carbohydrate intake increased marginally from 73.05 ± 18.5 g to 76.7 ± 19.5 g, remaining below the recommended 130 g. Protein intake saw a small decline from 12.6 ± 1.9 g to 11.9 ± 1.8 g, far below the RDA of 31.8 g. Fat intake decreased slightly from 12.5 ± 4.9 g to 11.9 ± 4.7 g, which is also below the recommended 35 g.

The experimental group (n=48) in this age category demonstrated significant improvements following the intervention. Energy intake nearly doubled, rising from 1054.1 ± 130.7 kcal to 2003.2 ± 172.4 kcal, approaching the RDA. Carbohydrate intake also increased significantly from 64.9 ± 12.2 g to 114.2 ± 17.64 g, moving closer to the recommended levels. Protein intake showed a substantial rise from 11.5 ± 0.8 g to 28.8 ± 2.0 g, while fat intake increased from 12.8 ± 2.3 g to 28.4 ± 4.73 g, nearing the RDA of 35 g.

In the **adolescent group (ages 13-15)**, the control group (n=72) experienced slight changes. Energy intake decreased slightly from 1677.1 ± 378.7 kcal to 1645.6 ± 367.6 kcal, below the RDA of 2860 kcal. Carbohydrate intake showed a small increase from 56.4 ± 15.2 g to 59.2 ± 16.0 g, below the recommended 130 g. Protein intake dropped slightly from 14.0 ± 3.5 g to 13.3 ± 3.3 g, far below the RDA of 44.9 g. Fat intake also saw a slight decline from 16.3 ± 11.0 g to 15.5 ± 10.5 g, still well below the RDA of 45 g.

Conversely, the experimental group (n=72) exhibited significant improvements post-intervention. Energy intake increased substantially from 1562.5 ± 312.9 kcal to 2552.8 ± 239.0 kcal, approaching the RDA. Carbohydrate intake increased from 56.4 ± 14.3 g to 111.0 ± 13.9 g, bringing the group closer to the recommended levels. Protein intake tripled from 13.0 ± 1.8 g to 40.6 ± 2.8 g, while fat intake increased significantly from 14.6 ± 3.1 g to 39.7 ± 6.7 g, approaching the RDA of 45 g.

In the **post-adolescent group (ages 16-18)**, the control group (n=30) showed slight reductions in macronutrient intake. Energy intake decreased marginally from 2050.8 ± 447.4 kcal to 2029.4 ± 341.2 kcal, well below the RDA of 3320 kcal. Carbohydrate intake increased slightly from 140.4 ± 28.7 g to 147.4 ± 30.1 g, which was still above the RDA of 130 g. Protein intake decreased slightly from 32.6 ± 8.6 g to 31.0 ± 8.1 g, while fat intake declined from 54.5 ± 21.4 g to 52.0 ± 20.6 g, both still below the RDA of 55.4 g and 50 g, respectively.

The experimental group (n=30) showed significant improvements. Energy intake increased considerably from 2035.9 ± 524.9 kcal to 3020.8 ± 145.1 kcal, approaching the RDA. Carbohydrate intake decreased slightly from 145.3 ± 33.7 g to 128.5 ± 4.6 g, which is still above the recommended 130 g. Protein intake increased significantly from 31.9 ± 7.9 g to 50.5 ± 3.2 g, meeting the RDA of 55.4 g, while fat intake decreased from 54.8 ± 16.2 g to 48.1 ± 12 g, approaching the RDA of 50 g.

In summary, the experimental groups across all age categories showed substantial improvements in energy, carbohydrate, protein, and fat intake post-intervention, compared to the control groups that showed either slight changes or decreases.

3.2. Mean Micronutrient intake of control and experimental group adolescent soccer players

Micronutrients play a crucial role in supporting the overall health and performance of adolescent athletes, particularly in high-intensity sports like soccer. Adequate intake of minerals such as calcium, magnesium, iron, and zinc is essential for maintaining bone health, muscle function, oxygen transport, and immune function, all of which are critical for athletic performance. Studies have shown that adolescent athletes often face challenges in meeting their micronutrient requirements due to increased physiological demands, highlighting the importance of tailored nutritional interventions to optimize performance and recovery **(American College of Sports Medicine, 2016).**

Table 2 depicts a comparison between the mean micronutrient intake of the control and experimental group (Pre and post-test) with RDA, 2024 (N=150)

Adolescent Stage	Groups	Variables	Calcium (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)
Pre-adolescent 10-12 years (N=96)	Control group (n=48)	Pre-test Mean ± SD	268.8±115.3	91.3±31.2	7.2 ±2.4	3.2±1.2
		Post-test Mean ± SD	**260.0±116.2**	**95.9±32.7**	**6.8±2.3**	**3.3±1.2**
	Experimental group (n=48)	Pre-test Mean ± SD	292.6±72.3	91.8±39.6	6.8±1.7	2.7±0.8
		Post-test Mean ± SD	**709.7±84.7**	**206.5±89.0**	**12.9±2.3**	**7.2±0.7**
		RDA	**850**	**240**	**16**	**8.5**
Adolescent 13-15 years (N=144)	Control group (n=72)	Pre-test Mean ± SD	277.9±60.8	138.5±36.5	5.5±1.6	4.4±2.5
		Post-test Mean ± SD	**266.4±59.2**	**144.3±37.6**	**5.3±1.5**	**4.7±2.7**
	Experimental group (n=72)	Pre-test Mean ± SD	317.5±77	130.0±28.5	5.8±1.5	4.4±2.1
		Post-test Mean ± SD	**834.5±68.1**	**293.4±61.3**	**18.4±2.3**	**11.9±1.3**
		RDA	**1000**	**345**	**22**	**14.3**
Post-adolescent 16-18 years (N=60)	Control group (n=30)	Pre-test Mean ± SD	404.8 ±204.9	236.3 ±59.1	12.0 ±3.0	5.6±1.7
		Post-test Mean ± SD	**392.9 ±197.4**	**238.2 ±68.4**	**11.1 ±2.9**	**5.8±1.8**
	Experimental group (n=30)	Pre-test Mean ± SD	354.9±134.3	256.9 ±89.7	11.0 ±3.6	5.8±1.6
		Post-test Mean ± SD	**888.8 ±61.0**	**388.0 ±39.6**	**21.3 ±1.9**	**14.4±0.8**
		RDA	**1050**	**440**	**26**	**17.6**

Note. RDA: Recommended Dietary Allowance suggested by Indian Council of Medical Research, 2024

Figure 2 depicts a comparison between the mean micronutrient intake of the control and experimental group (Pre and Post-test) with RDA, 2024 (N=150)

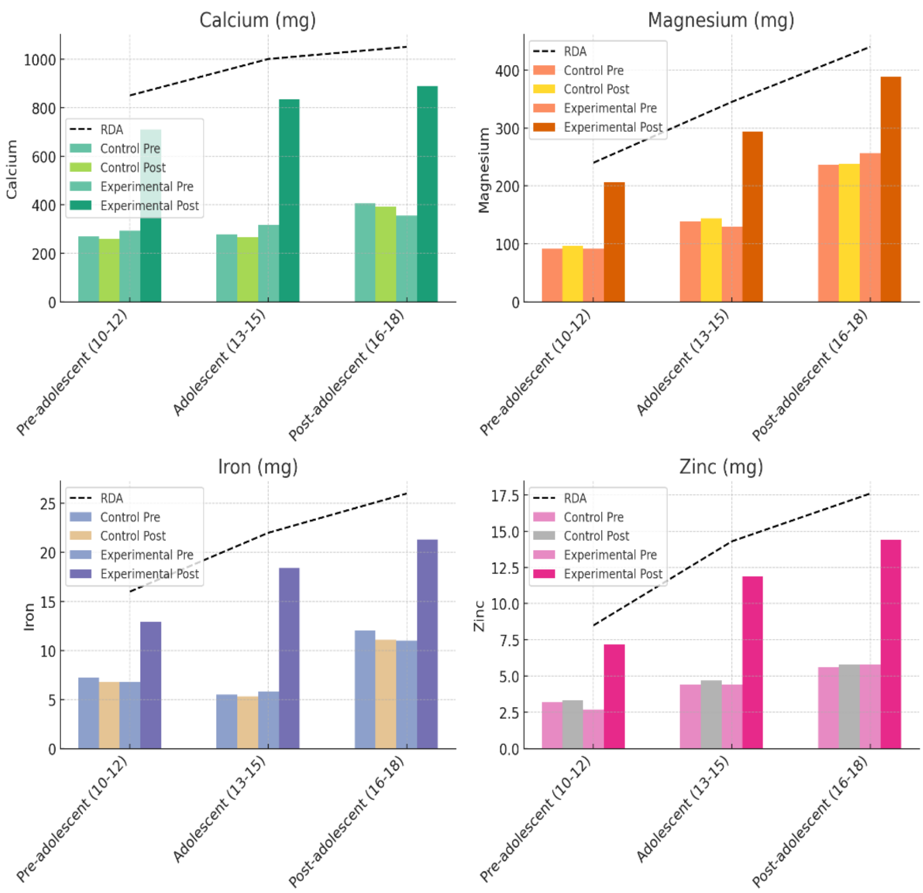

Table 2 and Figure 2 presents a comparative analysis of the mean micronutrient intake, including calcium, magnesium, iron, and zinc, between the control and experimental groups in three different adolescent stages (pre-adolescent, adolescent, and post-adolescent). The data is measured in pre-and post-tests and compared with the Recommended Dietary Allowance (RDA) for the year 2024.

In the **pre-adolescent group (ages 10-12)**, the control group (n=48) showed marginal changes between the pre-and post-test assessments. The pre-test calcium intake was 268.8 ± 115.3 mg, which decreased slightly to 260.0 ± 116.2 mg post-test, both well below the RDA of 850 mg. Magnesium intake increased from 91.3 ± 31.2 mg to 95.9 ± 32.7 mg, still falling short of the RDA of 240 mg. Iron intake decreased slightly from 7.2 ± 2.4 mg to 6.8 ± 2.3 mg, far below the RDA of 16 mg. Zinc intake showed a slight increase from 3.2 ± 1.2 mg to 3.3 ± 1.2 mg, but remained well below the recommended 8.5 mg.

The experimental group (n=48) in the same age range demonstrated significant improvements post-intervention. Calcium intake rose dramatically from 292.6 ± 72.3 mg to 709.7 ± 84.7 mg, moving closer to the RDA. Magnesium intake more than doubled, increasing from 91.8 ± 39.6 mg to 206.5 ± 89.0 mg, approaching the RDA. Iron intake almost doubled, rising from 6.8 ± 1.7 mg to 12.9 ± 2.3 mg, while zinc intake increased markedly from 2.7 ± 0.8 mg to 7.2 ± 0.7 mg, nearing the RDA of 8.5 mg.

In the **adolescent group (ages 13-15)**, the control group (n=72) experienced minor fluctuations in micronutrient intake. Calcium intake decreased slightly from 277.9 ± 60.8 mg to 266.4 ± 59.2 mg, well below the RDA of 1000 mg. Magnesium intake increased slightly from 138.5 ± 36.5 mg to 144.3 ± 37.6 mg, remaining below the recommended 345 mg. Iron intake showed a minor decrease from 5.5 ± 1.6 mg to 5.3 ± 1.5 mg, far below the RDA of 22 mg. Zinc intake saw a small increase from 4.4 ± 2.5 mg to 4.7 ± 2.7 mg, still well short of the RDA of 14.3 mg.

The experimental group (n=72) showed substantial improvements post-intervention. Calcium intake increased significantly from 317.5 ± 77 mg to 834.5 ± 68.1 mg, nearing the RDA. Magnesium intake rose sharply from 130.0 ± 28.5 mg to 293.4 ± 61.3 mg, approaching the recommended levels. Iron intake increased from 5.8 ± 1.5 mg to 18.4 ± 2.3 mg, a significant improvement, though still below the RDA. Zinc intake nearly tripled, rising from 4.4 ± 2.1 mg to 11.9 ± 1.3 mg, closing in on the recommended 14.3 mg.

In the **post-adolescent group (ages 16-18)**, the control group (n=30) showed minor declines in micronutrient intake. Calcium intake decreased slightly from 404.8 ± 204.9 mg to 392.9 ± 197.4 mg, well below the RDA of 1050 mg. Magnesium intake saw a marginal increase from 236.3 ± 59.1 mg to 238.2 ± 68.4 mg, still falling short of the RDA of 440 mg. Iron intake decreased from 12.0 ± 3.0 mg to 11.1 ± 2.9 mg, below the RDA of 26 mg. Zinc intake increased slightly from 5.6 ± 1.7 mg to 5.8 ± 1.8 mg, well below the recommended 17.6 mg.

The experimental group (n=30) showed significant improvements post-intervention. Calcium intake more than doubled from 354.9 ± 134.3 mg to 888.8 ± 61.0 mg, moving closer to the RDA. Magnesium intake rose substantially from 256.9 ± 89.7 mg to 388.0 ± 39.6 mg, nearing the RDA of 440 mg. Iron intake nearly doubled, rising from 11.0 ± 3.6 mg to 21.3 ± 1.9 mg, approaching the recommended intake. Zinc intake showed a notable increase from 5.8 ± 1.6 mg to 14.4 ± 0.8 mg, closing in on the RDA of 17.6 mg.

Overall, the experimental groups in all three age categories showed significant improvements in the intake of calcium, magnesium, iron, and zinc, demonstrating the effectiveness of the nutritional intervention compared to the control groups, which showed minimal or negative changes.

3.3. Overall Comparison of the control group with the experimental group

The overall comparison between the control and experimental groups highlights significant improvements in nutrient intake among the experimental group after the nutritional intervention. While the control group showed minimal changes or slight declines in key nutrients like calcium, magnesium, iron, and zinc, the experimental group demonstrated substantial increases across all micronutrients. For example, zinc intake, which plays a crucial role in immune function and muscle repair, rose markedly in the experimental group, particularly in the adolescent and post-adolescent stages, nearing recommended dietary allowances (RDA). These improvements underline the effectiveness of the intervention in aligning nutrient intake with the nutritional needs of adolescent soccer players.

4. Discussion

The findings suggest that a sustained nutritional intervention can significantly improve the dietary intake of adolescent soccer players, bringing their consumption closer to RDA recommendations. The marked increase in protein, calcium, and zinc intake is particularly noteworthy, given their critical roles in muscle repair, growth, immune function, and bone health. Zinc, in particular, is essential for immune response, wound healing, and protein synthesis, all of which are crucial for athletes. The significant rise in zinc intake among the experimental group highlights how the intervention successfully addressed this often-overlooked micronutrient, which is vital for athletic performance and recovery.

5. Conclusion

In conclusion, the study demonstrates that sustained nutritional interventions can significantly enhance the dietary intake of adolescent soccer players, particularly in key nutrients such as protein, calcium, and zinc, which are crucial for muscle repair, bone health, and immune function. The improvements seen in the experimental group highlight the effectiveness of tailored nutrition programs in addressing the specific needs of adolescent athletes, while the lack of progress in the control group reinforces the inadequacy of habitual diets in meeting these demands. Structured dietary interventions are essential to support the growth, performance, and overall health of young athletes.

6. Acknowledgments

The authors would like to express a deep sense of gratitude to all soccer players who willingly participated in the study.

7. Declaration

This paper is original and not published anywhere.

8. References

1. Bean, A. (2020). *Nutrition for adolescent athletes: A guide for coaches and parents*. Human Kinetics.
2. Maughan, R. J., Burke, L. M., & Dvorak, J. (2020). Nutritional requirements of soccer. *Journal of Sports Sciences*.
3. Beals, K. A. (2019). Nutrition for adolescent athletes: Current concepts and practical recommendations. *Sports Medicine*.
4. Indian Council of Medical Research (ICMR). (2020). *Nutrient requirements and recommended dietary allowances for Indians*. National Institute of Nutrition.
5. Deshmukh-Taskar, P., Nicklas, T. A., Morales, M., & others. (2010). Adolescent health and dietary behaviors. *Journal of the American Dietetic Association*.
6. Juzwiak, C. R., & Ancona-Lopez, F. (2009). Evaluation of nutrition knowledge and dietary recommendations by coaches of adolescent Brazilian athletes. *International Journal of Sport Nutrition and Exercise Metabolism*.
7. Thomas, D. T., Erdman, K. A., & Burke, L. M. (2016). Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and athletic performance. *Journal of the Academy of Nutrition and Dietetics*.
8. Iglesias-Gutiérrez, E., García, Á., García-Zapico, P., & others. (2019). Influence of nutrient intake on antioxidant capacity, muscle damage, and soccer performance. *Journal of Strength and Conditioning Research*.
9. Macdermid, P. W., & Stannard, S. R. (2014). A nutritional comparison of New Zealand adolescent rugby players and non-players. *Journal of Sports Sciences*.
10. Srilakshmi, N. (2014). *Nutrition science* (4th ed.). New Age International.
11. American College of Sports Medicine. (2016). *ACSM's guidelines for exercise testing and prescription* (10th ed.). Lippincott Williams & Wilkins.