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Relative Macronutrient Intake among Ethiopian Sport Academy Sprint Athletes: A Pre-Competition Analysis

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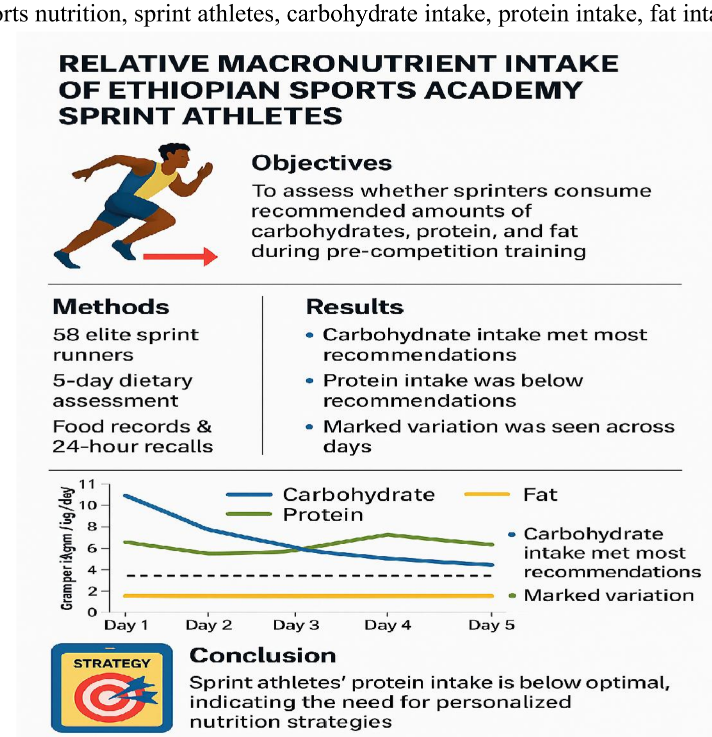
Abstract: *This study evaluated the daily macronutrient intake of elite Ethiopian sprint athletes during a pre-competition training phase, analysing their consumption patterns with international sports nutrition guidelines. Direct dietary record and observational study involved 58 national-level sprinters (aged 15–21), during which their dietary intake was documented through weighed food records and validated 24-hour recalls over five consecutive days. The estimation of total energy expenditure (TEE) was conducted using the Schofield Equation, which was modified according to sprint-specific physical activity levels (PALs). Macronutrient intake was presented in grams per kilogram of body weight per day (g/kg/day). The results indicated that carbohydrate intake adhered to recommendations on Days 1, 3, and 4, whereas protein intake was adequate only on Days 2 and 5. Fat intake remained within the optimal range on all days except Day 1. The findings highlight the variability in dietary patterns and the need for customised nutritional education and periodisation for sprint athletes in Ethiopia.*

Keywords: sports nutrition, sprint athletes, carbohydrate intake, protein intake, fat intake, Ethiopia



I. INTRODUCTION

High-intensity sprinting performance depends heavily on the quick generation of ATP, mainly derived from carbohydrates and supported by adequate protein and fat intake (Burke et al., 2021; Thomas et al., 2016). Sprinters should aim to consume 7–12 g/kg/day of carbohydrates to maintain glycogen stores, 1.6–2.2 g/kg/day of protein for muscle repair, and 1.0–1.5 g/kg/day of fats to aid hormone production and energy supply (Jeukendrup, 2017; Rodriguez et al., 2009).Research within East African populations has traditionally concentrated on endurance athletes, often emphasising high-carbohydrate diets derived from traditional dietary practices (Onywera et al., 2004). Nonetheless, athletes engaged in sprinting experience unique metabolic requirements that necessitate individualised and periodized nutritional strategies(Stellingwerff et al., 2019). Limited data are available concerning dietary adequacy among Ethiopian sprinters, thereby creating a notable gap in sport-specific nutritional research within sub-Saharan Africa.

This study aims to analyse the macronutrient intake patterns of elite Ethiopian sprinters, assess their adherence to international nutrition standards, and provide evidence to develop tailored performance nutrition strategies.

Historically, research in East Africa has primarily concentrated on distance runners, often emphasising high carbohydrate consumption from traditional diets (Onywera et al., 2004). However, sprint athletes face distinct metabolic demands that require individualised and periodized nutrition strategies (Stellingwerff et al., 2019)Limited data exists on Ethiopian sprinters' dietary adequacy, creating a gap in sport-specific nutrition research in sub-Saharan Africa. This study examines their macronutrient intake, compliance with guidelines, and supports context-specific performance nutrition strategies.

II. MACRONUTRIENT INTAKE AND SPRINT PERFORMANCE:

A Physiological Perspective

Macronutrients are crucial for athletic performance, especially in sprinters who depend on explosive anaerobic energy systems. Carbohydrates, proteins, and lipids play essential roles in energy generation, recovery, and adaptation (Burke et al., 2021; Jeukendrup, 2017).

Carbohydrates: Sprint fuel

Carbohydrates are the primary source of substrate for ATP generation during brief, high-intensity workouts. Carbohydrates are quickly converted into energy through anaerobic glycolysis, allowing for peak sprint performance (Jeukendrup, 2017)The International Olympic Committee (IOC), ACSM, and the International Society of Sports Nutrition suggest that sprint and power athletes consume 7-12 g/kg/day of carbohydrates to sustain glycogen levels (Thomas et al., 2016).

Inadequate carbohydrate intake has been linked to decreased performance by lowering muscle glycogen stores, limiting work capacity, and increasing perceived effort (Burke et al., 2021; Maughan et al., 2018). Maughan et al. (2018) discovered that African sportsmen, especially in East Africa, commonly underconsume carbs, which is generally due to economic, cultural, or seasonal dietary constraints. (Beis et al., 2011)showed similar results in top Kenyan athletes whose diets mainly consisted of traditional starchy foods with low carbohydrate density.

Proteins: Recovery, Repair, and Adaptation

Proteins are required to repair muscle tissue, recover from microtrauma, and adapt to sprint training.

Sprint athletes regularly face high-impact loads, which require an increased rate of amino acid turnover (Phillips et al., 2016). Recommendations suggest a daily protein intake of 1.6–2.2 g/kg for sprinters, with evidence indicating that higher amounts (~2.0 g/kg/day) may be advantageous during periods of intense training or competition (Moore et al., 2014; Tipton & Wolfe, 2020).

In addition to total quantity, the timing and distribution of protein intake are of equal significance. Intake of 20–40 grams of protein post-exercise enhances recovery and facilitates muscle protein synthesis (Morton et al., 2018; Tipton & Wolfe, 2020) observed that surpassing 2.2 g/kg/day does not yield additional benefits, emphasising the significance of nutrient timing rather than merely increasing intake. Access to high-quality protein sources continues to be a significant challenge in diverse regions of Africa. Dietary surveys conducted in Uganda, Ethiopia, and Nigeria reveal a consistent pattern of low consumption of complete proteins (Ethiopian & Nutrition Research, 2012; Folasire & Mkumbuzi, 2025).

The Role of Fats in Hormonal Regulation and Energy Storage

While dietary fats do not supply instant energy for sprints, they are crucial for sustaining hormonal balance, controlling inflammation, and serving as an energy reserve when carbohydrate intake is low (Rodriguez et al., 2009; Tarnopolsky, 2020). The suggested fat intake for sprint athletes is between 1.0 and 1.5 g/kg/day. Nonetheless, an excessive intake can lead to the displacement of carbohydrate-rich foods, potentially hindering glycogen replenishment and sprint performance (Slater et al., 2019).

Omega-3 fatty acids from fish or seeds help reduce inflammation caused by exercise, especially after sprint sessions (Rodriguez et al., 2009). Nevertheless, acquiring these resources may prove challenging in low-income or food-insecure environments.

Energy Balance, RED-S, and Periodized Nutrition

Energy Availability and RED-S

Sprint athletes must sustain a positive energy balance—where intake meets or slightly surpasses expenditure—to support growth, recovery, and optimal performance. Chronic low energy availability, known as Relative Energy Deficiency in Sport (RED-S), causes a range of physiological dysfunctions, including hormonal suppression, weakened immunity, delayed healing, and reduced neuromuscular performance (Mountjoy et al., 2018). (Mujika et al., 2019) observed that elite athletes with energy intakes below 90% of their total energy expenditure (TEE) experienced observable declines in sprint velocity and recovery markers.

Energy deficiency is especially likely in high-performance settings lacking structured nutritional support. Periods of intensified training, dietary fatigue, and lack of nutrition education often increase the risk (Stellingwerff et al., 2019).

Macronutrient Periodisation

Contemporary sports nutrition supports macronutrient periodization—the strategic adjustment of carbohydrate, protein, and fat intake according to training demands (Stellingwerff et al., 2019).

Athletes should increase carbohydrate intake to 8–10 g/kg/day during high-intensity training while reducing it during lighter sessions. Protein requirements similarly increase during competition or recovery phases to approximately 2.0 g/kg/day; moreover, a moderate intake of fat supports overall energy needs without hindering glycogen storage(Slater et al., 2019).

Jeukendrup (2017) emphasised that poor nutritional planning can result in less-than-ideal performance for elite athletes, especially during key training phases.

Nutritional Challenges in African Sports

The Implementation of evidence-based guidelines in African sports academies continues to face significant challenges. Contributing factors to poor nutrition encompass cultural dietary preferences such as injera, maize, and teff, which are generally low in nutritional value; seasonal insecurity and price volatility; restricted access to complete proteins; limited institutional support; and insufficient educational resources for athletes.

(Folasire & Mkumbuzi, 2025) found that merely 18% of elite athletes in East Africa obtained structured dietary guidance. In Ethiopia specifically, most sports programmes still lack embedded sports nutritionists or tailored menu planning systems.

Summary

This review emphasises that although international guidelines for macronutrient intake are well-established, their implementation remains inadequate—particularly in developing athletic settings. Sprint athletes need carbohydrate-rich diets for energy, protein for muscle repair, and sufficient fat for hormonal regulation. Nutrient timing and periodisation are crucial. However, cultural, economic, and institutional barriers still hinder optimal nutrition for high-performance athletes in Ethiopia and sub-Saharan Africa.

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III. METHODS

Study Design & Participants

A cross-sectional observational study was conducted among 58 elite Ethiopian sprint athletes (aged 15–21) training at the Ethiopian Sports Academy. Athletes followed a structured high-intensity program.

Dietary Assessment

Macronutrient intake was evaluated over five consecutive days utilising:

• Weighed food records with ±1g accuracy

• 24-hour dietary recall validated through food composition tables from (EHNRI, 1997; Ethiopian & Nutrition Research, 2012)

Energy Expenditure Estimation

Total Energy Expenditure (TEE) was determined using the Schofield Equation, adjusted to account for sprint-specific physical activity levels.

Statistical Analysis

Descriptive statistics and repeated-measures ANOVA were utilised to evaluate differences across days. One-sample t-tests were performed to compare nutrient intakes against international standards recommendations. Cronbach's Alpha for reliability: $\alpha = 0.78$.

IV. RESULTS

Table 1. Descriptive Statistics: Relative Macronutrient Intake (g/kg/day)

Day	Carbohydrates (g/kg/day)	Proteins (g/kg/day)	Fats (g/kg/day)
Day 1	8.11 ± 1.26	1.26 ± 0.31	0.90 ± 0.28
Day 2	5.92 ± 1.18	2.27 ± 0.45	1.43 ± 0.34
Day 3	7.79 ± 1.50	1.50 ± 0.38	1.07 ± 0.35
Day 4	7.46 ± 1.35	1.35 ± 0.36	1.28 ± 0.37
Day 5	6.61 ± 1.69	1.69 ± 0.41	1.44 ± 0.39
Recommended	**7.0–12.0**	**1.6–2.2**	**1.0–1.5**

Carbohydrate intake met recommended levels (7.0–12.0 g/kg/day) on Days 1, 3, and 4, but fell below recommended levels on Days 2 and 5.

Protein intake met recommendations only on Days 2 and 5, and was below on Days 1, 3, and 4.

Fat intake was within the optimal range (1.0–1.5 g/kg/day) for all days except Day 1.

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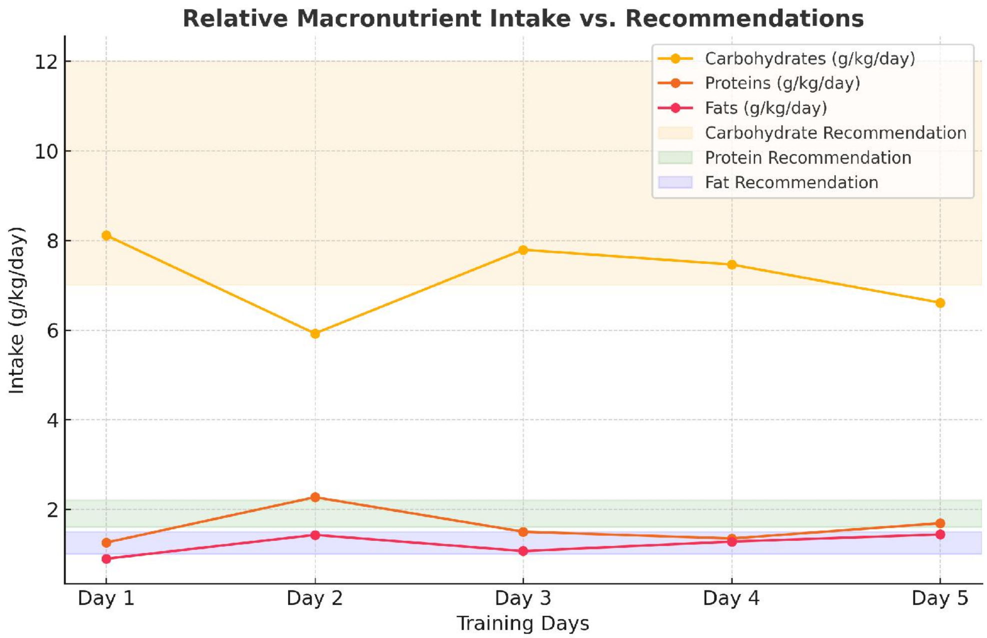

Figure 1. Relative Macronutrient Intake Across Five Days –
Daily intake of carbohydrates, proteins, and fats (g/kg/day) among elite Ethiopian sprint athletes compared to international recommendations. Carbohydrates met the guidelines on most days. Protein intake was suboptimal on three days. Fat intake was compliant except on Day 1.

V. INTERPRETATION AND DISCUSSION

Sprint athletes' pre-competition macronutrient intake (g/kg/day) showed variable adherence to sports nutrition guidelines.

Carb Consumption

Over five days, carbohydrate consumption ranged from 5.92 ± 1.18 to 8.11 ± 1.26 g/kg/day, with a mean value near the lower end of the recommended 7.0-12.0 g/kg/day (Burke et al., 2011; Thomas et al., 2016). On Day 2, intake dropped below the recommended minimum (5.92 g/kg/day), which could compromise muscle glycogen replenishment, especially in high-intensity, repeated sprints. Days 1, 3, and 4 met the lower bound. Still, none neared the higher bound, which is important during intensive training or competition taper to maximise glycogen storage (Jeukendrup, 2017).

These results indicate that carbohydrate consumption was generally within recommendations, although occasional deficits may reduce energy availability and sprint performance.

Protein intake ranged from 1.26 ± 0.31 to 2.27 ± 0.45 g/kg/day. The suggested daily intake for sprint and power athletes is 1.6–2.2 g/kg (Areta & Burke, 2013; Phillips & Van Loon, 2011). Three of the five days (Days 1, 3, and 4) had protein consumption below the minimum suggested level, suggesting muscle repair and adaptation may be inadequate (Morton et al., 2018). Day 5 (1.69 g/kg/day) met the lower limit, whereas Day 2 (2.27 g/kg/day) slightly exceeded it.

Protein timing, distribution, and total intake are important (Moore et al., 2014). Therefore, these changes could impede recovery and muscle protein synthesis during pre-competition, when athletes strive to improve neuromuscular performance and lean mass.

Fat intake ranged from 0.90 ± 0.28 to 1.44 ± 0.39 g/kg/day, with athletes recommended to consume 1.0-1.5 g/kg/day (Rodriguez et al., 2009; Thomas et al., 2016). Consumption (0.90 g/kg/day) was somewhat below the minimal recommended on Day 1, which may have reduced essential fatty acid and fat-soluble vitamin consumption. For the remaining days, intake was within or over the acceptable range.

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Sprint athletes should avoid high-fat diets since they use anaerobic glycolysis (Spriet, 2014), but enough consumption is necessary for hormonal balance and recovery.

VI. CONCLUSION AND RECOMMENDATIONS

Carbohydrate intake mostly met standards, but inconsistent consumption indicates a need for education on energy periodisation. Several days showed insufficient protein intake, implying inadequate recovery support. Fat intake remained consistent and within recommended levels; however, it should be tracked to prevent replacing carbohydrate sources.

Recommendations:

1. Carbohydrate intake should exceed 7 g/kg/day on training days.
2. Protein should be distributed evenly across the day and post-workout.
3. Fat intake should not displace carbohydrates in high-load phases.
4. Introduce athlete-specific nutrition planning and education at the national level.
5. Monitor seasonal variations and match dietary intake to training phases.

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