

Dietary Adequacy of Macro and Micronutrients in National Level Indian Male Sprinters

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Abstract Proper balance of nutrients is crucial for athletes to maintain a good nutritional profile and optimize sports performance. The aim of the study was to evaluate nutrient intake and adequacy among Indian sprinters among various age groups. Cross-sectional study on Indian male National level sprinters (n=80) was carried out. Height, weight, dietary practices, and nutrient intake were collected. Mean weight, height and BMI were 59.3±2.8 kg, 170.3±2.6 cm, and 20.5±1.6 kg/m² respectively. Mean daily energy, carbohydrate, and protein intake per kg BM was 51±20 kcal; 7.56g and 1.83±0.9g respectively and 24.89% came from fat. Nutrient Adequacy Ratio values reveal adequacy of vitamin A, B-complex vitamins, ascorbic acid, magnesium, calcium, zinc, and iron. Macro and micronutrient intake was significantly close to recommendations except for vitamin D in 10-12 years while in 13-15 years, protein, niacin, zinc, and pyridoxine were comparable and 16-17 years had a maximum deviation from recommendations. Nutrients (carbohydrate, protein, iron, zinc, and thiamine) were close to the recommendation in the 18+ group. Inter-individual variability in macro and micronutrient intake highlights the need for a well balanced, healthy meal plan from a sports nutritionist for tailor-made diets to suit training load to optimize performance.

Keywords: diet recall, macronutrient, micronutrient, nutrient adequacy ratio, sprinters

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1. Introduction

Running is often described as the world's most accessible sport and the term "athlete" can be used as a generic description for any type of sportsperson. [1] In sports, training and nutrition should go hand in hand to attain a high level of achievement [2] as the food they take leaves an impact on strength, training, performance, and recovery. [3] Food and beverages are composed of six essential nutrients that include carbohydrate, protein, fat, vitamins, and minerals. These nutrients are classified as macro and micronutrients which the body requires to function properly. [4] A proper balance between macro and micronutrients is important for optimum physical performance. [5,6]

An athlete's nutritional needs usually encompass a higher energy requirement to account for greater energy expenditure, increased protein and carbohydrate requirements to support lean muscle mass maintenance and glycogen stores, as well as an increased requirement for certain micronutrients. [7,8,9] In young athletes, nutrients identified as of concern due to insufficient intake include carbohydrates (especially during exercise), vitamin E, vitamin D, calcium, iron, magnesium and zinc [10,11,12,13] and low intake may cause poor performance during competition and also result in deficiencies affecting

health. [14] Recovery from a bout of exercise is integral to the athletes' training regime as without proper recovery of the nutrients such as carbohydrates, protein and electrolytes, the performance may be hampered. Consumption of a diverse diet is advised to ensure nutrient adequacy. [15]

Nutritional assessment is carried out for interpretation of information from dietary, laboratory, anthropometrics, and clinical studies. This information is used to determine the nutritional status of the individuals as influenced by the intake and utilization of nutrients. [16] Dietary assessment is routinely undertaken by nutrition professionals to evaluate whether an individual is achieving specific health and/or sports nutrition targets. [17] The 24 hour recall method is employed to assess the type of food and quantities consumed in the previous 24 hours using standardized utensils and recipes by the athletes. [18,19,20]

World Health Organization (WHO) defines people in the age range 10-24 years as young and it is important for them to maintain a good nutritional profile as ignorance towards any of the vital nutrients may degrade their performance. [21] Appropriate nutritional strategies have the ability to reduce the risk of injuries and enhance recovery by adopting a "food first approach" by consultation with a qualified sports nutritionist. [22]

Nutrient inadequacy has been documented in various sports and sportspersons such as college athletes, [23] swimmers, [24] adolescent female skater [25] and young athletes. [26] The data is naïve on young Indian male

sprinters in the area of macro and micronutrient demands and intake. Assessment of this modifiable factor will help sports nutrition professionals to design well-informed choices, facilitate healthy eating habits, and provide a specific targeted approach to achieve enhanced performance. Therefore, the aim of the study was to evaluate macro and micronutrient intake of young male Indian sprinters and assess nutrient adequacy among various age groups.

2. Material and Method

A cross-sectional study was carried out on all young male sprinters aged 11-24 years training in the athletic track for at least one year with a minimum of 10 hours per week at Sports Authority of India (SAI), New Delhi competing at National level. Female sprinters and sprinters under medication were excluded from the study. A total of 80 consented to participate in the study. The research protocol was reviewed and approved by the Institutional review board.

The demographic profile and dietary practices, using a validated interview schedule and dietary intake using 24-hour recall for 3 training days were elicited. The participants were weighed bare feet with minimum clothing, facing straight ahead, standing relaxed, with body weight distributed evenly on both feet using a digital flat scale. For height measurement, a portable stadiometer was used, and the participants were made to stand barefoot on the floor plate of the stadiometer, with the back of their head, shoulders, buttocks, and feet touching the measuring rod, and arms hanging loosely at the sides. The head plate of the stadiometer was moved to touch the head of the participants and the height was noted on the measuring rod. Based on these measurements, the Body Mass Index (BMI) of the sprinters was calculated and classified according to the WHO classification.

Diet Cal- A tool for dietary assessment and planning software (version 9.0) was used to estimate the dietary intake. A comparison of nutrient intake was drawn by comparing with Indian Council of Medical Research (ICMR) Recommended Dietary Allowance (RDA) [27] for Indians within age-groups. Nutrient Adequacy Ratio (NAR) was computed to determine the adequacy of the macro and micronutrient intake of the young male sprinters. The following formula was used to estimate the NAR of a particular nutrient:

$$\text{NAR} = \frac{\text{Actual intake of nutrient by sprinter}}{\text{Sprinter's RDA for that nutrient}}$$

The adequacy/inadequacy of a particular nutrient intake by the athletes was classified as:

1. Inadequate intake: NAR <0.66 (intake being less than 66% of the RDA)
2. Fairly adequate intake: NAR = 0.66 < 1.00 (intake of 66% to <100% of RDA)
3. Adequate intake: NAR ≥1.00 (intake being ≥100% of the RDA).

Statistical Analysis: The data were subjected to quantitative and qualitative analysis. The frequency and percentages were calculated for a demographic profile,

dietary practices, NAR of the young male sprinters. Mean and standard deviations were also calculated for anthropometric measurements, macro and micronutrient intake. Statistical Package for Social Sciences (SPSS) (version 20.0) developed by IBM Corporation (USA) was used for the analysis of data. Age group and total population differences between dietary intake and RDA of Indians analyzed using 2 tailed unpaired t-test.

3. Results

The general profile and dietary habits of the young male sprinters is presented in Table 1. The mean age of the sprinters was 17.7±0.31 years. The mean weight, height and BMI of the athletes were 59.3±2.8kg, 170.3±2.6 cm and 20.5±1.6 kg/m² respectively. BMI is defined as weight (kg) / height (m²) is used to assess the nutritional status. Majority (82.5%) of the sprinters belonged to the normal category of WHO BMI classification; [28] followed by 15% and 2.5% who fall in the underweight and overweight category respectively.

Overall, 90% of the sprinters were snacking in between regular meals and approximately one-third of the participants never ate out and preferred consuming home cooked meals.

Table 1. General profile and dietary practices of the young male sprinters

Characteristics	Category	Young male sprinters(n=80)
Age (years)	10-12	4 (5)
	13-15	14(17.5)
	16-17	27(33.8)
	18+	35(43.7)
Native State	Bihar	4(5)
	Delhi	40(50)
	Gujarat	1(1.2)
	Haryana	7(8.8)
	Tamil Nadu	1(1.2)
	Punjab	1(1.2)
	Uttar Pradesh	23(28.8)
Uttarakhand	3(3.8)	
Training duration (per day)	≤ 3 hours	31(38.7)
	3- ≤ 5 hours	20(25)
	5- ≤ 7 hours	26(32.5)
	≥ 7 hours	3(3.8)
Eating habits	Vegan	0(0)
	Lacto vegetarian	25(31.2)
	Ovo vegetarian	1(1.3)
	Peso vegetarian	0(0)
Non-vegetarian	54(67.5)	
Snacking in between meals	Yes	73(91.2)
	No	7(8.8)
Eating out pattern	Never	26(32.5)
	Daily	3(3.7)
	times a week	3(3.7)
	Twice a week	9(11.3)
	Once a week	11(13.8)
	Once a fortnight	2(2.5)
	Twice a month	8(10)
	Once a month	18(22.5)

#parenthesis denotes percentage.

The mean macronutrient intake per kg body mass (BM) of the sprinters according to different age group is presented in Table 2. The average energy value of the food intake was 2968 ± 1180 kcal. The intake within the groups (10-12, 16-17, and 18+ years) and mean was comparable to the recommendation at $p < 0.05$. The percentage calories derived from total fat and protein was 24.9% and 14.6% respectively.

Table 2. Macronutrient intake by the young male sprinters

Macronutrients	Age (Years)	Mean intake	Mean \pm SD (per kg BM)	Intake per kg BM
Energy (kcal)	10-12	2466	59 \pm 37	70kcal/kg BM
	13-15	2965	52 \pm 15*	
	16-17	3199	54 \pm 22*	
	18+	2848	47 \pm 19*	
Carbohydrates (g)	10-12	389.1	9.3 \pm 5.8	6 g/kg BM
	13-15	428.5	7.5 \pm 2.2	
	16-17	474.0	7.9 \pm 3.8	
	18+	432.1	7.2 \pm 3.5	
Protein (g)	10-12	86.2	2.1 \pm 1.9	1.6g/ kg BM
	13-15	113.1	2.0 \pm 0.8	
	16-17	111.2	1.9 \pm 0.9	
	18+	106.9	1.8 \pm 0.8	

*National Institute of Nutrition, *Significant ($p=0.05$).

The mean micronutrient (vitamin and mineral) intake has been compared with the RDA for Indians (2010), [27]

given by ICMR [27] for the respective age groups. There is no International or Indian RDA for young adults and adolescent sportspersons and the mean intake of the sprinters depends on their energy expenditure. The intake for the young male sprinters aged 18+ years has been compared with the dietary recommendation given by National Institute of Nutrition. [29]

The NAR values for macronutrients had been presented in Table 3.

Table 3. Distribution of young male sprinters by their NAR for macronutrients

Macronutrient (g)	Age (years)	NAR		
		Inadequate	Fairly adequate	Adequate
Carbohydrate	10-12	2(50)	1(25)	1(25)
	13-15	4(28.6)	9(64.3)	1(7.5)
	16-17	13(48.1)	8(29.6)	6(22.3)
	18+	17(48.6)	15(42.8)	3(8.6)
Protein	10-12	3 (75)	0 (0)	1 (25)
	13-15	9 (64.3)	4 (28.6)	1(7.5)
	16-17	19(70.3)	5(18.5)	3(11.2)
	18+	20(57.5)	10(28.6)	5(14.3)
Fat	10-12	4(100)	0(0)	0(0)
	13-15	11(78.6)	2(14.3)	1(7.1)
	16-17	19(70.4)	6(22.3)	2(7.4)
	18+	30(85.7)	4(11.4)	1(2.8)

#parenthesis denotes percentage.

Table 4. Mean micronutrient intake by young male sprinters

Micronutrients	Age (Years)			
	10 – 12y	13-15 y	16-17 y	18+ y
Iron (mg)	15.4 \pm 8.4	22.2 \pm 6.5*	19.9 \pm 9.9*	11.6 \pm 3.8
Zinc(mg)	9.5 \pm 5.9	12.3 \pm 8.1	11.6 \pm 3.8	13.0 \pm 5.6
Magnesium(mg)	441.9 \pm 228.9	586.0 \pm 375.7*	523.6 \pm 209.6*	553.5 \pm 212.4*
Calcium(mg)	685.2 \pm 346.5	1407.6 \pm 310.8*	1367.8 \pm 691.7*	1361.3 \pm 779.3
Retinol (μ g)	129.9 \pm 150.2	345.2 \pm 180.5*	424.9 \pm 349.8	230.6 \pm 239.7*
β -carotene (μ g)	2129.3 \pm 2332.3	2094.9 \pm 1467.5*	2297.0 \pm 3497.7*	2480.1 \pm 2593.7*
25 OH D ₃ (μ g)	0.00 \pm 0.01*	0.41 \pm 0.82*	0.38 \pm 0.82*	0.38 \pm 1.13*
Thiamine (mg)	1.1 \pm 0.6	1.7 \pm 0.6	1.5 \pm 0.8	1.5 \pm 0.6
Riboflavin (mg)	0.9 \pm 0.6*	1.3 \pm 0.4*	1.4 \pm 0.7*	1.2 \pm 0.8*
Niacin (mg)	20.3 \pm 24.6	17.1 \pm 13.1	14.2 \pm 9.1	14.2 \pm 9.2*
Total B ₆ (mg)	29.4 \pm 32.6	10.7 \pm 30.7	3.5 \pm 5.7	9.0 \pm 15.2*
Total folates (mg)	331.4 \pm 175.8	418.8 \pm 332.1*	340.8 \pm 143.3*	409.0 \pm 163.8*
Ascorbic acid (mg)	128.3 \pm 101.5	122.9 \pm 78.6	125.6 \pm 102.3*	126.2 \pm 109.3*

*RDA(2010), ICMR, *Significant ($p= 0.05$).

NAR values for micronutrients were also computed based on different age groups in the present study. Inadequate intake of iron was seen among 16-17 years (55.6%) of young male sprinters whereas more than 50% showed fairly adequate consumption of iron in athletes aged 10-12 and 13-15 years. Majority of the athletes in all the age groups had adequate intake of calcium (75%, 92.8%, 81.4% and 85.7%) and magnesium (75%, 100% 96.3% and 82.9%). Approximately two-third of the sprinters had fairly adequate intake of zinc (13-15 years) and more than 50% had adequate intake in the age group 10-12 years and 18+ years respectively.

Retinol and β -carotene intake was found to be inadequate among maximum sprinters across all the age groups. Also, the intake of riboflavin and niacin among

65.7% and 45.7% young male sprinters (18+years) was observed to be inadequate respectively. Half of the young male sprinters aged 10-12 years had fairly adequate intake of niacin. More than 90% of the young male sprinters had inadequacy of vitamin D as well.

Also, 70% young male sprinters (13-15years) had an adequate intake of thiamine but more than half had fairly adequate intake of thiamine in the age group 18+. Vitamin B₆ intake was adequate among more than two-third of the young male sprinters in all the age groups. The intake of folates (75%, 92.8%, 85.1% and 97.1%) and ascorbic acid (75%, 100%, 74.1% and 85.7%) were seen to be adequate among maximum number of sprinters in all the age group.

NAR values (n=80) of young male sprinters for various micronutrients had been presented in Figure 1.

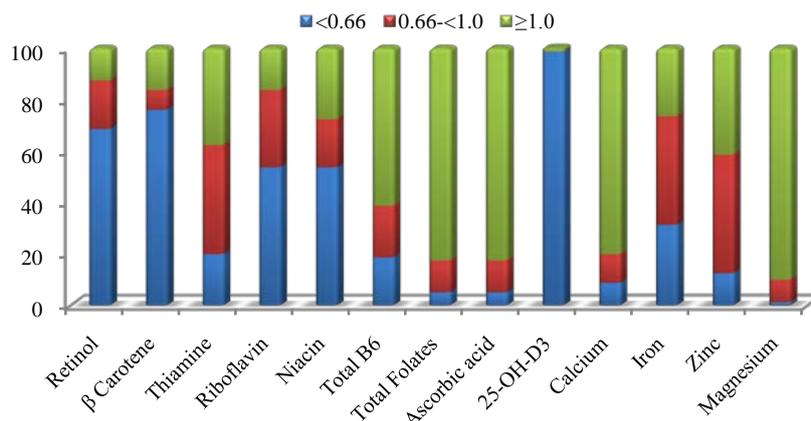


Figure 1. Adequacy of micronutrient intake by young male sprinters

The prevalence of inadequate dietary intake was high regarding the consumption of retinol, β carotene, riboflavin, niacin and vitamin D among the sprinters. The demand for thiamin, iron and zinc was met by at least 40% sprinters. Other micronutrients (total B₆, dietary folates, ascorbic acid, calcium and magnesium) were consumed in more than the recommended allowances given by ICMR [27] by at least 80% of the examined male sprinters.

4. Discussion

The dietary practices and intake of the sprinters is poorly documented. [30] Nevertheless, this is the first study to record the dietary adequacy of Indian sprinters at the national level. It is also the first to compare the micronutrient intake of national level sprinters with RDA for Indians. [27] In the current study, results showed that the prevalence of non-vegetarianism was the highest (67.5%) followed by lacto veganism (31.3%) similar to the results of Khanna et al, [31] and Sangeetha et al [32] while only 1.2% were ovo-vegetarians. Two-third of the participants preferred consuming home-cooked meals as street foods are not reliable and carry diseases originating from different food sources. [33,34,35,36]

The anthropometric characteristics are one of the most influential factors in determining good athletic performance besides other physiological characteristics. [37] Individuals engaged in intense physical activity have a tendency to be slimmer than those who are inactive or lead a sedentary lifestyle. [38] In the present study, the majority of the participants fall under the normal category of BMI of WHO. [28] However, BMI's application in sports often fails to give the true picture of body structures and therefore body fat is recommended as a more accurate parameter for assessment in the physically active population [39,40] and is a limitation of the current study.

4.1. Energy

Athlete's nutritional needs are principally determined by their training load and body mass. [41] Energy availability (EA) is the amount of dietary energy available after exercise for all other metabolic processes. The optimal EA recommended for athletes is >45 kcal/kg/BM.

[42] The exercise energy expenditure (EEE) is determined based on training load and body fat percentage. [43] In the present study, the players were training for nearly 10-12 hours per week but the load was not calculated. The reference value for Indian sprinters is 70 kcal/ kg BM. [29] The mean energy intake of the young male sprinters in this study was 2968±1180 kcal which accounts for 51±20 kcal per kg BM per day. This was significantly less in (13-15, 16-17, and 18+ years) all age groups (Table 2) compared to the reference value for the sprinters. Among others, low energy intakes had been observed also in Brazilian male amateurs marathon finishers (2258±125kcal) [44] and Australian football athletes (3583±263kcal). [45] Suitable energy supply helps to consume adequate macronutrients, vitamins, and minerals. [46] The mean energy intake of the young male sprinters in this study was 2968±1180 kcal which accounts for 51±20 kcal per kg BM per day and it was significantly less in (13-15, 16-17, and 18+ years) all age groups (Table 2). Among others, low energy intakes had been observed also in Brazilian male amateurs marathon finishers (2258±125kcal) [44] and Australian football athletes (3583±263kcal). [45] Suitable energy supply helps to consume adequate macronutrients, vitamins, and minerals. [46] In the absence of recommendation of adolescent athletes, comparisons with adult data are prudent. [47]

4.2. Macronutrients

The average consumption of carbohydrates, fats, and proteins was 443.4±206.6, 82.1±32.8, and 108.4±52.7 g/day respectively.

4.2.1. Carbohydrates

The most important dietary factor in determining glycogen storage is the amount of carbohydrate consumed. [48] Low muscle glycogen decreases high-intensity performance [49] and many athletes strive to consume carbohydrates to benefit from full glycogen stores. [50] In the present study the carbohydrate intake was higher (7.9±2.2g/kg BM) than the recommendation (5-6 g/kg BM). [50] The total carbohydrate intake comprised of 59.8% of the mean energy intake of 2968 kcal by the young male sprinters as against amateur marathon finishers (48.9±9%). [44] Most games and sports feature

demanding competition schedules, which require aggressive nutritional recovery strategies to optimize muscle glycogen re-synthesis. [51] Therefore, day to day carbohydrate intake must be emphasized throughout training and competition phases.

4.2.2. Protein

The dietary protein interacts with exercise, providing both a trigger and a substrate for the synthesis of contractile and metabolic proteins [52,53] as well as enhancing structural changes in non-muscle tissues such as tendons and bones. [54] High-quality dietary proteins are effective for the maintenance, repair, and synthesis of skeletal muscle proteins. [55] The mean protein intake was 1.83 ± 0.9 g/kg BM (108.4 ± 52.7 g/day) which is high compared to the recommended intake of 1.6 g/kg BM [44] and consistency was found within the age-groups. Inadequacy was seen in less than 20% of the total participants which is similar to the findings on Indian athletes. [56,57] It is observed that people who do not include adequate protein in the daily diet may show slower recovery and training adjustments. [58]

4.2.3. Fat

Fat is a crucial fuel source for energy production, in both sedentary and athletic populations with intakes limited to 25-30% of the total calories. [59] It is imperative to restrict fat intake to <30% as excess intake can lead to undue weight gain. [60] The adequacy and mean fat intake of the young male sprinters in all age groups were found to be consistent (24.9%) with the recommendations (Table 2), being contributed through saturated fats (ghee). [61,62] In contrast, higher intakes were reported in swimmers [56,63] volleyball players, weightlifters and runners. [64]

4.3. Micronutrient

Micronutrients like vitamin A, E, C, and zinc known as antioxidants when deficient, lead to oxidative stress thereby lowering the performance. [74] However, there is no evidence on the micronutrient requirements of athletes. [65,66] Therefore, it is nowadays advised to meet the general RDA followed by the country. [65] RDA for Indians [27] was used to compare the micronutrient intake of the sprinters. Although there are many vitamins and minerals required for good health, particular attention should be devoted toward iron, vitamin D, calcium, and antioxidants by athletes. [67,68] Table 4 shows the mean micronutrient intake by the sprinters.

4.3.1. Calcium

Calcium is a key component for functions such as muscle contraction, nerve conduction, intra-cellular signaling, [69] blood clotting and alleviating muscle cramp in athletes. [70] Inadequate intake of calcium may result in reduced bone mineral density and increasing the risk of osteoporosis. [28,71] Results of the current investigation reveals significantly excess consumption among various age groups (13-15, 16-17, and 18+ years) at $p < 0.05$ and close to RDA for 10-12 years. Consumption of all varieties of dairy calcium, increased frequency and

quantity could be a reason for meeting dietary adequacy of calcium [61]. Calcium adequacy was also reported by Baranauskas et al [72] and Kaur and Singla [57] while males had a higher calcium intake compared to females. [73] On the contrary, calcium intake below recommendations was reported among soccer players, [74] professional weightlifters, [75] female volleyball player [76] and male Kuwaiti National level fencers. [77]

4.3.2. Iron

Iron is a crucial micronutrient in energy production pathways and is a functional component of hemoglobin and myoglobin. [78] Researchers have reported that iron deficiency can be a common problem in athletes and it is advisable to emphasize on meeting the recommended allowances above that of the general population as compromised iron status can affect athletic performance, even of the fittest and best conditioned endurance athlete. [70,79] It may lead to impaired immune function, cognitive development and ability to thermo-regulate. [80] The total iron losses in feces, urine, and sweat in endurance-trained athletes are approximately 1.75 mg/day in males and 2.3 mg/day in females because of the additional iron losses with menses. [80] A conservative estimate is that athletes need 30% more iron than individuals who do not exercise. [81] The iron intake was found to be inadequate among one-third of the young male sprinters. Significantly low intake was observed in 13-15 and 16-17 years age group while 18+ years age group met the recommendations. A similar result was reported among swimmers in the study by Navaneetha & Suvidha. [56]

4.3.3. Magnesium

Magnesium, a vital mineral regulates membrane stability and neuromuscular, cardiovascular, immunological, and hormonal functions and is a critical cofactor in many metabolic reactions [82] including energy metabolism, [83] cell growth, [84] glycolysis [85] and protein synthesis. [86] Muscle performance is positively associated with serum magnesium levels in male athletes. [87,88] During accelerated metabolic situations, the demand for magnesium is likely to increase, therefore, physically active individuals may have higher requirements in order to maintain optimal exercise performance as compared to the inactive population. [89,90] Ninety percent of the sprinter's magnesium intake was consistent with the recommendation. Sprinters exhibited excess consumption compared to the RDA across age groups except 10-12 years (Table 4). In contrast, Passos et al [44] and Dobrowolski & Włodarek, [91] reported inadequate intakes among amateur elite sportsperson.

4.3.4. Zinc

Zinc is involved in energy metabolism and antioxidant functions. [92] The overall intake was found to be fairly adequate among 46.2% sprinters. Zinc intake was above the recommendation among the 13-15 and 18+ age group (Table 4) while the intake was below the RDA in 10-12 and 16-17 age groups. Dobrowolski & Włodarek, [91] reported a higher intake of zinc compared to RDA among polish female soccer players. A similar result has also been reported by Baranauskas et al [72] and Passos et al

[44] where high level endurance runner's zinc intake was close or above the RDA whereas in a study by Dwyer et al [25] elite female skater's intake was low compared to the recommendation.

4.3.5. Vitamin A

Vitamin A is necessary for vision, maintaining the structure of epithelial cells, immune responses [93] and it is also important in maintenance of bone tissue. [94] In the current study, more than two-third of young male sprinters consumed an inadequate intake of retinol and more than 70% did not meet the β -carotene adequacy. Retinol and β -carotene intake was below the RDA across age groups. Low vitamin A intakes have also been reported by Garrido et al [94] and Martinez et al [95] among adolescent athletes, female soccer players, [96] high performance endurance athletes. [72] Insufficient fruit and vegetable intake were attributed to low vitamin A status [5] which can also be seen in the study by Gaur & Bhushanam, [61] where only half of the young male runners were consuming seasonal fruits on a daily basis.

4.3.6. Vitamin B- complex

B-complex vitamins are responsible for energy [96] erythrocyte and protein production, tissue repair, [97] hemoglobin synthesis, immune function and muscle development, and enzyme reactions. [98] Poor status of thiamin, riboflavin, and pyridoxine negatively impacts performance. [99] Thiamine, riboflavin, and niacin were found to be insufficient by 54%, 50%, and 32% respectively in the diet of collegiate sports persons aged 20-35 years in a Coimbatore district, Tamil Nadu. [32] Similarly, this study reveals a proportionately inadequate consumption of riboflavin and niacin among 50% while thiamine deficit intake was found in 20 percent. Two-third of the young male sprinters had an adequate intake of pyridoxine (Figure 1) and total dietary folates were seen to be adequate among the majority (82.5%) of the sprinters.

4.3.7. Ascorbic Acid

Ascorbic acid plays a key role in various physiological functions such as collagen synthesis, carnitine formation, neurotransmitter synthesis, [100] iron absorption, [101] and antioxidant function. [102] Ascorbic acid increased glutathione levels [103] to prevent oxygen radicals from attacking cell structures. [104] The majority of the athletes had significantly higher intakes of ascorbic acid while the 10-12 year group met the age group's recommendation. [27] This could be attributed to the consumption of a variety of seasonal fruits and fruit juices available to them on a regular/daily basis [61] similar to high performance endurance athletes [72] and soccer players. [74]

4.3.8. Vitamin D

Among the two major physiological forms of vitamin D i.e., cholecalciferol (D_3) and ergocalciferol (D_2), vitamin D_3 is considered as a major dietary source for vitamin D. [105] Vitamin D deficiency has turned out to be a major public health problem in the current scenario of developing countries. [106,107,108] Currently, in developing countries, milk is also being fortified with

vitamin D [109] which is considered as one of the major food ingredients for the athletes. More than 90% of the young male sprinters had a poor dietary intake of vitamin D (25-OH- D_3) and significantly less across the age groups ($p < 0.05$). This was comparable to other populations [106,107,108] and among high performance endurance athletes who were 80% deficient.

5. Conclusion

Generally, sprinters had an adequate intake of macronutrients, minerals (magnesium, calcium), and water-soluble vitamins (folic acid, and ascorbic acid) and inadequate intake of micronutrients (iron, zinc, vitamin A, vitamin D, riboflavin, and niacin). Inter-individual difference variability among the age groups and in between groups existed. While the data may be limited based on the sprinters' 3-day 24-hour recall, the lack of a well-balanced diet is highlighted. This insight into known modifiable factors may assist sports nutrition professionals to be more specific and targeted in their approach to supporting players to achieve enhanced performance. A need for a well-balanced healthy diet, with healthy food choices, goes a long way in maximizing performance. Sprinters should take sports nutritionists' advice for a structured, tailor made diets to suit the training load to optimize performance. Total energy availability, biochemical, and clinical assessment could further augment the research in understanding the nutritional status of the sprinters.

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