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Physical Activity Level in Relation to the Nutrient Intake of Elite Athletes

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Authors' contributions

This work was carried out in collaboration among all authors. Author AS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors NS and RJ managed the analyses of the study. Author NS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aim: The present study was conducted to study the relationship between the nutrient intake and physical activity level of 120 (16-25 years) elite athletes.
Methods: Athletes were selected from 5 universities of Punjab, participating in 4 sports *viz.* hockey, athletics, badminton and lawn tennis and their nutritional status and sports performance was assessed.
Results: The findings suggested that athletes had a normal Body Mass Index (BMI) and the energy, protein and iron intake of all the athletes was lower than dietary recommendations (61, 61.3 and 35% respectively). However, percent adequacy of calcium (91%), vitamin A (94.7%) and vitamin C (183%) was adequately high among overall athletes. Majority of athletes (51.7%) had vigorously active lifestyle; 44.2% had moderately active lifestyle.
Conclusion: Intake of nutrients was positively correlated with physical activity.

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Keywords: Elite athlete; physical activity; sports performance; suggested dietary intake; recommended dietary allowance.

1. INTRODUCTION

An elite athlete is defined as one who has formerly or currently competed as a state player, varsity player (individual or team), a proficient player or a national or international level player. Physical fitness and training are very much dependent on nutritional status of sports personnel and has been recognized as a contributing aspect for success in competition [1]. Ample calorie intake, liberal hydration and consideration to timing of meals are desirable for ultimate athletic performance [2]. Thus, nutritional status has a direct bearing on the level of physical performance.

Insufficient calorie intake affects the body negatively as it starts using body fat and lean tissue mass as fuel, resulting in loss of muscle mass, thus compromising strength and endurance. In contrast, another study [3] stated that a marginal consumption of carbohydrates (<20g/day) for 2-3 weeks led to adaptation to increased plasma ketone levels, which may perhaps boost performance by minimizing dependence on muscle glycogen. Energy expenditure is affected by type, duration and intensity of exercise along with body size, fat free mass (FFM) and nutritional status prior to exercise. Studies have shown that performance lasting for about one hour can be promoted even with a rinse of carbohydrate in liquid form [4]. Market of nutritional supplements/ ergogenic aids being accepted and practiced by the athletes has led to its increased use in hopes of improving performance. However, a study [5] showed that supplementation of vitamin C and E reduced endurance exerciseand suggested for its cautious consumption. Another study [6] stated that chronic lactate supplementation had no effect on sports performance, blood bicarbonate and blood pH. Individual assessment besides recommendation from a sports nutrition expert has been suggested for athletes with extreme nutrient necessities, or with nutritional complications [7]. Athletes are not born but are trained, thus the work out and training process of athletes mainly depends on these nutritional status and their scientific nutrition knowledge to maintain required physique and improved physical performance. The study was carried out to study the nutritional status of elite athletes and assess the physical activity level of elite athletes along with the relationship between dietary intake and physical activity of elite athletes.

2. METHODOLOGY

The present study was conducted during the months of March to October, 2017 in five Universities of Punjab namely, Punjab Agricultural University, Ludhiana, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab University, Chandigarh, Guru Nanak Dev University, Amritsar and Punjabi University, Patiala. A total of one hundred and twenty elite athletes of the age-group 16-25 years, participating in Hockey, Athletics, Badminton and Lawn Tennis (30 in each category) were selected. The selection of subjects was independent of gender. The athletes were selected on the basis of their participation at state or national level tournaments.

2.1 Collection of Data

Required information was collected through developed questionnaire. This questionnaire was pretested on 20 athletes, who were not included during the final selection of subjects.

2.1.1 Questionnaire for athletes

The Questionnaire was developed to assess general information, dietary and supplement intake and physical activity pattern of athletes.

2.1.2 General information of athletes

The information regarding food habits, food consumption, time spent in workout and frequency of supplement consumption of athletes was collected.

2.1.3 Anthropometric measurements

Height and weight were recorded using standard methods [8]. Body Mass Index (BMI) was further calculated based on anthropometric measurements taken. The athletes were classified on the basis of Body Mass Index (BMI) as per the criteria [9].

2.1.4 Dietary survey

To obtain the information regarding dietary pattern and food consumption, dietary survey

was carried out using 24 hour recall method for three consecutive days. Calculations of nutrient intake were done with the help of Software Diet Cal A [10] for dietary assessment and planning. In general, the recommended allowances for female athletes are considered to be similar to those recommended for their male counterparts [11]. The dietary and nutrient intake of subjects was compared with Suggested dietary intake (SDI) and Recommended Dietary Allowances (RDA) of nutrients [11].

2.1.5 Food and nutrient intake of athletes

The food and nutrient intake record was done to assess the kind of meals and/or liquids consumed by the athletes at the time of their training. Percent Adequacy Ratio (PAR) of food groups and nutrients was calculated using following formula:

$$PAR = \frac{\text{Intake of food group/nutrient} \times 100}{\text{Suggested Dietary Intake/Recommended Dietary Allowance}} \quad (1)$$

2.1.6 Use of supplements and drugs

The information regarding use and type/composition of dietary supplements by athletes was also recorded.

2.1.7 Physical activity pattern of athletes

Information regarding the total time spent every day on exercise, sports, personal care and household work was collected. The Physical Activity Diary Method (PADM) was used to record time spent on different activities for the days during which the dietary survey took place. Physical Activity Level (PAL) of the athletes was calculated by using Physical activity Ratio (PAR) [12].

The following formula is used to calculate mean PAL using formula stated below:

$$PAL = \frac{\sum[\text{Time of each activity (min)} \times \text{energy cost of each acivity (KCal)}]}{1440} \quad (2)$$

The assessment of lifestyle of the athletes through physical activity level (PAL) was used as a determinant for the categorization based on categories given [12].

3. RESULTS AND DISCUSSION

3.1 General Profile

The data collected regarding general profile (Table 1) of the subjects revealed that a majority of the selected athletes i.e. 74.2 percent belonged to high income group. A great majority of the selected elite athlete i.e. 75.8 percent were participating at national level; however, only 24.2 percent were participating at state level. Data regarding time spent in workouts indicated that 34.2 and 34.1 percent of the athletes spent 4-6 and 0-2 hours, respectively in the workout followed by 28.3 percent of the subjects who were spending 2-4 hours in their workout. Regarding food habits, non-vegetarianism was found to be more common among the selected subjects (53.3%). Consumption of junk foods was also found to be high among 75.8 percent of the elected subjects. It was responded by a majority of the athletes (65.8%) that they were not in the habit of skipping meals. Only 25 percent of the selected subjects were found to consume protein supplements.

3.2 Anthropometric Measurements

One of the most persuasive aspects in defining sound athletic performance along with other physiological aspects is the anthropometric features [13]. Table 2 represents the anthropometric characteristics of the athletes which revealed the average BMI of the athletes was found to be 21.9 Kg/m^2 which fell in the category of normal BMI as per the specified criteria [9].

3.2 Food Intake of the Athletes

The data regarding daily average food intake and their percent adequacy ratio among various athletes have been presented in Tables 3 and 4, respectively. Average intake of cereal grains & products among athletes was found to be 272g/day against the suggested dietary intake of 630g/ day resulting in 43.2 percent adequacy ratio. However, percent adequacy ratio of pulses & legumes and milk & milk products was found to be marginally adequate i.e. 78.8 and 72.7 percent, respectively. Consumption of fruits was found to be more than the SDI, the value being 284 g/ day compared to SDI of 200 g/day.

Among various vegetables, daily consumption of leafy vegetables was only 2.9 g/ day against the SDI of 150 g/day. So, the percent adequacy ratio

of leafy vegetables was quite low i.e. 2 percent only. The percent adequacy of other vegetables and roots & tubers was found to be 26.2 & 71.3 percent, respectively. The daily intake and suggested dietary intake of sugar was 53.7 and 80g, respectively and the percent adequacy ratio was found to be 67. The consumption of fish, meat & poultry was found to be adequate (99%) when compared to the SDI percent.

3.2.1 Nutrient intake of the athletes

The data concerning average daily intake of various nutrients along with their percent adequacy ratio (PAR) have been presented in Table 5 and 6 and percent energy contribution by protein carbohydrates and fats in athletes' diet has been presented in Fig.1 and comparison with recommended pattern of energy distribution in Fig. 2.

The overall energy intake of selected athletes was found to be inadequate as compared to the Recommended Dietary Allowance (RDA). The percent adequacy ratio (PAR) of energy was observed to be 61 percent, with highest adequacy among athletes of athletics (67%), followed by lawn tennis players (63.1%). The reason could be attributed to relatively less time spent in workout, resulting in reduced energy requirement and a conscious approach towards food consumption to avoid weight gain.

As depicted in Table 4 the protein intake is highest among athletes of athletics (72%) which might be due to higher consumption of protein supplements by them. However, protein consumption by overall athletes was found to be inadequate (98 grams) with a percent adequacy ratio (PAR) of 61.3 percent as compared when dietary recommendations which could be attributed to the reason that majority of the selected athletes were staying in the hostels. So, they had to rely on the foods whatever was available to them.

Higher intake of carbohydrates was observed by athletes of badminton (383 grams) and lawn tennis (369 grams). The (PAR) of fat as observed in Table 6 showed a low intake of fat by all the athletes than recommendations (76.6%). A higher fat intake by athletes of athletics (82.5%) as compared to other athletes was observed. The lower intake of iron by athletes might be due to low consumption of green leafy vegetables by the athletes. The PAR revealed an inadequate intake of iron (35%) as compared to RDAs by the athletes. However, consumption of non-vegetarian foods by most of athletes had contributed to some average iron intake (21 mg/day) by them.

The average daily consumption of calcium was reported to be nearly adequate among athletes of lawn tennis (98.1%) and athletics (96.2%) as compared to other athletes. However, the consumption was found to be lower than RDA which could be attributed to inadequate consumption of milk and milk products by the athletes. The average daily nutrient intake of β-Carotene was found to be higher among athletes of hockey (44.2%) followed by badminton (28.1%) and lawn tennis players (27.6%). The PAR exhibited an inadequate intake of β-Carotene by all the selected athletes which might be due to low consumption of green leafy and other vegetables by them.

A higher average intake of vitamin A was observed among athletes of athletics (736 µg) and lawn tennis (586 µg) with PAR of 123 and 97.7 percent, which might be due to relatively higher consumption of non-vegetarian foods, particularly eggs by them. The average daily folic acid intake by athletes of athletics was found to be 255.7 µg which was higher than an intake of 247, 203 and199 µg by athletes of lawn tennis, hockey and badminton, respectively. The intake of folic acid was found to be inadequate among all the athletes when compared to RDA. The percent adequacy of Vitamin C was observed to be adequate to highly adequate with no significant difference between overall athletes. However, the athletes of badminton (202.5%) and lawn tennis (196%) had relatively higher intake of Vitamin C than other athletes, such high intake levels could be attributed to high consumption of seasonal fruits by them.

3.3 Physical Activity Pattern

The routine physical activity of the athletes was recorded along with time spent on these activities (Table 7) to study their physical activity pattern. The results revealed no significant difference in mean sleeping hours of overall athletes.Athletes of lawn tennis were found to spend more time (6.1 hours) in light activities as compared to their counterparts. There was no significant difference between overall athletes in preparing meals as majority of athletes resided in hostels. The time spent in other general household work was also found to be insignificant among all the athletes. A non-significant difference was observed in time spent in walking and time spent in athletes' respective sport.

Table 1. General profile of the athletes (N=120)

Characteristics	Hockey (n=30)	Athletics (n=30)	Badminton (n=30)	Lawn tennis (n=30)	Total (%) N=120
Family income (Rs/ annum)					
Low (upto 50,000/-)	3 (10)	0	0	0	3 (2.5)
Medium (50,000 to 2,50,000/-)	4 (13.3)	5 (16.7)	9 (30)	10 (33.3)	28 (23.3)
High (>2,50,000/-)	23 (76.7)	25 (83.3)	21 (70)	20 (66.7)	89 (74.2)
Level of participation					
State	0	15 (50)	9 (30)	5 (16.7)	29 (24.2)
National	30 (100)	15 (50)	21 (70)	25 (83.3)	91 (75.8)
Time spent in workout (in hours)					
0-2	9 (30)	10 (33.3)	13 (43.3)	9 (30)	34.1
2-4	5 (16.7)	9 (30)	5 (16.7)	15 (50)	28.3
4-6	16 (53.3)	9 (30)	12 (40)	4 (13.3)	34.2
6-8	0	2 (6.7)	0	2 (6.7)	3.3
Food Habits					
Vegetarian	22 (73.3)	10 (33.3)	9 (30)	13 (43.3)	45
Non-Vegetarian	8 (26.7)	19 (63.3)	20 (66.7)	17 (56.7)	53.3
Junk Food					
Yes	20 (66.7)	22 (73.3)	26 (86.7)	23 (76.7)	91 (75.8)
No	10 (33).3)	8 (26.7)	4 (13.3)	7 (23.3	29 (24.2)
Skipping Meals					
Yes	19 (63.3)	10 (33.3)	10 (33.3)	2 (6.7)	41 (34.2)
No	11 (36.7)	20 (66.7)	20 (66.7)	28 (93.3)	79 (65.8)
Protein Supplements	1 (3.3)	15 (50)	9 (30)	5 (16.7)	25

*(*Figures in parenthesis represent percentages)*

Table 2. Anthropometric measurements of the athletes (N=120)

Parameters	Hockey (n=30)	Athletics (n=30)	Badminton (n=30)	Lawn Tennis (n=30)	Total (N=120)
Height (mts)	1.65±0.08	1.75±0.1	1.7±0.08	1.73±0.08	1.71±0.09
Weight (Kg)	57.2±10.4	69.8±14.9	63.4±12.8	65.04±12.1	63.9±13.4
BMI (Kg/m^2)	21±2	22.7±3.2	22.1±2.9	21.7±2.5	21.9±2.7

Values are Mean ± SD

Table 3. Daily average food intake of athletes (N=120)

Food Groups	Hockey (n=30)	Athletics (n=30)	Badminton (n=30)	Lawn Tennis (n=30)	Total (N=120)
Cereals grains & products	276±80.8	279±78	270.3±80	263±75.4	272±78
Pulses & legumes	63.5±27	60.3±26	59±25.4	69.7±27.3	63±26.3
Milk & milk products	576±244	592±253	533±236	479.7±186	545±233
Fats & edible oils	29.9±3.2	29.7±3.3	30.6±3.7	30±3	30±3.3
Fruits	278.3±107	281±105.4	291±101	286.3±108	284±104
Leafy vegetables	3.3±13	6.7±17.3	1.7±9.1	0	2.9±11.8
Other vegetables	53.2±53.8	52.3±54.4	59.3±63.5	44.5±49.4	52.3±55
Roots and Tubers	109.8±51	109.7±51	100.7±50.3	108±42	107±48.3
Sugars	56±22.7	57.4±22.7	52.5±23	50±17.7	53.7±21.7
Fish, meat & poultry	88±152	102.3±153	123.7±176	82.7±156	99.1±158

*(°SDI – suggested Dietary intake by NIN (2007), Values are Mean ± SD, *Significant at 5% level, NS- Non significant)*

3.3.1 Physical activity level (pal) of athletes

FAO/WHO/UNU classification had been used to categorize the selected athletes into lifestyle pattern of sedentary/moderate/vigorous. Calculated values of physical activity level are represented in Table 7 which revealed an overall higher physical activity level of all the selected

athletes, consequently, no overall significant difference was observed regarding physical activity level with an average PAL value of 2.0 by total athletes.

3.3.2 Classification of athletes according to physical activity level

Categorization of athletes into sedentary, moderate and active lifestyle was done according to their physical activity level and is being presented in Table 6. The data revealed that majority (51.7%) of total athletes had vigorous or vigorously active lifestyle while others (44.2%) had an active or moderately active lifestyle, whereas only a few percentage (4.2%) of total athletes lived sedentary or light activity lifestyle.

3.4 Correlations

As depicted in Table 8, intake of nutrients including energy, protein, carbohydrates, calcium, iron, vitamin A and vitamin C had a positive but non-significant correlation with the time spent in respective sports. Similarly, intake of protein supplements was also found to be non-significantly correlated with the time spent in the respective sport.

3.5 Discussion

Majority of the athletes (75.8%) in the present study were participating at National level in their respective sport, clearly indicating their status as an 'elite' athlete. Research study [14] revealed that well-trained athletes tend to display optimal muscle contents, however, the fat mass can influence the BMI of athletes. The inadequate consumption of cereals, roots & tubers and other vegetables by the selected athletes in the present study can be very well compared with the inadequate of all. The above said food groups [15] revealed that more than 70 percent

Table 4. Percent Adequacy Ratio (PAR) of food intake of athletes (N=120)

Food Groups	SDI° (g)	Hockey (n=30)	Athletics (n=30)	Badminton (n=30)	Lawn Tennis (n=30)	Total (N=120)
Cereals grains & products	630	43.8	44.3	42.9	41.7	43.2
Pulses & legumes	80	79.4	75.4	73.8	87	78.8
Milk & milk products	750	76.8	78.9	71.1	64	72.7
Fats & edible oils	75	40	40	40.8	40	40
Fruits	200	139	140	146	143	142
Leafy vegetables	150	2.2	4.5	0	0	2
Other vegetables	200	26.6	26.2	29.7	22.3	26.2
Roots and Tubers	150	73.2	73	67	72	71.3
Sugars	80	70	71.8	65.6	62.5	67
Fish, meat & poultry	100	88	102.3	123.7	82.7	99.1

°SDI – Suggested Dietary intake by NIN (2007)

Table 5. Daily average nutrient intake of athletes (N=120)

Nutrients	Hockey (n=30)	Athletics (n=30)	Badminton (n=30)	Lawn Tennis (n=30)	Total (N=120)
Energy (Kcal)	2618±506	3012±551	2619±532	2839±535	2772±550
Protein (g)	89±29.4	115±39	89±22.1	99.5±29.6	98±32
Carbohydrate (g)	340.2±65	383±67	345±80	369±74	359±73
Fat (g)	89±24	99±34	85±19	94±20	91.9±25.1
Iron (mg)	19±3.5	22.5±4.5	20.7±7.6	21.7±4.6	21±5.4
Calcium (mg)	1648±539	1924±629	1735±546	1962±618	1817±592
Beta-carotene (µg)	2123±2101	1199±1577	1347±1116	1327±1688	1499±1678
Vitamin A (µg)	498±386	736±472	450±291	586±351	568±392
Folic Acid (µg)	203±80.5	255.7±67.2	199±74.7	247±110	225±87.3
Vitamin C (mg)	54.8±50.6	78±72.6	81±51.5	78.4±79.2	73.1±64.8

*(°RDA – Recommended Dietary intake by NIN (2007), Values are Mean ± SD, *Significant at 5% level, NS- Non significant)*

of athletes frequently do not consume cereals, roots and tubers, fruits and vegetables, legumes/nuts. Protein supplementation may boost performance by improving the muscle mass in the body if ample training stimulus along with constant dietary intake recommended for physically active individuals is maintained [16]. Research findings [17] revealed consuming bovine milk as a substitute to sports drinks to enhance hydration levels in athletes. In a study [18] reduced intake (42%) of animal fats in the light of dietary recommendations for athletes was specified.

The daily intake of fruits by the selected athletes in the present study was found to be higher than the suggested dietary intake. Similarly, another study [19] reported that significantly more fruits and vegetables were consumed by good nutritional knowledge group and nutritional knowledge was positively correlated to fruit and vegetables consumption.

Table 6. Percent Adequacy Ratio (PAR) of nutrient intake of athletes (N=120)

Nutrients	RDA	Hockey (n=30)	Athletics (n=30)	Badminton (n=30)	Lawn Tennis (n=30)	Total (N=120)
Energy (Kcal)	4500	58.2	67	58.2	63.1	61.6
Protein (g)	160	55.6	72	55.6	62.2	61.3
Fat (g)	120	74.2	82.5	70.8	78.3	76.6
Iron (mg)	60	75	60.8	67.8	56.2	65
Calcium (mg)	2000	82.4	96.2	86.8	98.1	91
Beta-carotene (µg)	4800	44.2	25	28.1	27.6	31.2
Vitamin A (µg)	600	83	123	75	97.7	94.7
Folic Acid (µg)	200	101.5	128	99.5	123.5	112.5
Vitamin C (mg)	40	137	195	202.5	196	183

°RDA – Recommended Dietary intake by NIN (2007)

Table 7. Physical Activity Pattern and Physical Activity Level of athletes (N=120)

Activities (in hours)	PAR°	Hockey (n=30)	Athletics (n=30)	Badminton (n=30)	Lawn Tennis (n=30)	Total (N=120)
Sleeping	1.0	7.9±1.3	7.5±0.8	7.8±1.4	7.3±0.9	7.6±1.2
Personal care	2.3	1.7±0.7	1.9±0.6	1.5±0.6	1.4±0.5	1.6±0.6
Having meals	1.5	3.2±0.8	2.7±0.6	2.8±0.5	2.8±0.4	2.9±0.6
Light activities while sitting	1.5	4.7±2.2	5.2±1.7	5.1±2.1	6.1±1.7	5.2±2
Watching TV/ Computer work	1.4	1±0.7	1.02±1	0.8±0.5	0.9±0.7	0.9±0.8
Driving	2.0	0.2±0.3	0.7±0.5	0.6±0.5	0.5±0.5	0.5±0.5
Preparing meals	2.1	0.3±0.2	0.02±0.1	0.2±0.4	0.02±0.1	0.13±0.3
Other general household work	2.8	0.5±0.5	0.4±0.5	0.4±0.4	0.24±0.3	0.4±0.4
Walking without load	3.2	1.5±0.8	1.1±0.6	0.9±0.6	1.01±0.4	1.1±0.6
Exercise, yoga and sports	4.8	3.1±1.3	3.6±1.5	3.9±1.6	3.9±1.5	3.6±1.5

*Values are Mean ± SD, *Significant at 5% level, NS-non significant, °Physical Activity Ratio*

Physical Activity Level (PAL) of Athletes (N=120)

Particulars	Hockey (n=30)	Athletics (n=30)	Badminton (n=30)	Lawn Tennis (n=30)	Total (N=120)
Physical Activity Level (PAL)	1.96±0.2	2.0±0.2	2.0±0.2	2.0±0.2	2.0±0.2

*^FAO/WHO/UNU (2004) Values are Mean ± SD, *Significant at 5% level, NS-non significant*

Classification according to Physical Activity Level (PAL) of Athletes (N=120)

Particulars	Hockey (n=30)	Athletics (n=30)	Badminton (n=30)	Lawn Tennis (n=30)	Total (N=120)
Sedentary or light activity lifestyle	3 (10)	1 (3.3)	0	1 (3.3)	5 (4.2)
Active or moderately active lifestyle	16 (53.3)	14 (46.7)	13 (43.3)	10 (33.3)	53 (44.2)
Vigorous or vigorously active lifestyle	11 (36.7)	15 (50)	17 (56.7)	19 (63.3)	62 (51.7)

*(*Figures in the parenthesis represent percentages)*

Table 8. Correlation of various factors with time spent in respective sports

S.No.	Factor-1	Factor-2	Correlation coefficient (r)
1.	**Intake of**		
	Energy	Time spent in respective sport	0.28^{NS}
	Protein		0.33^{NS}
	Carbohydrates		0.57^{NS}
2.	Protein supplement intake	Time spent in respective sport	0.34^{NS}
3.	Calcium	Time spent in respective sport	0.38^{NS}
4.	Iron	Time spent in respective sport	0.22^{NS}
5.	Vitamin A	Time spent in respective sport	0.41^{NS}
6.	Vitamin C	Time spent in respective sport	0.49^{NS}

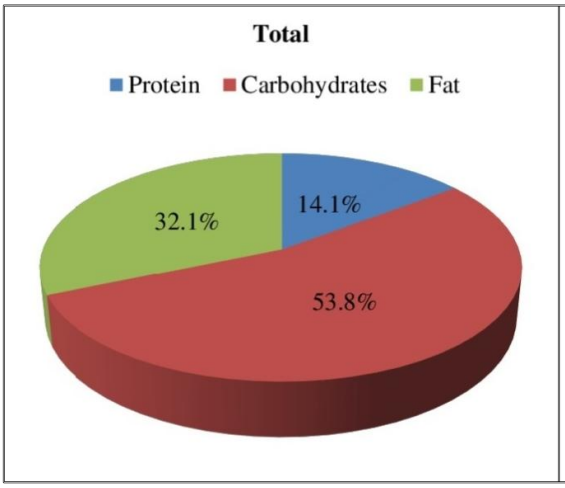

Fig. 1. Present energy contribution in diet of the athletes

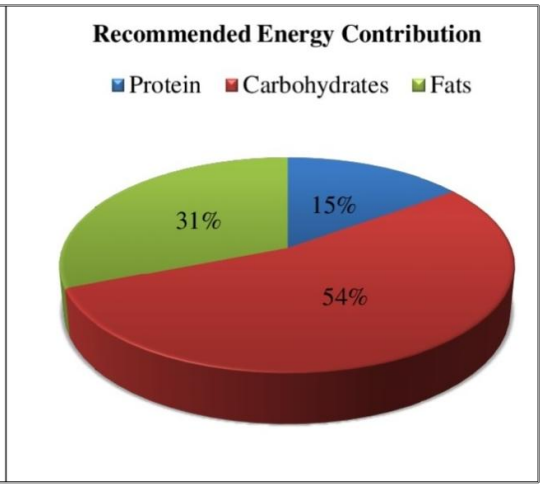

Fig. 2. Present energy contribution according to RDA (NIN 2007)

Percent adequacy ratio of energy consumption was found to be inadequate among all the athletes in the present study. Similarly, it was estimated, a mean daily energy deficit (947 Kcal) professional rugby league players [20]. A study, [21] revealed that during a marked energy insufficiency, consumption of 2.4 g protein/kg/day was found to be more effective than 1.2 g protein/kg/day in promoting lean body mass along with exercise while in a study [22], it was reported that a less favourable tendency of females was observed regarding consumption of carbohydrates as compared to males. A very low intake of iron by the athletes in present study was reported [23].

Similar to the present study, calcium intakes were also found to be below the estimated average requirement among adolescent non-athletes and athletes in a study [24] showed that the deficiency may be noted through muscle numbness, musculoskeletal pains, menstrual cramps, and osteoporosis. In contrast to the results of present study [25] showed significantly higher daily nutrient intake of β-Carotene by the athletes as compared to recommended dietary intake. Inadequate intake of folic acid among both boys and girls amateur swimmers [26]; study suggested that proper nutrient intake corresponds to peak athletes' functionality, and nutrient insufficiency may lead to reduced athletic performance [15]. Similarly, in the present study, the intake of various nutrients was found to be positively correlated to the time spent in their respective sports.

4. CONCLUSION

From the study it can be concluded that the percent adequacy ratio of food and nutrient intake was inadequate. The nutrient intake was positively correlated with time spent in training and practice sessions. Therefore, it can be recommended that good nutritional status complement full potential of athletes.

CONSENT

As per international standard written participant consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Alexopoulas Y, Frazier DM. Krause's food and the nutrition care process. USA. Elsiever Saunders; 2012.
2. Purcell LK. Sports nutrition for young athletes. J Paediatr Child Health. 2013;18: 200-202.
3. Burke LM. Re-examining high-fat diets for sports performance: did we call the 'nail in the coffin' too soon? Sport Med. 2015;45: 33-49.
4. Jeukendrup A. A step towards personalized sports nutrition. Carbohydrate intake during exercise. Sport Med. 2014; 44:25-33.
5. Paulsen G, Cumming KT, Holden G, Hallen J, Ronnestad BR, Sveen O, Skaug A, Paur I, Bastani NE, Ostgaard HN, Buer C, Midttun M, Freuchen F, Wiig H, Ulseth ET, Garthe I, Blomhoff R, Benestad HB and Raastad T. Vitamin E and C supplementation hamper cellular adaptation to endurance training in humans. A double-blind, randomised, controlled trial. J Phys. 2014;592:1887-1901.
6. Oliveira LF, Painelli VS, Nemezio K, Goncalves LS, Yamaguchi G, Saunders B, Gualano B, Artioli GG. Chronic lactate supplementation does not improve blood buffering capacity and repeated high-intensity exercise. Sci and J Med & Sci Sport. 2016;27:1231-1239.
7. Smart CE, Annan F, Bruno LPC, Higgins LA, Aceerini CL. Nutritional management in children and adolescents with diabetes. Paed Diab. 2014;15:135-153.
8. Jelliffe DB. The assessment of nutrition status of the community. World Health Organisation. Monograph series no. 1966;53:50-84.
9. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide. Br Med J. 2000;320:1-6.
10. Kaur G. Diet Cal- A tool for dietary assessment and planning. AIIMS; New Delhi; 2014.
11. NIN. Nutrition and Hydration Guidelines for Excellence in Sports Performance. Delhi: Sports Authority of India; 2007.
12. FAO/WHO/UNU Human Energy Requirements. Report of a Joint FAO/WHO/UNU Expert Consultation, Rome; 2004.
13. Adhikari A, Nahida P, Islam RN, Kitab A. Importance of anthropometric characteristics in athletic performance from the perspective of Bangladeshi national level athletes performance and body type. Am J Sports Sci Med. 2014;4:123-127.
14. Chamorro RPG, Belando JES, Lorenzo MG, Carratala MLM, Roche E. Correlation between body mass index and body composition in elite athletes. J Sports Med Phys Fitness. 2009;49:278-284.
15. Folasire OF. Does nutrition knowledge and practice of athletes translate to enhanced athletic performance? Cross-sectional study amongst Nigerian undergraduate athletes. Glob J Health Sci. 2015;7:215-225.
16. Pasiakos SM, McLellan TM, Lieberman HR. The effects of protein supplements on muscle mass, strength, and aerobic and anaerobic power in healthy adults. A Systematic Review. Sports Med. 2015; 45:111-131.
17. Pegoretti C, Antunes AEC, Gobattto FBM, Capitani CD. Milk: An Alternative beverage for hydration? Food & Nutr Sci. 2015;6: 547-554.
18. Gacek M. Association between self-efficacy and dietary behaviours of American football players in the Polish clubs in the light of dietary recommendations for athletes. Annals of the National Institute of Hygiene. 2015;66: 4.
19. Alaunyte L, Perry J, Aubrey T. Nutritional knowledge and eating habits of professional rugby league players: does knowledge translate into practice? J Int Soc Sport Nutr. 2015;12:18.
20. Tookey E, Bitcon M, Briggs MA. Estimates of energy intake and expenditure in professional rugby league players. Int J Sport Sci & Coach. 2015; 10:2-3.
21. Longland TM, Oikawa SY, Mitchell CJ, Devries MC, Phillips SM. Higher compared with lower dietary protein during an energy

deficit combined with intense exercise promotes greater lean mass gain and fat mass loss. A randomized trial. Am J Clin Nutr. 2016;103:738-746.
22. Okumura Y, Okumura K, Miyazaki S, Ishihara K, Yokota Y, Matsumoto M. Athletes' attitude on foods as snacks. The FASEB Journal. 2017;31:795-799.
23. Wardenaar F, Brinkmans N, Ceelen I, Rooij BO, Mensink M, Witkamp R, Vries JD. Micronutrient intakes in 553 Dutch elite and sub-elite athletes. Prevalence of low and high Intakes in users and non-users of nutritional supplements. Nutrients. 2017;9:142.
24. Coutinho LAA, Porto CPM, Pierucci APTR. Critical evaluation of food intake and energy balance in young modern pentathlon athletes. A cross-sectional study. J Int Soc Sports Nutr. 2016;3:15.
25. Nande P, Mudafale V, Vali S. Micronutrient status of male and female players engaged in different sport disciplines. J Exerc Sci Physio. 2009; 5:1-13.
26. Sonia M, Bruno NP, Dora R, Cati A, Pedrpo T, Antoni A. Anthropometric characteristics and nutritional profile of young amateur swimmers. J Str Cond Res. 2011;25:1126-1133.

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