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Influence of Sports Dietitian on the Dietary Intake and Hydration Habits of Collegiate Athletes

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Authors' contributions

This work was carried out in collaboration among all authors. Author RK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author AK helped in framing questionnaire and data collection from Patiala. Authors NK and RK managed the analyses of the study. Both authors 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 difference between the dietary intake and hydration habits of collegiate athletes with or without sports dietician.
Methods: A total of 120 athletes participating in 5 sports viz. hockey, basketball, handball, football and volleyball from two Universities were selected. Sixty athletes (30 males and 30 females) from Punjab Agricultural University without provision of sports dietician were treated as control group and sixty athletes (30 males and 30 females) from Punjabi University following sports dietician were treated as experimental group.
Results: The findings suggested that the athletes of experimental group had a normal Body Mass Index (BMI). The overall nutrient intake findings revealed that the macronutrient as well as micronutrient intake of experimental group athletes was significantly ($p \leq 0.01$) higher than the athletes of control group. Experimental group athletes followed better nutritional habits during team trips, before and after exercise, during in-season and off-season of their workout and followed proper hydration guidelines.
Conclusion: The athletes following sports dietician have better nutritional status and hydration habits.

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Keywords: Body mass index; macronutrients; sports dietician; control, experimental.

1. INTRODUCTION

Nutrition plays a vital role in attaining high levels of achievements in sports. Direct relation is found between physical performance and nutrition which is defined by three variables: Training, rest and feeding. The two main aspects to carry out better sports performance are the state of hydration and the energy availability. Dehydration leads to the various alterations in homeostasis, decreased blood volume, tachycardia, less release of sweat, increase in body temperature which results in deterioration of sports performance [1]. 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 [2]. Hence, physical fitness and training relay on athletes nutritional status.

Sports nutrition is an emerging discipline in which athletic performance is improved by using nutritional principles. In simple words, it is a science that provides necessary guidelines to improve health and athletic performance. In every physical fitness program the proper intake of nutrients should be there to get better results. Vigorous training along with nutritious diet can go long way in getting good results. Poor nutritional status leads to various health issues and affect physical performance. In case of female athletes who do not consume adequate diets due to lack of nutritional knowledge and nutritional misconceptions are more prone to the problems like Female Athlete Triad, a trio of low energy availability, menstrual dysfunction, and low bone mass.

Dietary knowledge and nutrition information of collegiate athletes can be improved by the registered dietician. Registered dieticians are those individuals who have achieved additional qualification in field of nutrition related to sports. Complete and appropriate sports nutrition education is provided by the sports dietician [3]. Good nutritional habits have a deep impact on the athlete's well being and performance. The role of sports dietician is to check nutrition and dietary intake, guide about nutritional supplements, fluid intakes, weight management and educate athletes for energy and nutrient requirements and for optimal food choices.

Therefore, this need become an issue of major concern to provide nutritional guidance and support to the athletes and it can only be possible if the Sports Departments appoint nutrition experts (registered dieticians) for supplying nutritional knowledge. Keeping this in view this study has been planned to evaluate the role of sports dietician in improving the nutritional status and nutritional knowledge of college athletes.

2. METHODOLOGY

The present study was conducted in two universities of Punjab namely- Punjab Agricultural University, Ludhiana and Department of Sports Science- Punjabi University, Patiala. A total of 120 athletes (60 men and 60 women) aged 18-25 years, participating in basketball, volleyball, football, hockey and handball were selected.

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.

2.2 Questionnaire for Athletes

Questionnaire was developed to collect information regarding anthropometry, dietary survey, food and nutrient intake in terms of pre and post workout nutrition, nutrition during team trips, nutrient periodization, breakfast and hydration habits.

2.3 Anthropometric Measurements

Height, weight, waist and hip circumference were recorded using standard methods [4]. Body Mass Index (BMI) and Waist/Hip ratio was further calculated based on anthropometric measurements taken [5].

2.4 Dietary Survey

To attain information regarding food habits, dietary pattern and food consumption, a dietary survey with detailed information of food intake using 24 hour recall method for three consecutive days was carried out and frequency of consumption of different foods was recorded. Calculations of nutrient intake were done with the help of Indian Nutritive Software DietCal-A [6] for dietary assessment and planning.

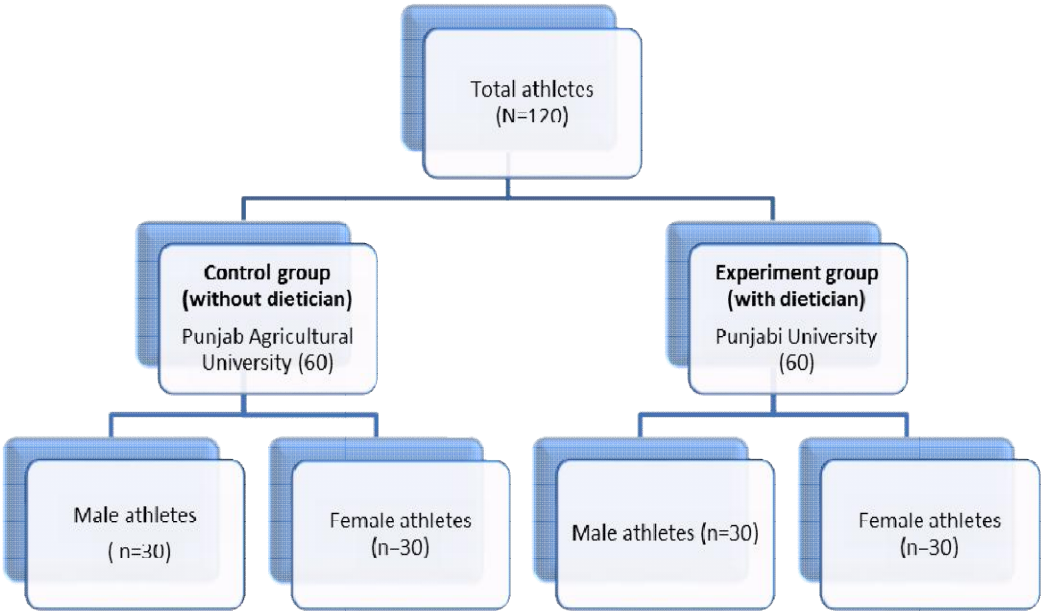

Fig. 1. Selection of athletes

In general, the recommended allowances for female athletes are considered to be similar to those recommended for their male counterparts. The dietary and nutrient intake of subjects was compared with Suggested Dietary Intake (SDI) and Recommended Dietary Allowances (RDA) of nutrients, respectively as specified by NIN [7].

2.5 Food and Nutrient Intake of Athletes

The food and nutrient intake record was divided into seven parts to assess the kind of meals and/or liquids consumed by the athletes at the time of their training, during team trips and during nutrient periodization. Percent Adequacy Ratio (PAR) of food groups and nutrients was calculated using following formula [2].

$$\text{PAR} = \frac{Intake\ of\ food\ groups\ or\ nutrients \times 100}{Suggested\ dietary\ intake\ or\ Recommended\ dietary\ allowances}$$

The seven foods and nutrients intake divisions are discussed below:

2.6 Pre workout Nutrition

The information regarding time and type of nutrients taken by the athlete before commencing training/practice of sport was collected.

2.7 Post Workout Nutrition

The time and type of nutrients taken by athletes after workout was recorded for analysis.

2.8 Nutrition during Team Trips

The information about the meals taken by athletes when they were out on trips for competition was recorded.

2.9 Nutrient Periodization

Consumption pattern of athletes during in season and off season is recorded to examine the energy intake of athletes.

2.10 Breakfast Habits

The time and type of breakfast taken by athletes before competitions was recorded for analyzing the breakfast habits.

2.11 Hydration Habits

The information about hydration schedule was also collected and was also divided into percent frequency and amount of liquids taken before, during and after training schedule of athletes.

3. RESULTS AND DISCUSSION

3.1 Anthropometric Measurements of the Athletes

In Table 1 the anthropometric measures were illustrated, the experimental athletes were better as compared to counterparts from control group and significant ($p \leq 0.05$) differences were found between waist, hip and waist-hip ratio and non-significant difference was found between height and weight among males and females of both groups. But the values were lower than the standard values given by ICMR [8]. Table 2 depicts the BMI values of male and female athletes of experimental group were found in normal range (18.5-24.99 kg/m^2). The BMI of athletes with good fitness was found to be closer to normal levels but higher than the ones with low status and the higher weight among the athletes with good fitness indicates more lean muscle mass and not necessarily body fat [9].

3.2 Food Intake

The consumption of all the food groups was depicted in Table 3 (cereal grains and products, pulses and legumes, milk and milk products, fruits, green leafy vegetables, other vegetables, roots & tubers and animal foods) was found to be significantly ($p \leq 0.01$) higher among male athletes of experimental group compared to the control group. Similar trend was seen amongst females in consumption of pulses and legumes, green leafy vegetables and animal foods. Consumption of sugars was higher among the athletes of control group and significant ($p \leq 0.01$) difference was found between males and females of both groups. The mean food intake and adequacy of all food groups and nutrients were less than the recommended standards for athletes shown in Figs. 2 and 3, except for fruits (139.6%) among male athletes of experimental group and the least adequacy was observed for green leafy vegetables (17.7%) among male athletes of control group.

3.3 Nutrient Intake

Table 4 revealed the average nutrient intake of athletes who were following sports dietician was higher and significantly ($p \leq 0.01$) different as compared to the average intake of nutrients by the athletes of control group who were not following sports dietician. But the intake of all the nutrients was inadequate as compared to the recommended values given by NIN [7]. Fig. 4 and 5 shows PAR of athletes nutrients consumed by the athletes of both groups.

Proper nutrition is essential to help athletes recover from workouts and competitions. The PAR of daily energy intake by experimental and control group of male athletes was 78.9 and 54.5. In context of female athletes of experimental and control group the PAR was 53.9 and 44.7. The intake values of athletes from experimental group were on higher side which showed that there was a significant ($p \leq 0.01$) difference between the energy intake of male and female athletes of both groups, similarly in case of protein consumption the significant difference was found between them. The PAR of protein of male and female athletes of experimental group was 53.1and 37.8 while among control group males and females was 35.3 and 28.4.

Higher intake of carbohydrates was observed among male athletes of experimental group (385.75 g) followed by female athletes of experimental group (296.72 g).The intake was lower among athletes of control group (297 g by males and 256.73 g by females). Significant ($p \leq 0.01$) difference was found between males and females of both groups. A higher intake of total fat was seen among athletes of experimental group. The PAR of fat among athletes of experimental group was found 82.3 by males and 75.1 by females while 72.7 and 70.5 by male and female athletes of control group, respectively. Iron intake was found lower among all the athletes of both groups with PAR of 52.4 percent in males and 45 percent in females of experimental group whereas 44.8 by male and 35.9 percent by female athletes of control group.

The average daily consumption of calcium was reported to be nearly adequate among athletes of both groups. The PAR of calcium consumption of experimental group's male and female was 99.3 and 91.3, whereas of control group's athletes 76.1 and 73.8 percent. The data 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 i.e. 52.5 and 41.0 by male and female athletes of experimental group, 40.9 by male and 33.9 by female athletes of control group.

Table 1. Anthropometric measurements of the athletes (N=120)

Parameters	Males			Females		
	Control group (n=30)	Experimental group (n=30)	t-value	Control group (n=30)	Experimental group (n=30)	t-value
Height(cm)	175.63±5.30	176.30±4.57	0.524^{NS}	160.70±3.63	161.21±4.99	0.453^{NS}
Weight(kg)	68.40±5.51	69.26±5.06	0.630^{NS}	54.12±8.48	50.90±3.66	1.910*
Waist (inch)	32.1±1.4	33.0±1.3	2.559**	28.4±2.6	27.3±1.0	2.163**
Hip (inch)	35.8±1.5	37.2±1.5	3.564**	34.0±2.8	32.0±1.2	3.596**
W/H ratio	0.89±0.01	0.88±0.02	2.449**	0.83±0.01	0.85±0.02	4.899**

*Values are in Mean±SD,*Significant at 5 per cent level,** Significant at 1 per cent level, NS-Non-significant*

Table 2. Classification of athletes on basis of body mass index (N=120)

Parameters	Males		Females	
	Control group (n=30)	Experimental group (n=30)	Control group (n=30)	Experimental group (n=30)
BMI				
Underweight (< 18.50)	0(000)	0(00.0)	7(23.3)	1(3.3)
Normal (18.5-24.99)	25(83.3)	30(100.0)	18(60.0)	29(96.7)
Overweight (≥25.00)	0(00.0)	0(00.0)	0(00.0)	0(00.0)
Obese I (25.00-29.99)	5(16.7)	0(00.0)	5(16.7)	0(00.0)
Obese II (≥30)	0(00.0)	0(00.0)	0(00.0)	0(00.0)

WHO (2004)

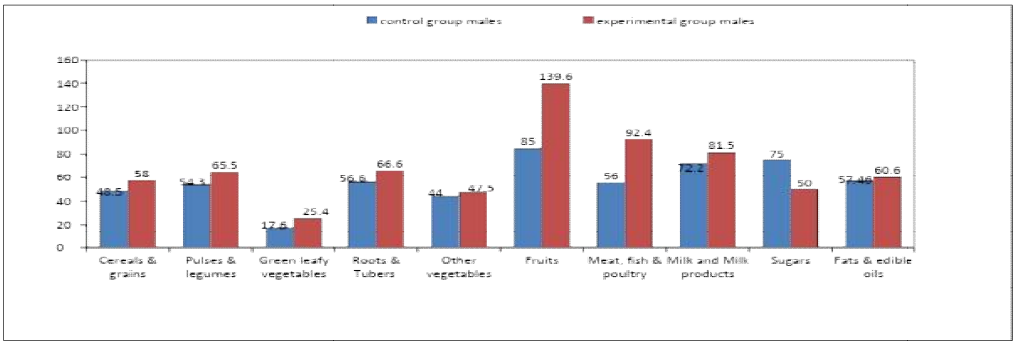

Fig. 2. Percent adequacy of food intake of male athletes

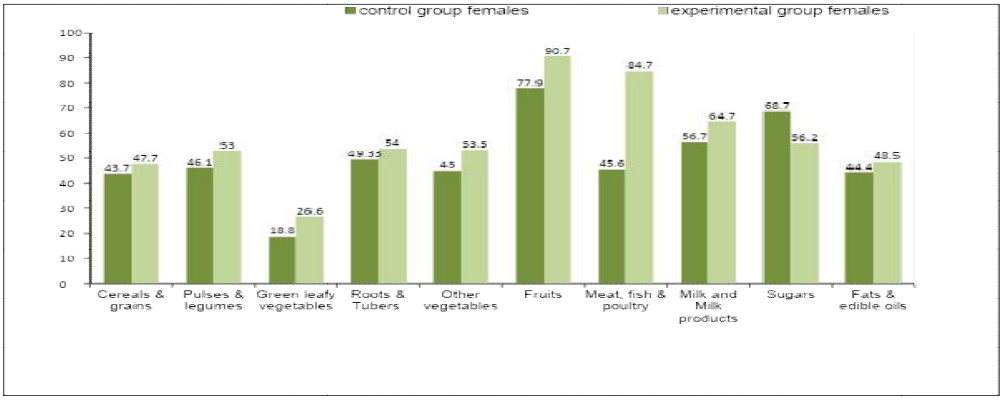

Fig. 3. Percent adequacy of food intake of female athletes

Table 3. Average daily food intake (g) of athletes (N=120)

Food groups	Males			Females			
	Control group (n=30)	Experimental group (n=30)	t – value	Control group (n=30)	Experimental group (n=30)	t- value	SDI (g)
Cereal grains and products	305.45±55.39	365.66±81.73	3.340**	275.54±68.60	300.45±43.81	1.676*	630
Pulses & legumes	43.45±9.70	52.46±20.39	2.186**	36.89±3.01	42.45±11.22	2.622**	40.0
Green leafy vegetables	26.52±6.87	38.12±5.66	7.138**	28.2±4.86	40±0.00	13.29**	150
Roots & tubers	85±36.06	100±0	2.278**	74±41.57	81±21.45	0.820^{NS}	150
Other vegetables	88±10.33	95±10.00	2.667**	90±11.52	107.89±66.63	1.449*	200
Fruits	170.00±68.23	279.23±76.02	5.857**	155.84±70.62	181.45±63.37	1.478*	200
Meat , fish & poultry	56.78±13.45	92.45±36.06	5.187**	45.65±12.02	84.78±25.35	7.639**	250
Milk & milk products	542.22±89.37	611.29±51.76	3.663**	425.54±150.2	485.78±166.7	1.470*	750
Sugars	60±5.41	40±8.7	10.698**	55±4.5	45±9.1	5.395**	80
Fats & oils	43.10±8.49	45.45±11.86	0.882^{NS}	33.30±8.66	36.40±3.33	1.830*	75

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

Table 4. Daily average nutrient intake of athletes (N=120)

Nutrients	Males			Females			RDA
	Control group (n=30)	Experimental group (n=30)	t-value	Control group (n=30)	Experimental group (n=30)	t-value	
Energy (Kcal)	2454.9±166.2	3554.7±297.4	17.68**	2011.4±228.5	2428.0±216.5	7.25**	4500
Protein (g)	56.51±9.18	85.12±5.28	14.79**	45.40±4.14	60.57±7.78	9.42**	160
Carbohydrate (g)	297±59.20	385.75±47.47	6.40**	256.73±32.45	296.72±23.83	5.40**	
Total Fat(g)	87.24±8.29	98.80±14.27	3.83**	84.71±8.57	90.21±8.34	2.51**	120
β –Carotene (µg)	1966.0±185.9	2520.8±203.4	11.02**	1629.3±233.9	1968.9±219.4	5.80**	4800
Vitamin A(µg)	412.12±111.9	570±156.1	4.50**	395.27±139.91	445±142.1	1.36*	600
Ascorbic Acid(mg)	65.96±10.42	80.77±6.37	6.64**	65.25±9.32	78.92±7.91	6.12**	40
Calcium (mg)	1520.3±170.2	1980.7±137.5	11.52**	1475.5±159.9	1826.6±182.3	7.93**	2000
Iron(mg)	27.02±1.98	31.48±3.30	6.34**	21.57±1.89	26.89±3.30	7.66**	60
Folic acid(µg)	188.31±52.53	204.89±61.96	1.11*	170.77±78.70	185.45±30.40	0.99*	200

*RDA by NIN (2007),*Significant at 5 per cent level,** Significant at 1 per cent level, NS-Non-significant*

A higher percent adequacy of vitamin A was observed among athletes of experimental group i.e. 95 percent males and 74 percent females than that of control group athletes i.e. 68.6 percent males and 65.8 percent females. The intake of folic acid was almost adequate as compared to the recommended values (200 µg) i.e. 102.4 and 92.7 per cent for male and female athletes of experimental group while 94.1 and 85.3 percent by male and female athletes of control group.

The average daily folic acid intake by athletes 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 highly adequate with significant difference between athletes of both groups i.e. 201.9 and 197.3 by male and female athletes of experimental group and among control group athletes around 164.9 by males and 163.1 by females.

3.4 Pre Workout Nutrition

Endurance athletes rarely compete in the fasted state, as this may compromise fuel stores. Thus, the timing and composition of the pre-exercise meal is a significant consideration for optimizing metabolism and subsequent endurance performance [10]. Table 5 depicts the distribution of athletes according to their pre workout nutrients. All the male and female athletes of experimental group had proper meals before exercise as compared to the athletes of control group i.e. 46.7 percent males and 26.7 percent females.

The majority of the athletes who took pre workout meals were dependent on the foods rich in carbohydrates, vitamins and minerals followed by the category of carbohydrates, proteins, vitamins and minerals. Majority of experimental group's athletes (76.7 percent males and 70 percent females) consumed pre- workout meal 30 minutes before exercise followed by control group female athletes (62.5%) and male athletes (35.7%).

3.5 Post Workout Nutrition

Table 6 depicts the distribution of athletes in accordance to consumption of post workout meal. The data revealed that all the athletes from experimental group were having their proper diets after exercise as compared to the athletes from control group and only 66.7 percent males and 40.0 percent females were taking the post workout meal. The majority of the athletes who were taking post workout meals were dependent on the foods rich in carbohydrates and proteins followed by the category of carbohydrates, proteins, vitamins and minerals. Furthermore, the distribution showed that the athletes were having post workout meals after 30 minutes were comparatively more from experimental group i.e. 70 percent males and 63.3 percent females as compared to the athletes of control group i.e. 40.0 percent of males and 41.7 percent of females.

The main aim of post workout meal is to restore the losses of nutrients and help in muscle recovery. This will acquire with the consumption of high grade proteins and carbohydrates as early as possible after exercise [11].

3.6 Eating Habits of Athletes during Team Trips

Eating habits of athletes during team trips are depicted in Table 7. First of all it was examined that whether athletes seek advice from dietitian during team trips or not. The data revealed that about 73.3 percent males and 76.7 percent females of experimental group and only 6.7 percent male athletes from control group seek dietitian's advice during team trips. Among those athletes 53.3 percent of males and 50.0 percent females of experimental group had dietician's recommended packed foods whereas nobody from control group consumed dietician's recommended packed foods. Majority of athletes from control group (60% males and 53.3% females) had fast foods during team trips but from experimental group only 26.7 percent male and 23.3 percent female athletes had fast foods. The athletes having access to sports dietician were more likely to consume dietician's recommended packed foods (21%) as compared to the other group with (7 %)which do not have sports dietician and the group without sports dietician consume more fast foods (19.57%) than the other group with sports dietician (9.90%) [12].

Distribution according to hydration habits during team trips showed that the majority of male athletes (60%) of experimental group were dependent on juices, 33.3 percent on energy drinks, 6.7 percent on carbonated beverages and no one preferred simple water. On the other

hand, the majority of male athletes from control group consumed carbonated beverages and simple water i.e. 33.3 percent and 26.7 percent were dependent on juices and only 6.7 percent on energy drinks. Majority of female athletes from experimental group (53.3%) were dependent on juices. Same percentage (16.7%) was found dependent on energy drinks and carbonated beverages and the rest 13.3 percent on simple water only whereas the majority of female athletes from control group were dependent (40.0%) on simple water only, 33.3 percent on juices and 26.7 percent on carbonated beverages and none of them were found to had energy drinks.

Table 5. Pre workout nutrition of the athletes (N=120)

Parameters	Response	Males		Females	
		Control group (n=30)	Experimental group (n=30)	Control group (n=30)	Experimental group (n=30)
Pre meal	Yes	14 (46.7)	30 (100.0)	8 (26.7)	30 (100.0)
	No	16 (53.3)	0 (00.0)	22 (73.3)	0 (00.0)
Carbohydrates	Yes	0 (00.0)	0 (00.0)	0 (00.0)	0 (00.0)
Carbohydrates +Protein	Yes	4 (28.6)	4 (13.3)	3 (37.5)	5 (16.7)
Carbohydrates +Vitamins& Mineral	Yes	7 (50.0)	21 (70.0)	3 (37.5)	19 (63.3)
Protein+Vitamins & Minerals	Yes	1 (7.1)	0 (00.0)	0 (00.0)	2 (6.7)
Carbohydrates + Proteins +Vitamin and Mineral	Yes	2 (14.3)	5 (16.7)	2 (25.0)	4 (13.3)
Time duration	Before 1 hour	5 (35.7)	0 (00.0)	3 (37.5)	0 (00.0)
	Before 30min	5 (35.7)	23 (76.7)	5 (62.5)	21 (70.0)
	Before 15 min	4 (28.6)	7 (23.3)	0 (00.0)	9 (30.0)

** Figures in parenthesis represent percentages*

Table 6. Post workout nutrition of the athletes (N=120)

Parameters	Response	Males		Females	
		Control group (n=30)	Experimental group (n=30)	Control group (n=30)	Experimental group (n=30)
Post meal	Yes	20 (66.7)	30 (100.0)	12(40.0)	30 (100.0)
	No	10(33.3)	0 (00.0)	18 (60.0)	0 (00.0)
Protein	Yes	0(00.0)	0(00.0)	0(00.0)	0(00.0)
Protein+Vitamins & Minerals	Yes	5(25.0)	2 (6.7)	1(8.3)	3(10.0)
Carbohydrates+ Vitamins & Minerals	Yes	0(00.0)	0(00.0)	4(33.3)	2(6.7)
Carbohydrates +Proteins	Yes	8(40.0)	19(63.3)	5(41.7)	18(60.0)
Carbohydrates + Proteins+ Vitamins & Minerals	Yes	7(35.0)	9(30.0)	2(16.7)	7(35.0)
Time duration	After 45 min	10(50.0)	5(16.7)	7(58.3)	6 (20.0)
	after 30 min	8(40.0)	21(70.0)	5(41.7)	19(63.3)
	After 15 min	2(10.0)	4(13.3)	0(00.0)	5(16.7)

**Figures in parenthesis represents percentages*

Table 7. Eating habits of athletes during team trips (N=120)

Parameters	Response	Males		Females	
		Control group (n=30)	Experimental group (n=30)	Control group (n=30)	Experimental group (n=30)
Advice during team trip	Yes	2(6.7)	22(73.3)	0(00.0)	23(76.7)
	No	28(93.3)	8(26.7)	30(100.0)	7(23.3)
Dietician's recommended packed foods	Yes	0(00.0)	16(53.3)	0(00.0)	15(50.0)
	No	2(6.7)	6(30.0)	0(00.0)	8(26.7)
Fast foods during team trips	Yes	18(60.0)	8(26.7)	16(53.3)	7(23.3)
	No	12(40.0)	22(73.3)	14(46.7)	23(76.7)
Hydration during team trips	Juices	8(26.7)	18(60.0)	10(33.3)	16(53.3)
	Carbonated beverages	10(33.3)	2(6.7)	8(26.7)	5(16.7)
	Energy drinks	2(6.7)	10(33.3)	0(0.00)	5(16.7)
	Only Simple water	10(33.33)	0(00.0)	12(40.0)	4(13.3)

** Figures in parenthesis represent percentages*

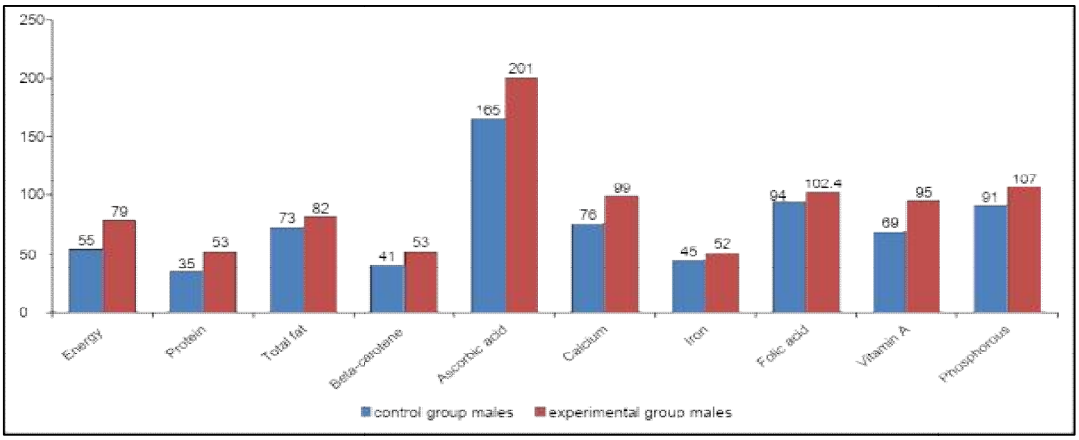

Fig. 4. Percent adequacy of nutrient intake of male athletes

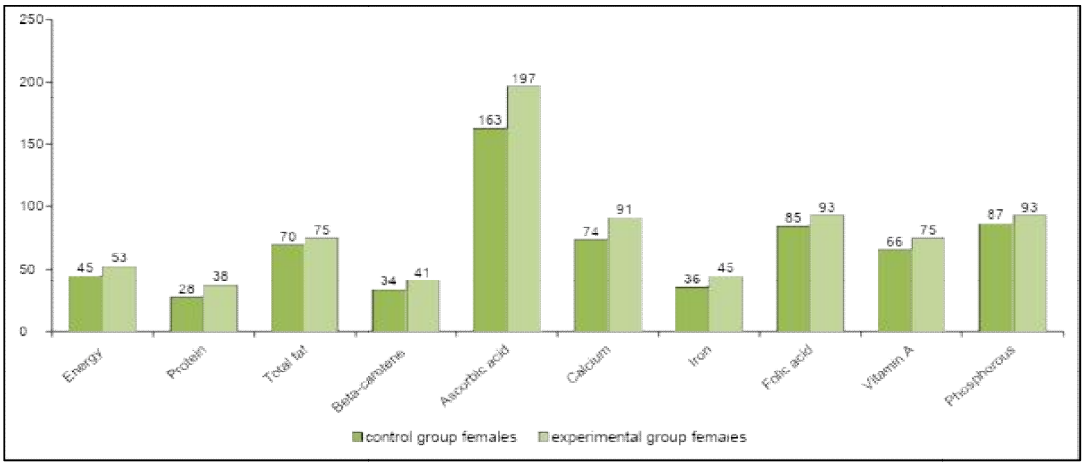

Fig. 5. Percent adequacy of nutrient intake of female athletes

3.7 Nutrient Periodization by Athletes

The data presented in the Table 8 reveals about the nutrition periodization which showed that the experimental group athletes (76.7% males and 73.3% females) and only 6.7 percent male athletes of control group seek advice of dietician during both (off and in) season. The control group athletes (50.0 percent males and 60.0 percent females) had same amount of calories during off and in season while none from experimental group had same amount of calories during off and in season. The athletes following dietician's advice knew that how to enhance their physical performance so they relied on high amount of carbohydrates prior to exercise. The amount of carbohydrates to be ingested was dependent on intensity of physical activities and the time duration of training i.e if the activity lasts for less than or equal to one hour small amount of carbohydrates even the mouth rinsing which increase activity through central nervous system effects, for exercises lasting for longer duration i.e one hour 30-60 g per hour and for the exercises that lasts more than equal to 2.5 hours get benefited by higher intake upto 90g per hour. Absorption of carbohydrates might increase with the consumption of products containing special blends of carbohydrates [13].

The athletes from experimental group (the group following dietician's advice) i.e. 73.3 percent of both categories used to do carbohydrate loading prior to competition but the athletes from control group (the group not following dietician's advice) only 6.7 percent males did carbohydrate loading prior to competition. Increased dietary carbohydrate intake can result in enhanced endurance exercise performance by increasing muscle glycogen stores [14]. Higher carbohydrates might increase physical performance and the ingestion of multiple transportable carbohydrates will allow very high carbohydrate oxidation rates and superior performance [15].

3.8 Breakfast Habits of Athletes

The breakfast habits of athletes are depicted in Table 9 which also showed the higher percentage of athletes from experimental group (83.3% males and 90.0% females) took breakfast before every competition than the athletes from control group (66.7% males and 73.3% females). Although 16.7 percent male and 10.0 percent female athletes from experimental group and 10.0 percent female athletes from control group skipped breakfast for one day in a week while 33.3 percent male and 16.7 percent female athletes from control group skipped breakfast for two days in a week. Around 85 percent sports person consumed breakfast. By skipping breakfast, adolescents have already started off poorly and are missing out on the essential nutrients [16]. The common reasons for skipping breakfast were no time to eat, not feeling hungry and disliking to have early breakfast. The decreased frequency of breakfast consumption among college players (81%) was also observed [17].

Additionally, the data also exposed the breakfast timings of athletes. Majority of athletes from experimental group had breakfast between 8 a.m. to 9 a.m. (86.7 percent males and 90.0 percent females) the rest (13.3% males and 10% females) had between 7a.m to 8a.m. The athletes from control group who followed the timings between 8 a.m. to 9 a.m. were 80 percent males and 70 percent females, further followed by 16.7 percent males and 30 percent females who had breakfast after 9 a.m. and the rest (3.3% males) followed the timing for breakfast before 8 a.m.

3.9 Fluid Consumption Pattern

Tables 10 and 11 shows the consumption frequency of different fluids by male and female athletes of both groups for the hydration. Water plays an important role in athlete's body because during exercise there is a lot of water loss due to sweating so preventing the significant hypo hydration water intake in proper amount is essential for better performance of athletes in competition [18]. The data revealed that out of all the different type of fluids, water was consumed by all subjects for recovery from dehydration. Majority of male and female athletes of control group (73.3 and 86.6%) never consumed sports drinks, whereas 43.3 percent male and 46.6 percent female athletes of experimental group weekly and fortnightly consumed sports drinks. Carbonated beverages contain carbonation in combination with added sugars, and real or artificial flavoring or syrups which have a negative effect entire body-affect athletic performance, impair metabolism, hurt kidneys and contribute to weight gain [19]. Further data revealed that among the control group athletes more than one-third (26.6%) of the males never consumed carbonated drinks whereas same percentage of female athletes fortnightly had carbonated drinks. Same percentage (20%) of male athletes from both groups consumed

carbonated drinks fortnightly and monthly. From control group, male (26.6%) and female (40%) athletes consumed hot coffee on daily basis and fortnightly. Majority (40%) of experimental group male athletes consumed hot coffee on the daily basis whereas 26.6 percent female athletes weekly consumed hot coffee. The role of coffee and caffeine consumption among athletes which showed that both consumption of caffeine and coffee one hour prior to the exercise improved the endurance exercise performances [20].

The data presented in the tables revealed that the experimental group athletes consumed more fruit juices according to their diet recommended by dietician and they had knowledge about nutrition. Tea was found to be favorite type of beverage among subjects. Around 50 percent of males and 73.3 per cent of females from control group and 56.7 percent males and 66.7 percent of females from experimental group had tea consumption on daily basis. On the other hand, majority of control group's male (40%) and female (43.3%) athletes never consumed green tea. Majority of experimental group's male (40%) and female (43.3%) athletes consumed lemon water on daily basis. Among control group athletes half of male and more than half of female (56.6%) monthly and never consumed glucose based drinks. On the other hand, majority of athletes (46.6 and 73%) consumed glucose based drinks on the daily basis which helps in enhancing the performance during competition. The consumption of healthy drinks like sports drink, fruit juices, green tea, lemon water and glucose based water was more frequent among male and female athletes of experimental group than control group. Mean intake of fluids was also significantly ($p \leq 0.01$) higher among athletes who were taking guidance from sports dietician for hydration also. The fluid lost during competition or physical exercise which leads to dehydration in athletes so, for rehydration lemon tea or water in proper amount was considered as very effective fluids [21]. There is a connection between green tea and recovery factors after exercise. During post-exercise recovery period the salivary antibacterial capacity was significantly enhanced by ingestion of green tea which showed beneficial effects on athlete's performance during competition [22].

Table 8. Nutrient periodization by athletes (N=120)

Parameters	Response	Males		Females	
		Control group (n=30)	Experimental group (n=30)	Control group (n=30)	Experimental group (n=30)
Dietitian advice during off and in season	Yes	2(6.7)	23(76.7)	0(00.0)	22(73.3)
	No	28(93.3)	7(23.3)	30(100.0)	8(26.7)
Take same calories during off and in season	Yes	15(50.0)	0(00.0)	18(60.0)	0(00.0)
	No	15(50.0)	30(100.0)	12(40.0)	30(100.0)
Carbohydrate loading prior to competition	Yes	2(6.7)	22(73.3)	0(00.0)	22(73.3)
	No	28(93.3)	8(26.7)	30(100.0)	8(26.7)

** Figures in parenthesis represent percentages*

Table 9. Breakfast habits of athletes (N=120)

Parameters	Response	Males		Females	
		Control group (n=30)	Experimental group (n=30)	Control group (n=30)	Experimental group (n=30)
Take breakfast before every competition	Yes	20(66.7)	25(83.3)	22(73.3)	27(90.0)
	No	10(33.3)	5(16.7)	8(26.7)	3(10.0)
Breakfast was skipped (no. of days)	No day	20(66.7)	25(83.3)	22(73.3)	27(90.0)
	1 day in week	0(00.0)	5(16.7)	3(10.0)	3(10.0)
	2 day in week	10(33.3)	0(00.0)	5(16.7)	0(00.0)
Time of breakfast	7:00-8:00am	1(3.3)	4(13.3)	0(00.0)	3(10.0)
	8:00-9:00am	24(80.0)	26(86.7)	21(70.0)	27(90.0)
	9:00-10:00am	5(16.7)	0(00.0)	9(30.0)	0(00.0)

** Figures in parenthesis represent percentages*

Table 10. Percent frequency of various types of fluids by male athletes (N=60)

Type of liquids	Males									
	Control group (n=30)					Experimental group (n=30)				
	Daily	Weekly	Fortnightly	Monthly	Never	Daily	Weekly	Fortnightly	Monthly	Never
Water	30(100)	0(0.0)	0 (0.00)	0(0.0)	0(0.00)	30(100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Sports drink	0 (0.00)	1 (3.33)	0 (0.00)	7(23.3)	22(73.3)	7(23.3)	13(43.3)	10 (33.3)	0 (0.0)	0 (0.0)
Carbonated drink	6 (20)	6 (20)	4 (13.3)	6 (20)	8(26.7)	0 (0.0)	4 (13.3)	6 (20)	6 (20)	14(16.7)
Hot coffee	8(26.7)	13(43.3)	5 (16.7)	4(13.3)	0(0.0)	12(40)	8 (26.7)	6 (20)	4(13.3)	0 (0.0)
Cold coffee	5(16.7)	15(50)	3 (10)	5(16.7)	2(6.7)	6 (20)	13(43.3)	7 (23.33)	4(13.33)	0 (0.00)
Preserved fruit juice	6 (20)	13(43.3)	4 (13.3)	7(23.3)	0(0.0)	5(16.7)	12 (40)	11 (36.7)	2 (6.7)	0 (0.0)
Fresh fruit juice	11(36.6)	12 (40)	4 (13.3)	3 (10)	0(0.0)	18(60)	6 (20)	6 (20)	0 (0.0)	0 (0.0)
Tea	15(50)	7 (23.3)	8 (26.7)	0 (0.0)	0(0.0)	17(56.6)	5 (16.7)	8 (26.7)	0 (0.0)	0 (0.0)
Green tea	2 (6.7)	4 (13.3)	4 (13.3)	8(26.7)	12(40)	9 (30)	8 (26.7)	10 (33.3)	3 (10)	0 (0.0)
Lemon water	6 (20)	6 (20)	8(26.7)	8(26.7)	2(6.7)	12 (40)	8 (26.7)	10 (33.3)	0 (0.0)	0 (0.0)
Glucose based drink	2 (6.7)	2 (6.67)	6 (20)	15 (50)	5(16.7)	14(46.6)	12 (40)	4 (13.3)	0 (0.00)	0 (0.0)

** Figures in parenthesis represent percentages*

Table 11. Percent frequency of various type of fluids by female athletes (N=60)

Type of liquids	Females									
	Control group (n=30)					Experimental group (n=30)				
	Daily	Weekly	Fortnightly	Monthly	Never	Daily	Weekly	Fortnightly	Monthly	Never
Water	30(100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	30(100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Sports drink	0 (0.0)	1(3.3)	0 (0.00)	3 (10)	26(86.7)	0 (0.0)	11 (36.7)	14 (46.7)	5 (16.7)	0 (0.0)
Carbonated drink	4(13.3)	5(16.7)	8 (26.7)	6 (20)	7(23.3)	0 (0.0)	0 (0.0)	4 (13.3)	8 (26.7)	18(60)
Hot coffee	5(16.7)	6 (20)	12 (40)	7 (23.3)	0 (0.0)	6 (20)	8(26.7)	9 (30)	5 (16.7)	2 (6.7)
Cold coffee	4(13.3)	8(26.7)	10 (33.3)	8 (26.7)	0 (0.0)	5(16.7)	11(36.7)	8 (26.7)	6 (20)	0 (0.0)
Preserved fruit juice	6 (20)	15 (50)	9 (30)	0 (0.0)	0 (0.0)	4 (13.3)	16 (53.3)	10 (33.3)	0 (0.0)	0 (0.0)
Fresh fruit juice	2 (6.7)	9 (30)	15 (50)	4 (13.3)	0 (0.0)	16(53.3)	11(36.7)	3 (10)	0 (0.00)	0 (0.0)
Tea	22(73.3)	4(13.3)	0 (0.00)	0 (0.00)	4(13.3)	20(66.7)	2 (6.7)	2 (6.7)	0 (0.0)	6 (20)
Green tea	3 (10)	0 (0.0)	4 (13.3)	10(33.3)	13(43.3)	7(23.3)	10(33.3)	4 (13.3)	5 (16.7)	4(13.3)
Lemon water	6 (20)	5(16.7)	12 (40)	7 (23.3)	0 (0.0)	13(43.3)	10(33.3)	7 (23.3)	0 (0.0)	0 (0.0)
Glucose based drink	0 (0.0)	0 (0.0)	3 (10)	10(33.3)	17(56.7)	22(73.3)	8(26.7)	0 (0.0)	0 (0.0)	0 (0.0)

** Figures in parenthesis represent percentages*

4. CONCLUSION

From the study, it can be concluded that the percent adequacy ratio of food and nutrient intake was higher among athletes of experimental group. They follow better hydration guidelines as compare to the athletes of control group. Therefore, it can be recommended that athletes should follow the dietary guidelines recommended by dieticians for better results in competitions and for sound health.

CONSENT

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

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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