Micronutrient Status of Male & Female Players Engaged in Different Sports Disciplines

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Abstract

The present study was undertaken to assess micronutrient status of female & male players engaged in different sports disciplines. For this purpose, university & / state level players aged 19 – 22 years were selected. Total 13 females & 46 males were chosen. 24 hour's dietary recall method was used to collect information on food habits, meal timings & dietary pattern of subjects. Biochemical parameters such as hemoglobin %, blood pressure & pulse rate were examined. The results revealed that irrespective of sex & sports, mean intakes of thiamine, riboflavin, folic acid, calcium & phosphorus were found to be less than their respective recommended dietary allowances (RDAS). In contrast, mean daily intakes of carotene & vitamin c among players were found to be significantly exceeding the rdas ($p<0.01$). Players met only 50 % of their requirements for iron. Poor micro nutrient intake could possibly be attributed to the skipping of meals & training & college schedule of players. Mean hemoglobin % of majority groups of players were found to be exceeding the cut off level given by world health organization (who). Systolic blood pressure & diastolic blood pressure values were recorded to be closer to the normal values. Majority of groups of players showed mean pulse rate insignificantly above the normal value of 70 beats / minute ($p>0.05$).

Key words: Micronutrient Status, Thiamine, Riboflavin, Calcium, Phosphorus, Iron, Carotene, Vitamin C, RDA, WHO

Introduction

Nutrition not only plays a role in performance, but it also helps to prevent injuries, enhance recovery from exercise, help maintain body weight, & improve overall health. It is important for all sports persons to have a good working knowledge, understanding of exercise science & sports nutrition so that these can help in their own performance potential *(Bakulin & Efimo, 1996)*.

The B vitamins are of special interest to athletes and exercisers because they govern the energy producing reactions of metabolism. Need for these vitamins increase proportionally with energy expenditure. To meet growth needs, athletes require higher intakes of some vitamins than those for non athletes. The need for riboflavin is higher because of increased energy intake, but intake is frequently low in teens, especially in girls. Folate and vitamin B_{12} needs are increased because of the high rates of growth. Vitamin B_6 is essential for the protein synthesis that occurs during rapid growth. *(Smolin and Grosvenor, 1997, Houtkooper et al., 1998).*

According to *Manore (2002),* the athletes most likely to have insufficient vitamin intake are those with low calorie intakes or whose diets consist of highly processed convenience foods that are high in fat and /or sugar. Inadequate vitamin consumption will lead to suboptimal health and, ultimately, poor athletic performance. If athletes are limiting food intake to maintain a lean build or a low body weight, they should supplement their diets with vitamins and minerals. The specific supplements will depend on their total energy intakes, the foods they typically eat, and their sports. If diet is the problem, then the solution should also be from the diet. There are many ways to achieve a balanced intake of vitamins, minerals, and energy substrates.

The needs for calcium, iron, and zinc increase substantially during the adolescent growth spurt. All three of these minerals are frequently deficient in the adolescent athlete's diet. The need for micro minerals should not be ignored *(Boyle, 2000).*

Rowland (2001) points out that calcium and iron are the two minerals that are worth watching in the athlete's diet. Generous intakes of calcium along with physical activity during growth are thought to contribute to maximizing peak bone mass. Achieving optimal bone mineralization may reduce athletes' risk of stress fractures during their athletic careers and help minimize the adverse consequences of bone loss later in life. Poor iron status among female athletes is a consequence of menstrual losses in girls and inadequate dietary intake.

To meet growth needs, athletes require higher intakes of some vitamins & minerals than those for non athletes. The B vitamins are of special interest to athletes and exercisers because they govern the energy producing reactions of metabolism. Need for these vitamins increase proportionally with energy expenditure. It has usually been assumed that if athlete meets requirements for increased energy, the vitamin & mineral requirements will also be satisfied. Vitamins play a very important role in nutrition for sportspersons. Vitamin deficiency leads to specific violation of metabolism and to diseases. Majority of hypovitaminosis causes lowering of work ability. Deficiency leads to lowering of training efficiency, and may cause training staleness. Minerals such as sodium, potassium, calcium, phosphorus & iron play an important role in achieving the winning edge for athletes *(Smolin and Grosvenor, 1997, Boyle, 2000).*

Present study was undertaken to assess the micronutrient & biochemical status of male & female players engaged in different sports disciplines.

Material and Methods

Table 1: Data on Meritorious Achievements of Female & Male Players classified Game-Wise

Sports Disciplines	**University Level**		**State Level**		**National Level**	
	N	**%**	**N**	**%**	**N**	**%**
FEMALES [N = 13]						
Half Marathon (n=3)	**3**	**100.00**	**3**	**100.00**	**0**	**0**
Hurdle Racing (n=2)	**2**	**100.00**	**2**	**100.00**	**0**	**0**
Athletics (n=4)	**3**	**75.00**	**3**	**75.00**	**0**	**0**
Badminton (n=4)	**2**	**50.00**	**2**	**50.00**	**0**	**0**
MALES [N = 46]						
Athletics (n=7)	**4**	**57.14**	**4**	**57.14**	**1**	**14.3**
Badminton (n=4)	**3**	**75.00**	**3**	**75.00**	**1**	**25**
Cricket (n=6)	**5**	**83.33**	**5**	**83.33**	**0**	**0**
Judo (n=5)	**4**	**80.00**	**4**	**80.00**	**0**	**0**
Judo & Gymnastics (n=6)	**4**	**66.66**	**4**	**66.66**	**0**	**0**
Volleyball (n=14)	**11**	**78.57**	**11**	**78.57**	**0**	**0**
Weight Lifting (n=4)	**2**	**50.00**	**2**	**50.00**	**0**	**0**

For the present study, both males & female players engaged in regular practice & participated in professional sport tournaments were taken as a sample. The athletes were young players from different sports disciplines such as athletics, volleyball, cricket, judo, gymnastics, weight lifting, hurdle racing, half marathon, badminton, cross country etc. The subjects aged between 18-22 years were taken from a well known Physical Education Institution of Vidarbha, Maharashtra.. Players who were participating in regular practice schedules & in many sports events from the past few years [players were in the field from last 3 – 7 years] were mainly of choice, data of which is shown in Table 1.

Major areas of the study protocol were as follows: -

- General Information
- Data on Sports
- Dietary Information
- Recording body weight & height of players
- Energy Expenditure (through Daily Activity Schedule)
- Statistical Analysis

A total of 13 females & 46 males from various sports disciplines were chosen & surveyed. Game wise classification of subjects is shown in Table 2.

Table 2: Game-Wise Classification of Subjects

Sr. No.	Sports Disciplines	No. of Subjects	Age (yrs) Mean ± SD
FEMALES [N = 13]			
1	Half Marathon	3	19.89 ± 0.95
2	Hurdle Racing	2	20.13 ± 1.62
3	Athletics	4	19.27 ± 1.00
4	Badminton	4	20.45 ± 1.00
MALES [N = 46]			
1	Athletics	7	20.52 ±1.30
2	Badminton	4	21.87 ±0.50
3	Cricket	6	20.98 ±1.40
4	Judo	5	21.02 ±1.70
5	Judo / Gymnastics	6	21.00 ±1.20
6	Volleyball	14	20.39 ±1.50
7	Weight Lifting	4	21.08 ±0.50

For collecting information, an interview schedule was designed to elicit information from all players on their socioeconomic background, sport profile (information regarding time & duration of subject's engagement in the chosen sport/s, their daily routine, hours of practicing a game, their meritorious achievements etc.), dietary profile, anthropometric measurements such as body weight & height & energy expenditure pattern.

Players were nutritionally assessed as follows -

Precise information on food consumption pattern of subjects was gathered through three day dietary recall method. The intake of macro nutrients viz., carbohydrate, protein & fat was computed using the values given in the Nutritive Value of the Indian Foods *(Gopalan et. al., 2004).* Energy intake was computed for all players. Means were derived & nutrient intakes were compared with their respective RDAs *(Satyanarayana, 1991).*

Biochemical Data:

Under this section, hemoglobin level was estimated. Pulse rate & blood pressure were recorded. For this purpose, subjects were asked to come in decided time schedule to the pathology laboratory. The hemoglobin level was estimated by a trained pathologist using Sahli's Haemometer. Sphygmomanometer was used to measure the blood pressure of subjects. Pulse rate, which is simply the number of times the heart contracts each minutes was measured accordingly. Three readings were taken, of which average was considered a standard.

Data was collected, tabulated & grouped. Means & standard deviation values were calculated. Minimum, maximum, range values & percentages were taken out. Comparisons were made with the available standards. Student's't' test was applied to see the differences. The difference was tested at both 1% (0.01) & 5% (0.05) levels of significance.

Results and Discussion

FIGURE 1 . DATA ON APPROXIMATE MONTHLY MEAN TOTAL INCOME & RANGE FOR FEMALE PLAYERS

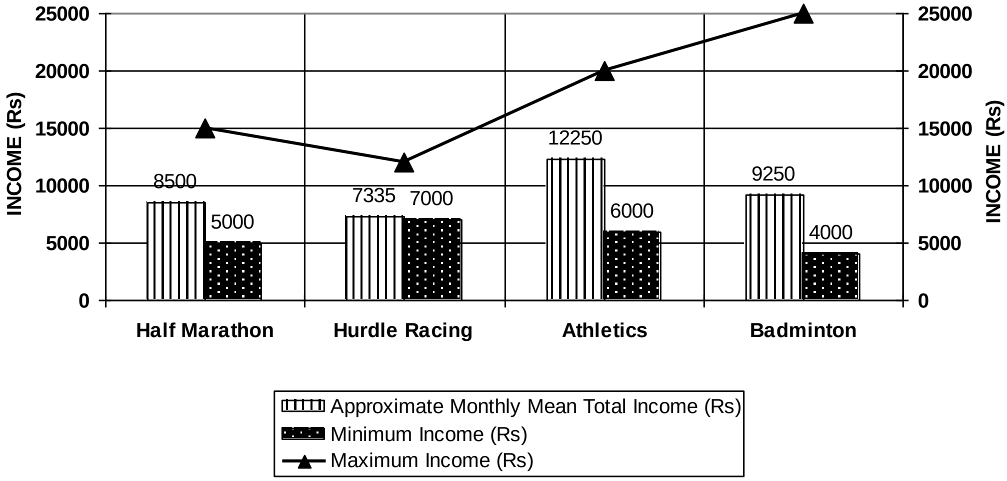
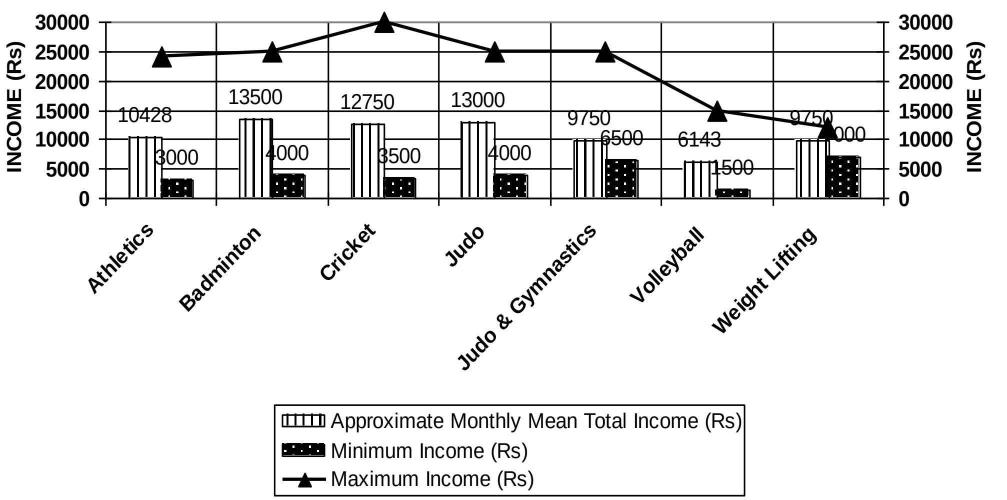
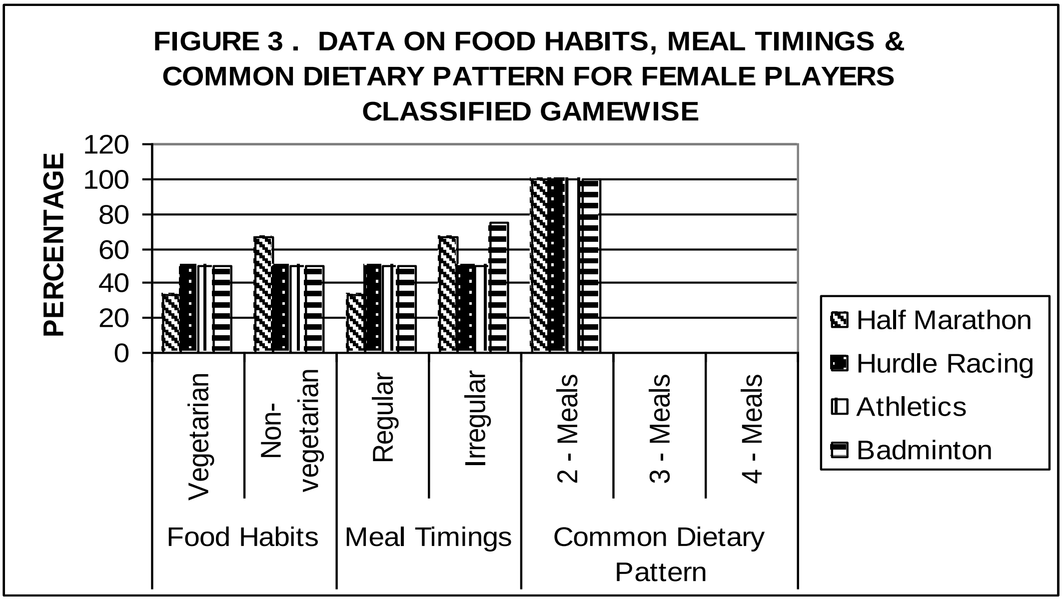


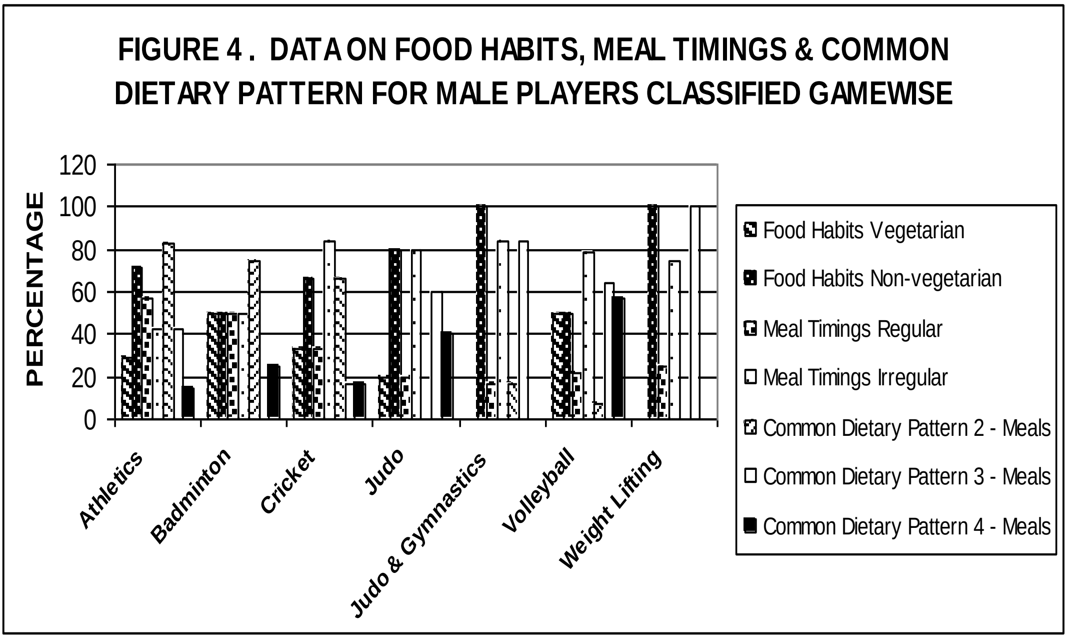
FIGURE 2 . DATA ON APPROXIMATE MONTHLY MEAN TOTAL INCOME & RANGE FOR MALE PLAYERS



Figures 1 & 2 present data on approximately mean monthly family income for female & male players' classified game wise. Variability in range values can be seen for monthly family income for players. For females a minimum of Rs.4000 /- & a maximum of Rs. 25000 /- monthly income was found out. For male players, minimum monthly income was recorded as Rs. 1500 /- & that of maximum as Rs. 30000 /-.

Food Intake:





Figures 3 & 4 show data on food habits, meal timings & common dietary pattern for subjects. Among female players, majority of players were found to be vegetarian, % of non vegetarian was more for half marathon group. The intake of meat, chicken & egg was found to be occasional – either fortnightly or monthly.

Majority of female players were consuming meals irregularly, all of them were found to be following a dietary pattern of two meals.

In contrast, majority of male players were found to be non vegetarians, with three & / four meals dietary pattern. They were accustomed to skipping meals. This could be attributed to the college timings & practice schedules. It is speculated that because of training & work schedules, athletes seldom eat three balanced meals, but they rely heavily on snacking to maintain their energy levels, & these snacks may be less nutrient dense than the meals they replace. The poor nutritional status of some athletes may be due to their training & work schedules. Some athletes have low energy intakes because of concerns about body weight & appearance, which makes the likelihood of them having inadequate intakes of vitamins & minerals even greater ***(Bishop, 1989)***.

Micro Nutrient Intake:

Nutrient intake of elite athletes is a critical determinant of their performance & ability to compete *(Kelkar et al. 2006).* Tables 3 & 5 show mean daily intakes of vitamins for female & male players respectively. Tables 5 & 6 show mean daily intakes of minerals for female & male players respectively.

Table 3. Mean Daily Intake of Vitamins for Female Players Classified Game-Wise

Sports Disciplines	Thiamine (mg)		Riboflavin (mg)		Folic Acid (µg)		Carotene (µg)		Vitamin C (mg)	
	M ± SD	RDA	M ± SD	RDA	M ± SD	RDA	M ± SD	RDA	M ± SD	RDA
Half Marathon (n=3)	1.3±0.2 (0.9–1.5)	3.18	1.2 ± 0.3 (0.9 – 1.5)	3.18	196.8 ± 53.4 (129.5 – 260.2)	300	6859.0 ± 523.4 (6216 - 7498)	3262	164.0 ± 27.09 (126.0 – 187.5)	102
Hurdle Racing (n=2)	1.9 ± 0.03 (0.6 – 12.2)	3.68	0.9 ± 0.1 (0.8 – 1.0)	3.68	242.8 ± 4.2 (238.7 – 246.9)	300	6114.0 ± 504 (5610 - 6618)	3385	166.4 ± 48.04 (118.4 – 214.5)	106
Athletics (n=4)	1.8 ± 0.2 (0.4 – 8.7)	2.08	0.9 ± 0.08 (0.8 – 1.0)	2.08	214.0 ± 56.5 (128.4 – 284.7)	300	5462.5 ±710.1 (4432 - 5482)	2545	144.7 ± 24.9 (103.6 – 168.5)	80
Badminton (n=4)	2.0 ± 0.4 (0.4 – 10.8)	3.03	1.4 ± 0.5 (1.0 – 1.9)	3.03	218.0 ± 34.5 (146.5 – 260.5)	300	5590.3 ± 934.9 (4224 - 6865)	3059	129.6 ± 24.0 (103.7 – 168.5)	95

RDA's referred from **Satyanarayana (1991),** Figures in parenthesis indicate range.

Table 4: Average daily excess/deficit intake of vitamins in females classified gamewise

Sports Disciplines	Thiamine (mg)	Riboflavin (mg)	Folic Acid (µg)	Carotene (µg)	Vitamin C (mg)
	% Excess or Deficit	% Excess or Deficit	% Excess or Deficit	% Excess or Deficit	% Excess or Deficit
Half Marathon (n=3)	-37.74	-59.11	-34.4	110.26	60.78
Hurdle Racing (n=2)	-75.54	-48.36	-19.06	80.62	56.98
Athletics (n=4)	-56.74	-13.46	-28.66	114.63	80.87
Badminton (n=4)	-53.79	-33.99	-27.33	82.74	36.42

Vitamin Intake:

Table 3 depicts mean daily intake of vitamins for female players. Irrespective of sports disciplines, mean intakes of thiamine, riboflavin & folic acid among females were found to be less than their respective recommended dietary allowances (RDAs). When student's't' test was applied to draw the significance of difference, it was found that the differences were significant at

0.01 level for folic acid (t=11.19, p<0.01); insignificant for thiamine (t=1.55, p>0.05) & significant at 0.05 but insignificant at 0.01 level for riboflavin (t=3.26, 0.01<p<0.05). Percent deficit was found to be highest for thiamine in half marathon (-59.11%), for riboflavin in hurdle racing (- 75.54 %) & for folic acid in athletics (- 28.66 %).

Table 5:. Mean Daily Intake of Vitamins for Male Players Classified Game-Wise

Sports Disciplines	Thiamine (mg)		Riboflavin (mg)		Folic Acid (µg)		Carotene (µg)		Vitamin C (mg)	
	M ± SD	RDA	M ± SD	RDA	M ± SD	RDA	M ± SD	RDA	M ± SD	RDA
Athletics (n=7)	2.6 ± 0.5 (2.02 – 3.2)	3.87	2.3 ± 0.9 (0.9 – 3.7)	3.87	226.5 ± 66.4 (125.0 – 346.3)	300	6751.6 ± 1087.9 (5426 - 8421)	3403	195.5 ± 44.3 (143.5 – 262.3)	106
Badminton (n=4)	2.5 ± 0.3 (2.09 – 2.8)	3.87	1.7 ± 0.6 (1.0 – 2.7)	3.87	258.4 ± 63.6 (187.9 – 354.7)	300	6613.5 ± 1064.8 (5578 - 8362)	3403	183.2 ± 55.4 (123.4 – 273.6)	106
Cricket (n=6)	2.2 ± 0.1 (2.0 – 2.3)	-	2.4 ± 0.4 (1.9 – 2.7)	-	228.2 ± 57.9 (152.6 – 314.3)	-	7154.2 ± 1387.6 (4782 - 8436)	-	180.6 ± 39.2 (137.5 – 255.0)	-
Judo (n=5)	2.2 ± 0.2 (2.03 – 2.4)	3.16	1.5 ± 0.7 (0.9 – 2.6)	3.16	223.6 ± 36.3 (158.4 – 269.5)	300	6719.4 ± 1370.7 (4782 - 8761)	3237	166.7 ± 20.9 (137.5 – 196.8)	101
Judo & Gymnastics (n=6)	2.4 ± 0.4 (1.9 – 2.9)	3.68	2.0 ± 4.0 (1.8 – 2.5)	3.68	253.9 ± 44.6 (194.8 – 325.4)	300	6530.9 ± 826.4 (5426 - 7384)	3237	204.6 ± 53.7 (148.4 – 293.0)	101
Volleyball (n=14)	2.06 ± 0.3 (1.9 – 2.7)	4.06	1.8 ± 0.6 (1.0 – 2.6)	4.06	201.9 ± 58.5 (125.5 – 345.7)	300	6885.5 ± 1246.8 (4782 - 8761)	3570	164.9 ± 38.3 (123.4 – 264.5)	112
Weight Lifting (n=4)	2.5 ± 0.3 (2.2 – 2.8)	4.06	2.6 ± 0.2 (2.5 – 2.8)	4.06	222.7 ± 35.5 (163.8 – 253.2)	300	7088.0 ± 886.9 (5832 - 8261)	3570	186.05 ± 4.6 (127.7 – 275.7)	112

Table 6. Mean Daily Intake (excess or deficit) of Vitamins for Male Players Classified Game-Wise

Sports Disciplines	Thiamine (mg)	Riboflavin (mg)	Folic Acid (µg)	Carotene (µg)	Vitamin C (mg)
	% Excess or Deficit	% Excess or Deficit	% Excess or Deficit	% Excess or Deficit	% Excess or Deficit
Athletics (n=7)	-32.81	-40.56	-24.4	98.41	84.44
Badminton (n=4)	-35.4	-56.07	-13.86	94.35	72.84
Judo (n=5)	-30.37	-52.53	-25.46	107.59	65.05
Judo & Gymnastics (n=6)	-34.78	-45.65	-15.36	101.76	102.57
Volleyball (n=14)	-49.26	-55.66	-32.7	92.88	47.24
Weight Lifting (n=4)	-38.42	-35.96	-25.76	98.55	66.12

Similar results were obtained for male players engaged in different sports disciplines (Table 5). Intakes of folic acid were found to be significantly less than the respective RDAs (t = 14.43, p<0.01). Insignificant differences were noticed between intakes & RDAs for thiamine & riboflavin (t = 0.57 & 0.48 respectively, p>0.05). Male athletics players showed highest mean intake of thiamine (2.6 ± 0.5 mg), that of weight lifters for riboflavin (2.6 ± 0.2 mg) & that of badminton group for folic acid (258.4 ± 63.6 µg). Percent deficit was found to be highest in volleyballers for thiamine & folic acid (- 49.26 & - 32.7 % respectively) & in badminton players for riboflavin (- 56.07 %). *Manore (2000)* studied the effect of physical activity on thiamine, riboflavin & vitamin B-6 requirements. Because exercise stresses metabolic pathways that depend on thiamine, riboflavin, & vitamin B-6 the requirements for these vitamins may be increased in athletes & active individuals. Active individuals who restrict their energy intake or make poor dietary choices are at greatest risk for poor thiamine, riboflavin, & vitamin B_6 status.

The antioxidant vitamins – such as vitamin A, C & beta-carotene– play an important role in protecting the cell membrane from oxidative damage. Exercise can increase the oxidative processes in the muscle, leading to increased generation of lipid peroxides & free radicals *(Keith, 1994)*. In the present study, irrespective of sex & sport, mean daily intakes of carotene & vitamin C were found to be highly exceeding their respective RDAs. Differences were highly significant at 0.01 level for both these vitamins (t = 8.19 & 6.89 for carotene & vitamin C respectively, $p<0.01$). Intakes were found to be almost double the requirements which could be attributed to inclusion of higher amount of seasonal fruits & vegetables rich in carotene & vitamin C. Among female players, mean intakes of carotene & vitamin C were recorded to be highest in half marathon & hurdle racing respectively (6859 ± 523.4 µg & 166.4 ± 48.04 mg respectively). Among male players, cricket & weight lifting groups showed extremely high intakes of carotene (7154.2 & 7088 µg respectively). Differences were found to be highly significant at 0.01 level (t = 5.26, $p<0.01$). Judo & gymnastics group showed 102 % excess mean intake of vitamin C (204.6 mg) followed by athletics with 84.44 % excess intake of vitamin C (195.5 mg). It is evident from Tables 3 & 5 that for all groups of female & male players, minimum values of carotene & vitamin C intakes were also exceeding the RDAs. The effect of vitamin C supplementation on performance has received considerable attention, mainly because athletes consume Vitamin C in large quantities, often because of the volume of food they consume. In studies where athletes were deficient in vitamin C, supplementation improved physical performance, but a thorough analysis of these studies supports the general conclusion that vitamin supplementation does not increase physical performance capacity in subjects with normal body levels of vitamin C *(Keith, 1994)*. On the other hand, because exercise is a stressor to the body, some nutritionists recommended that the active individual may need slightly more vitamin C than the RDA.

Mineral Intake:

Tables 7 & 9 demonstrate mean daily intakes of minerals for female & male players respectively. Mean iron intakes for both female & male players engaged in different sports disciplines were found to be significantly less than their respective standards (t = 7.44, $p<0.01$ for females & t = 4.4, $0.01<p<0.05$ for males). Players met nearly 50 % of their requirements for iron. Among female players, mean iron intake was found to range between 25.4 to 32.8 mg (the minimum value is for athletics & the maximum value is for hurdle racing). Among male players, highest mean intake of iron was recorded by judo & gymnastics (37.04 mg) & that of lowest both by athletics & volleyball groups (28.8 mg). A combination of factors increases athlete's chances of depleting his or her iron stores. Inadequate dietary intakes of iron-rich foods combined with iron losses aggravated by physical activity compromise iron status. Physical activity may cause increased iron losses in sweat, feces and urine, plus increased destruction of red blood cells that occurs during exercise *(Boyle, 2000).* Typical endurance athlete's diet contains about 6 mg iron per 1,000 calories. And recent studies of iron deficient female athletes reported iron intakes of only 13.6 mg / day. *(Clement & Asmundson, 1982).*

Table 7: Mean Daily Intake of Minerals for Female Players Classified Game-Wise

Sports Disciplines	Iron (mg)		Calcium (mg)		Phosphorous (mg)		Potassium (mg)	Sodium
	M ± SD	RDA	M ± SD	RDA	M ± SD	RDA	M ± SD	M ± SD
Half Marathon (n=3)	27.07 ± 2.05 (24.2 - 28.6)	61	1004 ± 191.2 (832.4 – 1270.7)	2038	1783.9 ± 164.8 (1580.6 – 1984.4)	2038	2633 ± 85.0 (2529.0 – 2738.0)	2027.7 ± 58.4 (1985.5 – 2110.2)
Hurdle Racing (n=2)	32.3 ± 6.7 (26.2 - 38.5)	63	749 ±61.6 (687.4 – 810.6)	2115	1873 ± 35.0 (1838.0 – 1908.0)	2115	2687.5 ± 138.5 (2549.0 – 2826.0)	1777.3 ± 95.0 (1682.2 – 1872.6)
Athletics (n=4)	25.4± 0.1 (24.4 - 26.5)	48	854.5 ± 279.9 (608.8 – 130.8)	1590	1852.5 ± 231.6 (1510.7 – 2164.0)	1590	2643 ± 117.7 2548.0 – 2842.0()	1945.6 ± 138.3 (1775.2 – 2154.3)

Table 8: Mean Daily Intake (excess or deficit) of Vitamins for female Players Classified Game-Wise

Sports Disciplines	Iron (mg)	Calcium (mg)	Phosphorous (mg)
	% Excess or Deficit	% Excess or Deficit	% Excess or Deficit
Half Marathon (n=3)	-55.62	-50.73	-33.72
Hurdle Racing (n=2)	-48.73	-64.58	-44.53
Athletics (n=4)	-47.08	-46.25	-38.51
Badminton (n=4)	-42.45	-52.89	-37.24

Intakes of both calcium & phosphorus in female & male players were observed to be less than their respective RDAs ($t = 4.4$, $0.01<p<0.05$ & $t = 7.63$, $p<0.01$ for females; $t = 3.05$, $p>0.05$ & $t = 2.25$, $p>0.05$, respectively). Players were able to meet only 50 % of their requirements of calcium. % deficit was found to range between – 46.25 to – 64.58 % for females & - 35.47 to – 63.78 % for males. Highest mean calcium intake was recorded for half marathon among females (1004 ± 192.2 mg) & judo among males (1305.4 ± 333.5 mg) whereas the lowest mean intake of calcium was recorded for hurdle racing among females (749 ± 61.6 mg) & badminton among males (804 ± 107.2 mg).

Mean phosphorus intake among female players ranged between 1749.8 to 1873 mg while that in male players it was found to range between 1761.8 to 1849 mg.

Calcium/phosphorus ratio was derived & a range of 0.4 to 0.6 among females & 0.44 to 0.74 among males was noticed.

Mean daily total sodium & potassium intakes among females & males were found to be in the range of 2633 to 2687.5 mg & 1777.3 to 2166.1 mg and 2543.5 to 2713 mg & 1921 to 2166.5 mg respectively **(Table 7 & 9).** Total sodium indicates sodium from food stuffs & sodium from salt.

Table 9: Mean Daily Intake of Minerals for Male Players Classified Game-Wise

Sports Disciplines	Thiamine (mg)		Riboflavin (mg)		Folic Acid (µg)		Carotene (µg)	Vitamin C (mg)
	M ± SD	RDA	M ± SD	RDA	M ± SD	RDA	M ± SD	M ± SD
Athletics (n=7)	28.8 ± 4.0 (22.0 – 35.8)	64	869.3 ± 193.05 (654.0 – 1236.0)	2127	1820 ± 213.3 (1583.0 – 2183.0)	2127	2574.7 ± 98.8 (2442.0 – 2738.0)	1921± 195.9 (1682.0 – 2262.0)
Badminton (n=4)	32.2 ± 5.0 (27.3 – 40.4)	64	804 ± 107.2 (688.0 – 979.0)	2127	1849 ± 139.6 1552.0 – 2076.0()	2127	2713 ± 106.1 (2623.0 – 2884.0)	1945.2 ± 253.8 (1722.0 – 2383.0)
Cricket (n=6)	34.8 ± 5.0 (28.8 – 42.9)	-	962 ± 181.3 (674.0 – 1272.0)	-	1818 ± 190.1 (1572.0 – 2152.0)	-	2711.1± 221.8 (2471.0 – 2832.0)	1967 ± 155.0 (1710.0 – 2189.0)
Judo (n=5)	33.5 ± 4.7 (29.5 – 42.3)	61	1305.4 ± 333.5 (865.0 – 1823.0)	2023	1766.8 ± 108.3 (1664.0 – 1923.0)	2023	2631.6 ± 129.9 (2442.0 – 2819.0)	2118.6 ±174.1 (1889.0 – 2361.0)
Judo & Gymnastics (n=6)	37.04 ± 4.7 (30.3 – 42.6)	61	892.7 ± 359.3 (539.0 – 1542.0)	2023	1761.8 ± 193.1 (1514.0 – 1987.0)	2023	2602.8 ± 91.05 (2515.0 – 2786.0)	1970.5 ± 161.5 (1737.0 – 2213.0)
Volleyball (n=14)	28.8 ± 3.0 (24.4 – 32.7)	67	808.0 ± 140.9 (557.0 – 1323.0)	2231	1834.7 ± 211.6 (1531.0 – 2183.0)	2231	2672.2 ± 124.4 (2486.0 – 2892.0)	2014.9 ± 209.2 (1711.0 – 2345.0)
Weight Lifting (n=4)	33.8 ± 4.6 (29.9 – 41.3)	67	961±152.7 (729.0 – 1138.0)	2231	1816.5 ± 136.3 (1663.0 – 2031.0)	2231	2543.5 ± 103.1 (2392.0 – 2683.0)	2166.5 ± 156.3 (2392.0 – 2683.0)

Table 10: Mean Daily Intake of Minerals (excess or deficit) for Male Players Classified Game-Wise

Sports Disciplines	Iron (mg)	Calcium (mg)	Phosphorous (mg)
	% Excess or Deficit	% Excess or Deficit	% Excess or Deficit
Athletics (n=7)	-55.00	-59.13	-33.23
Badminton (n=4)	-49.69	-62.2	-40.07
Judo (n=5)	-45.08	-35.47	-30.45
Judo & Gymnastics (n=6)	-39.27	-55.87	-36.8
Volleyball (n=14)	-57.01	-63.78	-44.33
Weight Lifting (n=4)	-49.55	-56.92	-39.86

To know consumption of electrolytes especially sodium & potassium & vitamin C through any sport drink, information on quantity & type of fluids consumed by players was gathered. It was noticed that players were relying mainly on plain water to fulfill their thirst.

Table 11 depicts approximate mean daily intake of water by players. Female players drank approximately 6.3 ± 1.09 to 8.7 ± 0.5 glasses of water daily whereas male players drank approximately 9.4 ± 1.6 to 12.7 ± 1.8 glasses of water daily.

Water is the nutrient most critical to athletic performance. Without adequate water, performance can suffer in less than an hour. Water is necessary for the body's cooling system. It also transports nutrients throughout the tissues and maintains adequate blood volume.

During exercise there is always the risk of becoming dehydrated (fluid volume deficit), especially when the temperature is hot. When athletes sweat, they lose water *(Williams, 1990; Grodner et al., 1996).*

Table 11: Mean Approximate Daily Intake of Water by Female & Male Players Classified Game-Wise

Sr. No.	Sports Disciplines	Approximate Intake Of Water (glasses)	
		Mean	Range
	FEMALES [N = 13]		
1	Half Marathon (n=3)	8.7 ± 0.5	8.0-9.0
2	Hurdle Racing (n=2)	7.6 ± 0.6	7.0-8.0
3	Athletics (n=4)	8.6 ± 0.9	8.0-10.0
4	Badminton (n=4)	6.3 ± 1.09	5.0-8.0
	MALES [N = 46]		
1	Athletics (n=7)	11.5 ± 1.7	10 -15
2	Badminton (n=4)	10.0 ± 2.0	8.0-12
3	Cricket (n=6)	12.7 ± 1.8	10 -15
4	Judo (n=5)	9.7 ± 1.9	8.0-13
5	Judo & Gymnastics (n=6)	9.4 ± 1.6	7.0-12
6	Volleyball (n=14)	10.8 ± 3.3	8.0-15
7	Weight Lifting (n=4)	11.0 ± 1.3	9.0-12

Table 12: Mean of Hemoglobin, Blood Pressure & Pulse Rate Values for Male & Female Players Classified Game Wise

Sports Disciplines	Hemoglobin % (g / dl)			Blood Pressure (mm / Hg)						Pulse Rate (beats / minutes)		
				Systolic Blood Pressure			Diastolic Blood Pressure					
	Mean	Range	* C.O.L	Mean	** Std	Range	Mean	** Std	Range	Mean	** Std	Range
FEMALES [N = 13]												
Half Marathon (n=3)	12.5 ± 0	12.5-12.5	12	120 ± 0	120	120-120	80 ± 0	80	80-80	73 ± 3.8	70	69-78
Hurdle Racing (n=2)	12 ± 0.5	11.5-12.5	12	117 ± 4.3	120	114-120	81 ± 1.5	80	80-82	73 ± 3.0	70	70-76
Athletics (n=4)	12.1 ± 1.9	9-13.8	12	115 ± 5.3	120	110-120	75 ± 6	80	68-80	71 ± 7.3	70	62-82
Badminton (n=4)	11.1 ± 1.8	9-13	12	116 ± 4.9	120	110-120	82 ± 5.5	80	78-90	76 ± 2.5	70	74-80
MALES [N = 46]												
Athletics (n=7)	13.4 ± 2.4	11.5-13.8	12	116.3 ± 4.7	120	110-120	78.9 ± 4	80	72-82	71 ± 4.9	70	68-82
Badminton (n=4)	11.2 ± 1.4	9-12.5	12	116.5 ± 4.2	120	112-120	74 ± 7	80	68-80	69 ± 2.4	70	67-73
Cricket (n=6)	12 ± 1.4	9-13	12	119.4 ± 1.7	120	116-120	80 ± 0	80	80-80	72 ± 5.03	70	65-78
Judo (n=5)	12.5 ± 1.5	10-13.5	12	122 ± 1.6	120	120-124	80 ± 0	80	80-80	76 ± 4.6	70	68-82
Judo & Gymnastics (n=6)	11.8 ± 1.8	8.5-13.5	12	119.7 ± 0.9	120	118-120	80 ± 0.9	80	78-80	68 ± 5.5	70	69-75
Volleyball (n=14)	11.6 ± 1.5	9-13.5	12	120 ± 5.9	120	110-126	79 ± 3.9	80	68-80	74 ± 4.99	70	65-84
Weight Lifting (n=4)	12.5 ± 1.6	10-14	12	117.5 ± 5	120	110-120	78 ± 4	80	72-80	73 ± 2.2	70	70-76

Std – Standard, * C.O.L – Cut Of Level by world health organization (WHO) (referred from **Bamji et al., 2005)**
** - Referred from **"Nutrition"** - Quarterly Publication (NIN, 2000). Vol. 34(4):15

Biochemical Status: Information on biochemical data of players is presented in Table 12.

Among female players, highest value of mean hemoglobin was recorded for half marathon group (12.5 g / dl) & that of lowest for badminton group (11.1 g / dl). Among males, athletics group showed highest mean hemoglobin % (13.4 g / dl) & badminton group showed lowest mean hemoglobin % (11.2 g / dl). Mean hemoglobin levels of majority groups were found to be exceeding the cut off level given by world health organization *(Bamji et al, 2005)*. However, the differences were found to be insignificant (t = 1.01 for females & t = 0.06 for males, p>0.05). Among groups of players such as female athletics & badminton & male badminton, cricket, judo & judo & gymnastics & weight lifting, minimum hemoglobin values show prevalence of anemia (values were found to be less than 10 g / dl). A reduced hemoglobin level in an athlete's blood means reduced oxygen carrying capacity, with obvious implications for aerobic capacity & ability to sustain an exercise workload. Another factor in athlete's low – normal hemoglobin levels may be hemodilution. Strenuous training leads to an increase in plasma volume & absolute quantity of hemoglobin, the increases may not be proportional plasma volume increases more than does the hemoglobin level. Hemodilution with increased iron loss & increased red blood cell turnover may account for the prevalence of low – normal values among athletes. Obviously this situation is complicated if the diet is inadequate in bioavailable iron, as is sometimes found *(Williams, 1990).*

Blood pressure values reflect a mean of systolic blood pressure (SBP) ranging between 115 to 120 mm/Hg for females & 116.3 to 122 mm / Hg for males. Mean diastolic blood pressure (DBP) values were found to range between 75 to 82 mm / Hg for females & 74 to 80 mm / Hg for males. These values were found to be closer to the normal values of SBP (120 mm / Hg) & DBP (80 mm / Hg) (t = 1.48 & 1.07 for females & males respectively, p>0.05).

Highest value of pulse rate among female players was recorded for badminton (76 ± 2.5 beats / minute) & that among male players for judo (76 ± 4.6 beats / minute). With the exception of male players involved in badminton and judo & gymnastics, rest of the groups of players showed mean pulse rate insignificantly above the normal value of 70 beats / minute (t = 1.48 & 1.07 for females & males respectively, p>0.05). The mean heart rate & blood pressure of the selected athletes studied by *Chandrashekhar et al., (1988)* was found to be less than the normal values of 72 beats / min & 120 / 80 mmHg respectively.

Summary & Conclusion

Present study revealed that female & male players were accustomed to skipping meals which lead to inadequate intakes of vital micronutrients such as iron, calcium, phosphorus, thiamine & riboflavin. Varied dietary practices & consumption of imbalanced diets or failure to consume right diets hampered the micro nutrient status of players. Hemoglobin % in some players indicates a need for scientifically planned balanced diets by expert nutritionists.

The idea that specific nutrients might enhance athletic performance and confer athletic prowess is not new. For competitive athletes, the diet must therefore provide the optimal mixture of macro & micro nutrients to fuel their special needs & enhance performance.

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