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RESEARCH ARTICLE

FLUID CONSUMPTION PATTERN AMONG ATHLETES AND NON ATHLETES (17-23YEARS)

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ABSTRACT

Sports nutrition plays a significant role in the advancement of the knowledge available to the athletic community and hydration is of special importance as a part of the preparation, participation, and recovery of every athlete from the stress of training or competition. Twenty five each of female athletes (physical education students) and non athletes respectively from Avinashilingam University for Women and male athletes and non athletes from Karate Association and Rotary Club of Coimbatore respectively were selected. Socio economic background was elicited using questionnaire. Nutritional status was assessed through anthropometry, biochemical tests, clinical examination and dietary survey. Fluid intakes were recorded, average intake was recorded. Fitness tests (athletes) for cardiovascular endurance, flexibility, agility and strength were carried out. Computer assisted nutrition education materials. (Power point) and a booklet were developed. Education was imparted on sports nutrition and hydration and its effect on nutritional knowledge was ascertained. Sixty nine per cent male athlete, 84 per cent male non athlete, 80 per cent female athlete, 88 per cent female non athlete had optimal systolic pressure. All male athletes and female athletes and 84 per cent male non athlete and 96 per cent female athlete had normal blood glucose level. Diet of athletes lacked in major foods and nutrients and non athletes was high in fats and sugar. None of them consumed suggested quantity of fluids per day. No contaminating microbes were present in the fluids consumed by the subjects as proved by Total plate count test. Majority of athletes showed average to excellent performance in all four physical fitness tests. Knowledge pertaining to sports nutrition and hydration was very low before nutrition education (4.56-5.4). Education on sports nutrition and hydration imparted to the athletes and non athletes showed increase in knowledge scores (11.24-11.56).

INTRODUCTION

Sports nutrition is the application of nutrition knowledge to practical daily eating plan to provide the fuel for physical activity, facilitate repair and rebuilding processes following hard physical work in order to optimize athletic performance in competitive events, thereby promoting overall health and wellness. Although many athletes carefully regulate their diet, they may pay little attention to their body's fluid needs. They often misunderstand and, as a result, underplay the importance of water to good nutrition. Hydration is the process by which water is ingested and absorbed into the body. Sports nutrition has played a significant role in the advancement of the knowledge available to the athletic community concerning the importance of hydration. Hydration is of special importance as a part of the preparation, participation, and recovery of every athlete from the stresses of training or competition. It is well understood in modern athletic training that water is the key to athletic comfort and performance.

MATERIALS AND METHODS

Twenty five each of female athletes and non athletes pursuing Bachelors' degree in Physical Education and other courses respectively from Avinashilingam University for Women and twenty five each of male athletes and non athletes from Karate Association and Rotary Club of Coimbatore respectively were selected. Nutritional status was evaluated through anthropometric measurements, biochemical tests, clinical examination and dietary survey. Food and nutrient intakes were assessed by the 24 hour Food Recall method for all the athletes and non athletes. Fluid intakes were recorded for a period of one week using diary method. The daily average fluid intake of every individual was then calculated. Total plate count test was carried out to determine the microbial safety of popular fluids (water and fruit juice). Fitness tests for cardiovascular endurance, flexibility, agility and strength were carried out for athletes. Computer assisted nutrition education materials and a booklet was developed (using Microsoft Power Point) and the athletes and non athletes were educated on the importance of sports nutrition and hydration.

RESULTS AND DISCUSSION

Background Information

Ninety six per cent each of male athletes and female non athletes belonged to nuclear and the remaining four per cent

Table I. Mean food intake of male athletes and non athletes

[N=25/group]

Food	Suggested Allowance		Actual Intake		Per Cent Excess/Deficit	
	A@	NA*	A	NA	A	NA
Cereals and Millets	550	420	400	423.5	-27.2	+0.83
Vegetables	350	400	350	397.8	0	-0.55
Fruits	150	100	90	87.5	-40	-12.5
Milk and milk products	750	300	250	250	-66.6	-16.6
Pulses	40	60	45	60	+12.5	0
Fats/Oils	50	20	13	20	-74	0
Sugar	80	25	18	25.5	-77.5	+2

@ Suggested Dietary Allowance: Satyanarayana *et al* (1985); *ICMR (2005)

Table II. Mean food intake of female athletes and non athletes

[N=25/group]

Food	Suggested Allowance		Actual Intake		Per Cent Excess/Deficit	
	A@	NA*	A	NA	A	NA
Cereals and Millets	550	300	254	284.7	-53.8	-5.1
Vegetables	350	300	232	286.3	-33.7	-4.5
Fruits	150	100	92	91.24	-38.6	-8.76
Milk and milk products	750	300	275	200	-63.33	-33.33
Pulses	40	60	50	50	+25	-16.6
Fats/Oils	50	20	12	23.5	-76	+17.5
Sugar	80	20	14	23.5	-82.5	+17.5

@ Suggested Dietary Allowance: Satyanarayana et al (1985); *ICMR (2005)

Table III. Mean nutrient intake of athletes

[N=50]

Nutrient	RDA (SAI*)		Actual intake		Per cent Excess/deficit	
	Male	Female	Male	Female	Male	Female
Energy	4750	4000	3036	2440	-36	-39
Protein	164	147	99	77	-39	-47
Fat	161	145	49	43	-69	-70
Calcium	2000	2000	1046	887	-47	-55.65
Iron	17	21	21	20	+23.5	-4.7
Carotene	4800	4800	3959	3975	-17.5	-17.1
Riboflavin	1.4	1.1	1.37	1	-2.1	-9
Thiamine	1.2	0.9	1.2	1	0	0
Vitamin C	50	50	45	50	-10	-20

*Sports Authority of India (2001)

Table IV. Mean nutrient intake of non athletes

[N=50]

Nutrient	RDA*		Actual Intake		Per Cent Excess/Deficit	
	Male	Female	Male	Female	Male	Female
Energy	2138	1899	2152	1669	+0.65	-12.1
Protein	60	60	60	47	0	-21.6
Fat	15-20	15-20	16	27	0	+35
Calcium	600	600	592	674	-1.3	-12.3
Iron	17	21	16	23	-5.8	-9.5
Carotene	4800	4800	3966	2974	-17	-38
Riboflavin	1.4	1.1	1.42	1.12	+1.4	+1.8
Thiamine	1.2	0.9	1.2	0.92	0	+2.2
Vitamin C	50	50	35	30	-30	-40

*Recommended Dietary Allowance for Indians (ICMR 2009)

belonged to joint families. All the male non athletes and female athletes were from nuclear type families. A majority of the families (88% each of male athletes and male non athlete) had one to four members highlighting the preponderance of small family norms. The remaining twelve per cent of the families had more than four members. The families of all the female athletes had less than four members. Seventy two per cent of female non athletes had less and the remaining 24 per cent had more than four members. A majority of the male athletes (64%) were from families with a monthly income of Rs.20,000 to Rs.30,000. Among male non athletes 52 per cent were from families with a monthly income of Rs.20,000 to Rs.30,000. Among female athletes, 60 per cent of the families earned less than Rs.200,00 per month. In the case of the families of female non athlete 48 per cent earned between Rs. 20,000 and Rs. 30,000 per month.

Table V: Effect of nutrition education on knowledge pertaining to sports nutrition

[N=100]

Group	Initial Mean ± SD	Final Mean ± SD	Difference	't' value
Athlete Male	2.96±0.61	5.6±0.57	+2.64	14.54**
Athlete Female	2.92±0.70	5.44±0.71	+2.52	12.05**
Non athlete Male	2.84±0.74	5.2±1.19	+2.36	8.73**
Non athlete Female	3.0±0.86	5.24±0.92	+2.24	8.65**

** Significant at one per cent level.

Table VI. Effect of nutrition education on knowledge pertaining to hydration

[N=100]

Group	Initial Mean ± SD	Final Mean ± SD	Difference	't' value
Athlete Male	2.84±0.74	5.84±0.37	+3.0	17.32**
Athlete Female	3.08±0.86	5.68±0.69	+2.6	13.57**
Non athlete Male	2.96±0.61	5.72±0.54	+2.76	15.69**
Non athlete Female	2.92±0.70	5.80±0.50	+2.88	15.528**

** Significant at one per cent level.

Height, Weight, MUAC and Chest Circumference

Male athletes were shorter (158.56cm) than their non athletic counter parts (170.31cm) and their respective reference counterparts (174cm). They were lighter (58.92kg) than standard (70kg) but were comparable with male non athletes (62.25kg). The height (170.31cm) and weight (62.25kg) of male non athletes were not significantly different from those of standard (170cm and 60kg). Male athletes had higher mid upper arm circumference (35.5cm) than non athletes (26cm). Both male athletes and non athletes had less arm circumference when compared to the standard values of 40cm and 30cm respectively. Chest circumference of male athletes (89.56cm) and non athletes (66.36cm) were not different from the standard values of 90cm and 70cm. The chest circumference of male athletes was higher (83cm) than that of non athletes (66cm). Female athletes were taller (158.22cm) than their non athletic counter parts (154.36cm). Mean weight of female athlete (53.64kg) was not different from the weight of non athletes (55.9kg). Both female athletes and non athletes were shorter than their standards (163cm and 160cm) respectively. Female athletes were lighter (53.6kg) than the standard weight (56.7kg) while female non athletes were heavier (55.9kg) than the standard weight (50kg). Mid upper arm circumference of female athletes (24.1cm) was less than non athletes (26.9cm) and their respective standard (30cm), while among non athletes MUAC was higher than their respective standard (25cm).

BMI

Classification according to categorisation of BMI (ICMR, 2009) showed that among men, none of the athletes and 16 per cent of non athletes had BMI less than 18.5. Forty four and 68 per cent of athletes and non athletes respectively were in the normal BMI range of 18.5-23. Forty four and 16 per cent of the men were in the overweight category of (23-27). Twelve per cent of athletes and none of the non athletes were in the obese category of BMI (>27). Among women 12 per cent and eight per cent of athletes and non athletes respectively had BMI less than 18.5, while 80 per cent and 32 per cent had normal BMI (18.5-23). Eight and 56 per cent were overweight (BMI 23-27) and none and four per cent of athletes and non athletes respectively had BMI of more than 27.

Blood Pressure

Distribution according to European Society of Hypertension (2007), showed that among men, 60 per cent athletes had optimal systolic pressure (<120mm Hg) and 12 per cent had optimal diastolic pressure (<80mm Hg) respectively. Eighty four per cent and 24 per cent of non athletes had optimal systolic pressure and optimal diastolic pressure respectively. Similarly among women, 80 per cent of athletes had optimal systolic pressure and 92 per cent of them had optimal diastolic pressure. Eighty eight per cent 56 per cent of non athletes had optimal systolic and diastolic pressure. Eighty eight per cent and 56 per cent of non athletes had optimal systolic and diastolic pressure.

Haemoglobin Levels

Classification of anaemia and haemoglobin level according to Chatterjee (2003) showed that, among men, none of the athletes and non athletes had moderate anaemia. Sixteen per cent of athletes and 12 per cent of non athletes had mild anaemia. Eighty four per cent of athletes and 88 per cent of non athletes had normal level of haemoglobin. Similarly among women, none of the athletes and non athletes had moderate anaemia. Twelve per cent each of athletes and non athletes had mild anaemia. Eighty eight per cent each of athletes and non athletes had normal level of haemoglobin.

Blood Glucose

Classification of blood glucose level according to Bamji (2009) that among men, none of the athletes and 16 per cent of non athletes were hypoglycaemic. All the athletes and 84 per cent of the non athletes had normal glucose level. None of the athletes and non athletes were hyperglycaemic. Similarly in women, none of the athletes and non athletes were hypoglycaemic. Ninety six per cent of athletes and all the non

athletes had normal blood glucose. Four per cent of athletes and none of the non athletes were hyperglycaemic.

Clinical Signs

With regard to clinical signs and symptoms, among male athletes, pale face and easy pluck able hair were found among eight per cent each. Twenty four per cent had dental caries. Bleedings gums, angular stomatitis were noted each among 16 per cent each of male athletes. Among male non athletes, 16 per cent each of athletes had pale face, thin sparse hair and four per cent had easy pluck able hair. Forty eight per cent of them had dental caries, eight per cent each had bleeding gums, angular stomatitis. Similarly among female athletes, 12 per cent each had pale face and bleeding gums eight per cent of them had easy pluck able hair and 28 per cent of them had dental caries. None of the athletes suffered from thin sparse hair and angular stomatitis. Among female non athletes, 24 per cent each of the non athletes had pale face, bleeding gums. Eight per cent of them had thin sparse hair, 16 per cent each had easy pluck able hair and 32 per cent had dental caries.

Food and Nutrient Intake

Mean food intake among athletes and non athletes are presented in Tables I and II. Athletes (both male and female) consumed diets deficient in cereals and millets, fruits, milk and milk products, fats/oils and sugar. Both the groups consumed excess of pulses in their diet. Non athletes (both groups) consumed diet deficient in vegetables, fruits, milk and milk products. Male non athletes consumed excess of cereals and millets and sugar, but consumed proper amounts of pulses and fats. Female non athletes consumed excess of fats/oils and sugar. Mean nutrient intake among athletes and non athletes are presented in Tables III and IV. Athletes (both male and female) consumed diets deficient in energy, protein, fat, calcium,carotene, riboflavin and vitamin C. Non athletes (both groups) consumed diet deficient in calcium, iron, carotene, vitamin C. Male athletes consumed excess of iron, male non athletes consumed excess of energy and riboflavin, while female non athletes consumed excess of riboflavin and thiamine.

Fluid Consumption and Microbial Safety

Average fluid consumption of athletes and non athletes compared with the respective suggested allowance by Venkataramana (2009) and National Academy of Sciences (2003). It showed that among men, 16 per cent of athletes and 48 per cent of non athletes consumed fluids less than 1.5l/day. Twenty per cent of athletes and 40 per cent of non athletes consumed fluids of 1.5-2.5l/day. Sixty five per cent of athletes and 12 per cent of non athletes consumed 2.5-3.5l of fluids per day. Among women, eight per cent and 52 per cent of athletes and non athletes respectively consumed less than 1.5l of fluids per day. Eight per cent of athletes and 44 per cent of non athletes consumed 1.5-2.5l/day, while 84 per cent of athletes and four per cent of non athletes consumed 2.5-3.5 litres of fluids per day. It was encouraging to observe that both water and fruit juices (orange and lemon) popular among the athletes were totally devoid of contaminating microbes.

Physical Fitness Levels

Categorisation of athletes according to cardiovascular fitness and aerobic endurance according to Mc Ardle *et al* (2000) showed an equal percentage (28% each) came under excellent and average category. Among females, 44 per cent of them were excellent. Results from flexibility test indicated 84 per cent of male athlete and 76 per cent of female athletes in excellent category. In agility test, eight per cent of male athletes showed excellent performance while, none of the female athletes were in this category. Strength level of 20 per cent of male athletes and four per cent of female athletes was above average. In Medicine Ball throw, the highest point of five was scored by 40 per cent of male athletes and 24 per cent of female athletes.

Nutrition Education

The initial overall mean score obtained by male athletes was 4.56 and after nutrition education, the mean scores were found to have increased to 11.24. The initial mean scores obtained by female athletes were 5.4 and their final mean score was 11.56. The mean scores obtained by male and female non athletes were 5.32 and 4.64 respectively, which increased to 11.48 and 11.32 after nutrition education. All these improvements in nutritional knowledge were significant at one per cent level. Effect of nutrition education on knowledge pertaining to sports nutrition and hydration are given in Table V and VI.

Summary and Conclusion

The findings of the study indicated that majority of athletes and non athletes were in a state of optimum health with respect to anthropometry, biochemical and biophysical tests. Majority of male athletes and non athletes and female athletes had normal BMI while most female non athletes were overweight. However, clinical symptoms of nutritional deficiencies such as dental caries, mild anaemia, bleeding gums, pale tongue, angular stomatitis etc, were seen among all of them. Diet of athletes also lacked in major foods and nutrients and non athletes was high in fats and sugar. None of the athletes and non athletes consumed suggested quantity of fluids per day. Commonly consumed fluids among all subjects were water, milk, orange juice and lemon juice. Total plate count test indicated that there were no contaminating microbes present in the fluids consumed by the subjects. Majority of athletes showed average to excellent performance in all four physical fitness tests. Knowledge pertaining to sports nutrition and hydration was very low before nutrition education (4.56-5.4). Education on sports nutrition and hydration imparted to the athletes and non athletes showed an appreciable increase in the knowledge scores (11.24-11.56).

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