

Assessment of Nutritional Practices of Indian Female Athletes

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ABSTRACT Nutritional status has a direct bearing on the level of physical performance, that's why sports nutrition is considered as an integral part of sports medicine. The aim of the study was to evaluate the nutritional status of Indian female athletes. To solve the purpose, a total of purposely selected 100 Indian female athletes aged 20-25 years (mean age 21.87 years $\pm$ 2.59) collected from six Indian universities, were considered for the present study. The competition was organized in Guru Nanak Dev University, Amritsar, Punjab, India. An equal number of controls (n=100) were also collected from the same place for comparisons. Six anthropometric characteristics, viz. height, weight, BMI, waist circumference, hip circumference, waist to hip ratio and mid-upper arm circumference were considered in this purpose. A pre-tested semi-structured questionnaire and 24-hours recall method were applied for the assessment of nutritional status of the athletes. Results indicated statistically significant differences ($p < .001$) in hip circumference and waist to hip ratio between Indian female athletes and controls. So far BMI was concerned, no significant differences were found between Indian athletes and controls, showing majority of individuals fall well within the normal range of BMI. When mean nutrient intake of athletes and controls were compared, significant differences ($p < .05$ - .001) were found in all the variables studied, except energy, iron and sodium between them. It may be concluded from the present study that nutritional status of Indian female athletes were superior as compared to their control counterparts.

INTRODUCTION

Nutrition plays a very important role in attaining high level of achievements in sports (Kreider et al. 2009). Nutritional status has a direct bearing on the level of physical performance, that's why sports nutrition is considered as an integral part of sports medicine (Kerksick et al. 2008). Hence, physical fitness and training are very much dependent on nutritional status of sports persons (Rodriguez et al. 2009). Nutritional supplements are widely used by athletes for the enhancement of performance in international competitions (Buford et al. 2007; Harger-Domitrovich et al. 2007; Willoughby et al. 2007; Dalbo et al. 2008; Holm et al. 2008; Wilson et al. 2008; Jeukendrup et al. 2009; Hoffman et al. 2009). In spite of deep interest and effort in research related to maximal performance, the dietary regime to support such achievements requires a high level of knowledge (Aubertin-Leheudre et al. 2007; Storer et al. 2008).

Anthropometric dimensions and morphological characteristics play an important role in determining the success of an athlete (Koley 2011; Koley et al. 2011). Anthropometric measurements are used to provide a basis for assessment of nutritional status (Kaur and Koley 2010). Certain general principles of conditioning and nutrition are common to all sports, but specific nutritional program is important for optimal perfor-

mance in each sport. These athletes also have unique nutritional needs based on the type of training sessions specific to their sports. To solve the purpose, in the present study, an attempt has been made to evaluate the nutritional status of Indian female athletes.

MATERIAL AND METHODS

Subjects

The study was conducted on purposely selected 100 Indian female athletes (35 handball, 27 volleyball, 23 softball and 15 archery players) of six Indian universities, viz. Punjabi University, Patiala, Punjab University, Chandigarh, Guru Nanak Dev University, Amritsar, Kurukshetra University, Kurukshetra, Himachal Pradesh University, Himachal Pradesh and Delhi University, Delhi, and the competition was organized in Guru Nanak Dev University, Amritsar, Punjab, India, aged 20-25 years (mean age 21.87 years $\pm$ 2.59). An equal number of controls (n=100) were also collected from the same place for comparison. All the athletes were undergoing a regular practice session daily for a minimum of 2 hours each in the morning and evening in the university campus. The study was conducted from July, 2011. The age of the subjects were recorded from the date of birth registered in their respective

institutes. The subjects were divided in such a way that age 20 refers to the individuals aged 19 years and 6 months through 20 years and 5 months and 29 days. A written consent was obtained from the subjects. The data were collected under natural environmental conditions in morning (between 8 AM. to 12 noon). The study was approved by the local ethics committee.

Procedure

A pre-tested semi structured questionnaire was applied to all the subjects to collect the information regarding existing food habits, special foods consumed and also foods consumed and avoided before, during and after the event.

The nutritional status of subjects was assessed by nutritional anthropometry and diet survey.

Anthropometric Measurements

Seven anthropometric characteristics, viz. height, weight, BMI, waist, hip and mid upper arm circumferences and waist to hip ratio were measured on each subject using the techniques provided by Lohmann et al. (1988) and were measured in triplicate with the median value used as the criterion.

The height was recorded during inspiration using a stadiometer (Holtain Ltd., Crymych, Dyfed, UK) to the nearest 0.1 cm. The subject was asked to stand erect on the stadiometer with bare foot. The horizontal bar of the stadiometer was placed on the vertex of the subject and the readings were recorded. Weight was measured by digital standing scales (Model DS-410, Seiko, Tokyo, Japan) to the nearest 0.1 kg. The subject was asked to stand erect on the digital weighing machine with minimum cloths and bare foot. The readings were recorded from the scales of the digital weighing machine in kilograms. BMI was then calculated using the formula $\text{weight (kg)}/\text{height}^2 (\text{m})^2$. Waist, hip and mid-upper arm circumferences were measured by a flexible metallic tape (Holtain Ltd) from the right side of the subject. Waist to hip ratio was then computed. The abdominal obesity was judged by waist to hip ratio (Lean et al. 1995).

Dietary Survey

Dietary survey was conducted to gather the information regarding dietary habits, through 24 hours dietary recall method. The athletes were issued with a food and activity questionnaire

along with verbal and written instructions for its completion. Information provided focused on average portion sizes for common foods (bread, rice, cereals) and a guide to universal household measures (for example, teaspoon, tablespoon, cup) to improve the estimation of daily intake.

The validated questionnaire included the following headings; meal, food/beverage description, quantity, food type and cooking method to facilitate accurate analysis.

Data Analysis

Standard descriptive statistics (mean $\pm$ standard deviation) were determined for directly measured and derived variables. Student's t-test was used for the comparison of various anthropometric characteristics between Indian athletes and controls. Percentage calculation was computed. Data were analyzed using SPSS (Statistical Package for Social Science) version 17.0. A 5% level of probability was used to indicate statistical significance.

RESULTS

Descriptive statistics of anthropometric variables in Indian inter-university athletes and controls are shown in Table 1. The athletes have higher mean values in height, waist circumference and waist to hip ratio and lesser mean values in weight, BMI, hip circumference and mid upper arm circumference than their control counterparts, showing statistically highly significant differences ($p < .001$) in hip circumference and waist to hip ratio between them.

Table 2 shows the distribution of subjects according to body mass index. No significant differences were found between Indian athletes and controls in this regard.

The mean nutrient intake of athletes and control groups are depicted in Table 3. The athletes have higher mean values in energy, protein, carbohydrate, fat, fiber, calcium, iron, carotene, retinol, thiamine, riboflavin, niacin, vitamin C, sodium and potassium than controls, showing statistically significant differences ($p < .05 - .001$) in all the variables, except energy, iron and sodium between them.

Frequency of food consumption by athletes is presented in Table 4. All the 100 athletes were consuming cereals, vegetables and sugar daily, followed by milk (94%), curds (91%), pulses (85%), cooking oils (79%), butter (74%), fruits (51%), ghee (38%), green leafy vegetables (37%), oil seeds (17%), cheese (12%) and bakery prod-

Table 1: Descriptive statistics of anthropometric variables in elite female athletes and controls

Variables	Athletes		Controls		t -value
	Mean	S.D	Mean	S.D	
Height (cm)	160.31	5.23	158.96	4.54	1.950
Weight (kg)	55.24	6.71	55.70	5.49	0.530
BMI (kg/m ²)	21.83	2.62	22.11	2.75	0.730
Waist circumference (cm)	75.02	5.01	74.62	4.71	0.58
Hip circumference (cm)	83.45	7.17	89.90	7.14	6.400**
Waist to hip ratio	0.89	0.047	0.827	0.048	9.534**
Mid upper arm circumference (cm)	11.9	0.94	11.9	1.09	0.139

*Significant at .05 level, **Significant at .001 level

Table 2: Distribution of subjects according to body mass index

BMI classes	Presumptive diagnosis	Frequency		Percentage	
		Athletes	Controls	Athletes	Controls
< 18.5	Under weight	5	2	5	2
18.5 – 24.9	Ideal BMI	85	89	85	89
25.0 - 29.9	Obese grade I	9	8	9	8
> 30.0 – 38.9	Obese grade II	1	1	1	1

X² = 1.39; NS

Table 3: Mean nutrient intake of elite female athletes and controls

Variables	Athletes		Controls		t -value
	Mean	S.D	Mean	S.D	
Energy (kcal/d)	2006.53	209.13	1999.03	1704.25	0.044
Protein (g/d)	69.91	11.38	65.81	12.03	2.478*
Carbohydrates (g/d)	266.56	58.57	235.34	37.42	4.496**
Fat (g/d)	104.83	141.08	64.22	9.11	2.873*
Fibre (g/d)	18.19	3.68	16.08	2.60	4.700**
Calcium (mg/d)	1012.10	213.74	937.27	234.80	2.357*
Iron (mg/d)	34.87	6.51	34.43	6.08	0.485
Carotene (mg/d)	1492.9	1608.96	1076.10	1300.52	2.015*
Retinol (µg/d)	315.3	411.51	218.2	346.7	1.805
Thiamine (mg/d)	1.64	0.2704	1.45	0.3105	4.571**
Riboflavin (mg/d)	1.53	0.3074	1.45	0.195	2.146*
Niacin (mg/d)	13.82	2.23	11.9	3.13	5.036**
Vitamin C (mg/d)	95.64	38.5	74.76	18.78	4.878**
Sodium (mg/d)	396.16	81.07	389.84	56.63	0.640
Potassium (mg/d)	2454.3	853.3	2185.7	317.3	2.950*

*Significant at .05 level, **Significant at .001 level

ucts (10%). Nutrients consumed by Indian athletes weekly, twice a week, fortnight, monthly, occasionally are also shown in the table.

DISCUSSION

Nutritional aspects of the athletes are one of the important factors for the success in interna-

tional sport (Kreider et al. 2009). It is affected by a number of factors, viz. socio-economic status, race (caste or religion), geographical region and altitude, season and climate, diseases, personal hygiene and others. India is a country of varied populations with various gene pools, food habits, geographical regions and environments, cultures and social values. So it is quite difficult to

Table 4: Food frequency of Indian elite female athletes

Particulars	Daily		Weekly twice		Weekly once		For- night		Once a month		Occasionally		never	
	F	P	F	P	F	P	F	P	F	P	F	P	F	P
Cereals (g)	100	100	-	-	-	-	-	-	-	-	-	-	-	-
Pulses (g)	85	85	15	15	-	-	-	-	-	-	-	-	-	-
Oil seeds (g)	17	17	6	6	21	21	7	7	19	19	11	11	19	19
Milk (ml)	94	94	3	3	3	3	-	-	-	-	-	-	-	-
Curds (g)	91	91	3	3	3	3	-	-	3	3	-	-	-	-
Cheese (g)	12	12	40	40	38	38	4	4	2	2	4	4	-	-
Egg (g)	-	-	14	14	7	7	-	-	3	3	2	2	74	74
Chicken (g)	-	-	1	1	12	12	1	1	6	6	3	3	77	77
Fish (g)	-	-	1	1	3	3	2	2	9	9	5	5	80	80
Mutton (g)	-	-	-	-	2	2	-	-	11	11	5	5	82	82
Green leafy Veget. (g)	37	37	54	54	9	9	-	-	-	-	-	-	-	-
Other vegt. (g)	100	100	-	-	-	-	-	-	-	-	-	-	-	-
Fruits (g)	51	51	36	36	10	10	-	-	3	3	-	-	-	-
Butter (g)	74	74	17	17	3	3	-	-	5	5	1	1	-	-
Ghee (g)	38	38	30	30	12	12	6	6	7	7	-	-	7	7
Cooking oil (g)	79	79	2	2	-	-	-	-	3	3	-	-	16	16
Sugar (g)	100	100	-	-	-	-	-	-	-	-	-	-	-	-
Bakery products (g)	10	10	18	18	24	24	20	20	11	11	13	13	4	4

F – Frequency, P – Percentage

set a common nutritional program for all the Indian athletes. In the present study, Indian athletes had significantly higher mean values in protein, carbohydrates, fats, fiber, calcium, carotene, thiamine riboflavin, niacin and vitamin-C as compared to their control counterparts. As athletes undergo regular strenuous exercise and training, they are to take proper nutrients regularly, it is obvious. However, when the present data was compared with the data of Malaysia (Ismail et al. 1995), the Malaysians had higher mean values in energy (2784 kcal), protein (94.0 g), carbohydrates (426 g), riboflavin (2.5 mg), niacin (19.5 mg) and vitamin C (100 mg) and lesser mean values in fat (78.4 g), calcium (713 mg), iron (31.0 mg) and thiamine (1.5 mg) than Indian athletes.

Though India has a sound talent in all sports, due to lack of proper nutrition and knowledge of it, they are unable to attain their potential levels, when compared with athletes of other nations. Hence, there is a need to study the nutritional status of these athletes and to provide them with a nutrient-rich diet and supplements with proper guidance to use it, in order to enhance their endurance capacity and thereby improving their sports performance.

CONCLUSION

It would be concluded from the present study that nutritional status of Indian female athletes

were superior as compared to their control counterparts.

PRACTICAL IMPLICATIONS

The data presented in the present study carry immense practical applications and should be useful in dietary program development in Indian athletes. Sports administrators, coaches and even sports persons can use the data in their future planning for nutrition.

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