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Assessment of Nutritional Status of Regular Adolescent Swimmers (13-18 Years)

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Abstract

Physical activity and good nutrition plays a pivotal role in maintaining good health. Swimming is a low impact activity and a good workout which confers physical and mental health benefits. It was hypothesized that the nutrient intake and nutritional status of the adolescent swimmers (experimental group) will be different from the non-swimmers (control group). The BMI will be different from non-swimmers (control group). The study was undertaken with an aim to assess the nutritional status of regular swimmers and non-swimmers in the age group of 13-18 years. Assessment of somatic status and nutrient intake were the objectives. A sample consisting of swimmers (N=80) including 40 male swimmers and 40 female swimmers was selected along with the control group containing 30 male swimmers and 30 female non-swimmers (N=60). Irrespective of their status as swimmers or non-swimmers, the mean nutrient intake in both the groups was significantly less than their RDA (carbohydrates, proteins, fats, calcium, iron, vitamin D, vitamin C.). The BMI of the swimmers was less compared to the non-swimmers but within the normal range in case of both the boys and girls. However, the Mid Arm Circumference which depicts the muscle mass was higher among the swimmers. The study revealed that there was no significant difference in the nutrient intake of both the groups irrespective of the competitive sport. Even though nutrient intake is not meeting the RDA, the Mid Arm Circumference is good indicator depicting the importance of physical activity. Even though the nutritional knowledge was good in both the groups, their nutrient intake shows they not practising the same. Most of the swimmers were found to be non-vegetarians following a meal pattern of 4 meals per day, while most of the non-swimmers were found to be vegetarians and ova-vegetarians following a 3 meal pattern per day. A habit of skipping meals was found in adolescent boys (swimmers and non-swimmers). The water consumption was found to be more than 5 litres per day among the swimmers as against the non-swimmers who were consuming less than 3 litres per day.

Introduction

Definition for adolescence

Adolescence (ages 11 to 21), the transition between childhood and adulthood, is one of the most dynamic periods of human development. Adolescence is characterized by dramatic physical, cognitive, social, and emotional changes. These changes, along with adolescents' growing independence, search for identity, concern with appearance, need for peer acceptance, and active lifestyle, can significantly affect their eating behaviours and nutrition status [1]. Rapid physical growth creates an increased demand for energy and nutrients. The period of adolescence is divided into three stages. Early adolescence, ages 11 to 14, includes pubertal and cognitive changes. Middle adolescence, ages 15 to 17, is a time of increased independence and experimentation. During late adolescence, ages 18 to 21, adolescents make important personal and vocational decisions. These stages provide a useful context for understanding the eating behaviours and body-image issues of adolescents, as well as a framework for providing adolescents with the information they need to practice healthy eating behaviours and participate in regular physical activity. The World Health Organization (WHO) defines an adolescent as any person between ages 10 and 19. Adolescence is the transitional phase of growth and development between childhood and adulthood. This age range falls within WHO's definition of young people, which refers to individuals between ages 10 and 24.

Early adolescence-11 to 14 years: Parents should help adolescents understand and accept normal physical changes (e.g., weight changes; the widening of females' hips and fat accumulation in their bodies; the large variation in height, weight, and growth rates in Adolescent females' physical growth and development may lead to dissatisfaction with their appearance. Reassure them that fat accumulation in the hips, thighs, and buttocks is normal during adolescence (from 15 to 18 percent of body weight before puberty to 20 to 25 percent at the end of puberty) [2].

Adolescent males have a mild weight gain before their growth spurt (i.e., increase in height), which occurs at 9 to 13 years of age. In addition, their percentage of body fat decreases during their growth spurt (sexual maturity rating 3 to 4). After puberty, their percentage of body fat increases and by age 18, it is about 15 to 18 percent of their body weight. Reassure adolescent males and their parents that fat gain is normal and will probably level off during the upcoming growth.

Middle adolescence-15 to 17 years: Explain the standard growth chart to adolescents, and show them how they compare to other adolescents their age. Discuss their upcoming physical changes and specific concerns. Emphasize that a healthy body weight.

Reassure late-maturing adolescent males that they are normal. Use charts that plot height velocity by age and sexual maturity rating to ease their concerns.

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Late adolescence-18 to 21 years: Explain the standard growth chart to adolescents, and show them how they compare to other adolescents their age. Discuss any specific concerns. Emphasize that a healthy body weight is based on a genetically determined size and shape rather than on an ideal, socially defined weight [3].

Anthropometry

Young athletes are subjected to high intense training programs, and competitions that involve the need of getting good performance at the same time health level is maintained at a good standard. This phenomenon is commonly seen among swimmers. Recently, very young swimmers beating records, won titles and, therefore, were subjected to high volumes of training and competition. However, apart from training, it is important to control for other variables that also affect both performance and health of young athletes. Nutrition and body composition are factors that influence athletic performance and health of swimmers from both sexes at all levels. Adequate nutrient intake is essential to sustain athletes 'daily activities and optimize their performance during training and competition. Inadequate energy consumption can contribute to poor athletic performance and physical conditioning. In fact, nutrition is often referred as the invisible training. Previous studies have reported that athletes are often in negative energy balance, do not follow the patterns recommended, have low carbohydrate intake, or low vitamin and mineral intake [4]. Furthermore, the essential role of carbohydrates in performance, overestimation of protein benefits for athletic performance, and the little attention given to fluid intake are also essential aspects that should be taken into account when dealing with young athletes' nutritional status. Adolescents, in particular, have increased energy and nutrient needs for normal growth and development. Adolescent athletes may require more energy depending on the intensity, duration, and type of exercise performed. They have increased protein needs to accommodate growth, maturation, and exercise as well. Thus, an adolescent athlete requires specific nutritional support to maintain normal growth and physiological maturation and to aid athletic performance.

Physical activity

"Sport" comes from the Old French *desport* meaning "leisure", with the oldest definition in English from around 1300 being "anything humans find amusing or entertaining". Other meanings include gambling and events staged for the purpose of gambling; hunting; and games and diversions, including ones that require exercise. Roget's defines the noun sport as an "activity engaged in for relaxation and amusement" with synonyms including diversion and recreation. Sport is all forms of usually competitive physical activity which, through casual or organised participation, aim to use, maintain or improve physical ability and skills while providing entertainment to participants, and in some cases spectators. Sports are usually governed by a set of rules or customs, which serve to ensure fair competition, and allow consistent adjudication of the winner. Winning can be determined by physical events such as scoring goals or crossing a line first, or by the determination of judges who are scoring elements of the sporting performance, including objective or subjective measures such as technical performance or artistic impression [5].

Methodology

Objectives

- To study the somatic status of the adolescent swimmers (experimental group) and non- swimmers (control group).

- To study the dietary intake through 24 hours recall of control and experimental group.

- To compare the nutrient intake with the RDA of control and experimental group.

Hypothesis

Hypothesis 1: The nutritional status of the adolescent swimmers (experimental group) will be different from the non-swimmers (control group).

Hypothesis 2: The nutrient intake of the adolescent swimmers (experimental group) will be different from the non-swimmers (control group).

Hypothesis 3: The BMI will be different from non-swimmers (control group) [6].

Study location

The study included various swim centres. Swimmers from Global Swim Centre, Sadashivnagar and Basavangudi Aquatic Centre, Basavangudi, were chosen in order to reach the objective of the study. While the control group was chosen from St.Stracey Memorial High School, St Marks Road Bangalore. These subjects were screened to achieve the objectives of the study.

Study subjects

A total of 80 adolescent swimmers were selected, which includes 40 female adolescent swimmers and 40 male adolescent swimmers. The control group includes 60 non-swimmers, which includes 30 male adolescents and 30 female adolescents. The respondents were aged between 13-18 years [7].

Research design

The cross sectional study installed purposive sampling technique. The sample selection was done on availability of the respondents in the swim centre. The subjects and their parents were briefed about the purpose of the study and oral consent was obtained prior to the study. A structured open ended questionnaire with interview method was adopted to obtain specific information targeted to achieve the objectives of the study. A systemic study was executed in order to minimize the errors during the course of the study.

Tools and Techniques for Data Collection

Tools and techniques used in the study are:

- Anthropometric measurements

- Nutrient intake

- Statistical analysis

Anthropometric measurements

Height: Respondent's height was measured without footwear, using a measuring rod. Respondents were made to stand on a flat surface, looking ahead. The measurement was taken until the scale touched scalp. The height was read in centimetres.

Weight: Weight is a measure of overall nutritional status with age, sex and height/length required for optimal interpretation. Body weights of the respondents were taken with help of beam scale machine. Scale calibration was regularly checked before taking each measurement. Respondents were made to stand at the centre of the weighing scale

without footwear, without holding anything and looking straight ahead parallel to the floor.

Mid arm circumference: Mid arm circumference is feasible and is accessible in any age and sex. MAC not only identifies malnutrition but also determine mortality risk.

The mid arm circumference was measured with a flexible paper tape up to 0.1 cm. It is taken on the left arm, while hanging freely by the side, at its midpoint of the left upper arm is measured by taking first the length of the upper arm-between acromion process of scapula and the tip of the ulna- by flexing the forearm at right angles. The midpoint is marked at half the length with a skin marking pencil/pen. The tape is placed at the midpoint gently but firmly without disturbing the contours of the arm in any way (concepts of public health nutrition, 2013).

BMI (body mass index): The BMI was calculated from the measured heights and weights of the adolescent swimmers (experimental group) and non-swimmers (control group) [8].

Dietary habits

Nutrient intake: A 24- hour recall method was used to collect the information pertaining to the dietary intake. The nutrient content of the diets was calculated which included the energy intake (kilocalorie), protein (grams), fat (grams), carbohydrate (grams), calcium (milligrams), iron (milligrams), vitamin C (milligrams), vitamin D (IU) using nutritive value of Indian foods. The adequacy of nutrient was evaluated by comparing the intakes with recommended dietary allowances (RDA).

Data analysis: Data analysis including coding and decoding of the questionnaire and same was subjected to statistical analysis. Data was subjected to appropriate statistical test such as percentage, mean, standard division, t test and chi-square.

Results and Discussion

The above table clearly shows that comparison of anthropometric measurements among swimmers and non-swimmers (boys and girls) height, BMI, MAC are significant at 1% level and weight is not significant. In anthropometric characteristics and nutritional profile of young amateur swimmers. The aim of this study was to evaluate nutritional and anthropometric profiles of young swimmers belonging to semi professional teams. Thirty-six Caucasian adolescent swimmers (22 boys and 14 girls) participated voluntarily in the study. Anthropometric data, dietary intake, and blood parameters were determined. Female swimmers had greater values of triceps, suprailiac, and abdominal skin folds (Table 1).

Endomorphic somatotype was twofold greater in girls compared with in boys. In conclusion, young swimmers participating in the present study had differences between sexes in somatotype. Adolescent swimmers had low average total energy intakes, excessive protein intake, and lower intake of several micronutrients in both sexes (Table 2).

Dietary intake and food pattern indicates that majority of adolescent girls (swimmers and non-swimmers) are non vegetarians and showed a significant value of 8.3129 at 5% level. The main reasons for adopting vegetarian diets reported by the general population include cultural and religious beliefs, moral beliefs concerning animal rights, health benefits and environmental issues. For athletes, reasons are likely to be similar to those of the general population (Table 3) [9].

The above table clearly shows that there is no significant difference in the consumption of energy, protein, iron, carbohydrates, vitamin C, calcium among adolescent boys and girls (swimmers). However the consumption of fat is found to show a significance at 5% level and vitamin D at 1% level (Table 4).

The above table clearly indicates that there is no significant difference in the consumption of Energy, protein, fat, carbohydrates, iron, calcium and vitamin C among adolescent's boys and girls (non-swimmers). However the vitamin D is found to show significance at 1% level (Figure 1).

Dietary intake and food patterns indicates that the majority of the adolescent non-swimmers boys are non vegetarians with a percentage of 80%, whereas, 68% of adolescent swimmers boys are non-vegetarians. A majority of the non-swimmers girls are non-vegetarians with a percentage of 74%, whereas 68% of adolescent swimmers girls

Anthropometric measurements	Swimmers (n=80)		Non swimmers (n=60)		Significance of t value
	Mean	SD	Mean	SD	
Height (cms)	162.57	9.24	155.13	8.20	4.9504**
Weight (kgs)	54.30	9.78	53.29	9.96	0.6006[NS]
BMI	20.03	2.52	22.15	3.36	4.2724**
Mid-arm Circumference	243.45	30.89	214.10	40.20	4.8916**

**Significant at 1% level, NS: Not significant

Table 1: Comparison of anthropometric measurements among swimmers and non-swimmers (boys and girls combined).

Type of diet followed	Adolescent Boys				Adolescent Girls			
	Swimmers (n=40)		Non swimmers (n=30)		Swimmers (n=40)		Non swimmers (n=30)	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Vegetarian	11	27	14	47	8	20	10	33
Non-vegetarian	26	65	12	40	28	70	14	47
Ova-vegetarian	1	3	1	3	4	10	2	7
Vegan Ova-vegetarian	2	5	3	10	-	-	4	13
Total	40	100	30	100	40	100	30	100
Significance of Chi square	4.3797[NS]				8.3129*			

*Significant at 5% level, NS: Not significant

Table 2: Type of diet followed by adolescents.

Type of Nutrients	Boys (n=40)		Girls (n=40)		Significance of t value
	Mean	SD	Mean	SD	
Energy (Kcal)	1100.19	454.57	1096.18	467.49	0.0388[NS]
Protein(g)	47.02	24.49	45.76	22.07	0.2418[NS]
CHO(g)	208.84	63.34	183.75	76.26	1.6011[NS]
Fat(g)	22.66	19.69	39.28	42.41	2.2489*
Iron(mg)	64.00	42.69	66.25	63.52	0.1859[NS]
Calcium(mg)	69.17	119.38	44.47	63.08	1.1574[NS]
Vit-C(mg)	84.75	102.76	93.68	183.19	0.2688[NS]
Vit-D IU/mcg	92.87	10.30	38.63	53.46	6.3069**

**Significant at 1% level, *Significant at 5% level, NS: Not significant

Table 3: Level of nutrition among adolescent boys and girls (swimmers).

Type of Nutrients	Boys (n=30)		Girls (n=30)		Significance of t value
	Mean	SD	Mean	SD	
Energy (Kcal)	709.70	240.00	715.66	355.94	0.0760[NS]
Protein(g)	31.85	37.25	25.63	14.83	0.8501[NS]
CHO(g)	123.36	62.97	118.04	54.29	0.3506[NS]
Fat(g)	19.63	23.31	17.17	17.17	0.4656[NS]
Iron(mg)	31.16	18.63	33.30	24.24	0.3835[NS]
Calcium(mg)	17.65	23.76	20.51	20.91	0.4951[NS]
Vit-C(mg)	26.57	26.58	24.84	45.10	0.1811[NS]
Vit-D IU/mcg	132.66	104.00	19.77	39.79	5.5583**

**Significant at 1% level, NS: Not significant

Table 4: Level of nutrition among adolescent boys and girls (non-swimmers).
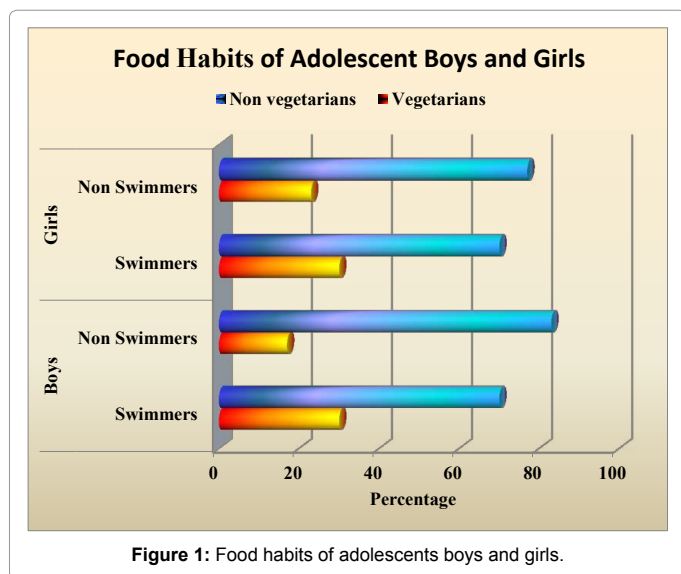

Figure 1: Food habits of adolescents boys and girls.

are non-vegetarians. In both, the experimental group and the control group vegetarians are found to be of a lesser percentage [10].

Summary

Dietary intake during adolescent is important for growth. Total nutrients needs are higher in adolescence than during any other period in life, because of the rapid growth and development. Nutritional intake during this period can have long term implications.

A questionnaire was used to collect general information, dietary habits, nutrient consumption, calcium intake and physical activity pattern. The anthropometric measurements were taken and Body Mass Index (BMI) was determined to help categorize the individuals if they were under or over nourished.

Conclusion

Physical activity with optimum nutrition plays a pivotal role as far as performance is concerned in competitive sports. Skill-or performance-related fitness involves skills that will enhance one's performance in athletic or sport events. The height, BMI, MAC were found to be significant among the swimmers and non-swimmers. Adolescent swimmers followed a 4 meal pattern everyday, which is healthy. The nutrient intake of the swimmers was less than the RDA computed on individual basis pertaining to carbohydrate, protein, iron, vitamin C and calcium among the swimmers (boys and girls). Similar patterns were also observed in case of control. The adolescent swimmers and non-swimmers followed a regular work out of more than 2 hours every week. Sports nutrition is an important aspect in maintaining the health and to improve the performance of swimmers, and the cramps experienced can be related to low calcium intake.

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