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ANTHROPOMETRIC MEASUREMENTS AND NUTRIENT INTAKE OF SWIMMERS

Vandana Sharma[1] **& Prajakta Nande**[2]

[1]M. Sc. (Food Science & Nutrition)
[2]Assistant Professor in Food Science & Nutrition
Department of Home Science
Rashtrasant Tukadoji Maharaj Nagpur University
Mahatma Jyotiba Phule Educational Campus, Amravati Road-440033, Nagpur (Maharashtra)
Email ID: vandana_s11@yahoo.com

ABSTRACT

Present study was conducted to assess anthropometric measurements & nutrient intake of swimmers, girls and boys (10-15 yrs). Total 50 subjects (25 girls and 25 boys) who were engaged in regular swimming were selected. Anthropometric measurements were recorded using standard procedures & equipments. Dietary assessment was done by 24 hours dietary recall method. Results of study revealed that subjects were shorter & lighter than reference standards for age. Subjects consumed diets deficient in energy. Girls had significantly higher mean protein intake than recommended dietary allowances (RDAs) whereas boys consumed deficient amounts of protein. Mean intake of thiamine, riboflavin, vitamin C, folic acid and niacin by girls and boys was found to be greater than RDAs. It is concluded that food choices of young children engaged in swimming on regular basis need to be proper & adequate to meet increased nutrient demands of sports & growth.

Keywords: Anthropometric measurements, nutrient intake, energy, RDAs.

INTRODUCTION

Swimming is a foundation Olympic sport included at every Summer Games since 1896. Competitive races are held for the four swimming strokes (freestyle, backstroke, butterfly, breaststroke), individually or in combination (medley). With events lasting from 20 s to 16 min (50 m-1500 m), swimming is a highly technical sport demanding power and endurance underpinned by different combinations of anaerobic and aerobic fuel systems. Relays add the dimension of a team sport to the competition format. Race programs vary from a single day of competition to multiday meets in which swimmers often compete in multiple events of varying distance and stroke over a number of heats,

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semifinals, and finals. Swimmers traditionally learn to swim at an early age and transition into formal training soon afterward. It is not uncommon for large training volumes to be undertaken by young swimmers to ensure that they develop optimal biomechanical technique, physiological capacity and race skills to allow them to compete at the elite level by adolescence. Indeed, it is possible for swimmers (particularly female swimmers) to achieve high levels of success before full pubertal development (Shaw et al., 2014).

The practice of competitive sports by adolescents requires special attention owing to their biological stage in which significant body changes related to sexual maturation and growth take place. Adolescent athlete's nutrition must promote adequate growth and development in addition to meeting the increased nutritional demands of strenuous physical activity.

Nutrition plays a crucial role in athletic performance. Swimming is a demanding sport, in which nutritional needs can be extraordinary. A balanced intake of macronutrients is essential, as adequate carbohydrate and protein intakes are necessary for maintaining and enhancing glycogen stores and lean body mass, respectively, during training. Sufficient micronutrient intake is also important, as minerals facilitate the development of swimming performance and contribute to the attainment of optimal physiological function. Nevertheless, reports show suboptimal dietary intakes of swimmers. Such findings could be partially attributed to the lack of nutritional education and scientific monitoring. Moreover, swimmers do not always adjust their nutrient needs to the training stress, but information about possible modifications of the dietary habits of swimmers during different training phases is limited. Training of swimmers needs to be accompanied by appropriate evaluation of a variety of parameters, including hematologic

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and biochemical ones. Variations in these parameters may influence the performance capacity of swimmers and such variations do take place during swimming training, although in diverse directions. Some of these parameters, for instance, parameters of the iron status, are influenced not only by training but also by nutrition (Kabasakalis et al., 2007). Proper nutrition is a fundamental component of athlete's training and performance plan. Proper nutrition ensures that an individual is amassing the fuels necessary for the energy production needs related to activity and recovery.

In general, adolescent athletes often show insufficient intake of calcium, thereby becoming susceptible to low bone density and stress fractures. It has been suggested that track and field athletes consume high amounts of lipids, saturated fats, and mono- and disaccharides whereas their iron intake is usually lower than recommendations, especially in women. Such deficient energy balance and insufficient nutrient intake may impair the growth, health, and physical performance of these athletes. Thus, young athletes constitute a population that is vulnerable to the physiological effects of chronic physical fatigue owing to intense exercise, especially if they have inadequate food consumption (Smith at al., 2015).

This research was undertaken with the aim to assess anthropometric measurements & nutrient intake of young girls & boys engaged in regular swimming.

METHODOLOGY

For this study, total 50 girls and boys were selected from age group 10-15 yrs, out of which 25 were girls and 25 were boys.

Samples were selected from well known swimming coaching center from Nagpur city, Maharashtra, India.

DATA COLLECTION

For data collection, questionnaire was constructed.

Anthropometric Measurements

Body measurements like height, weight & circumferences

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like mid upper arm, waist & hip & skinfolds at biceps, triceps, subscapular & suprailiac were recorded. Standard procedures were followed to record all these measurements (Nande, P. J. & Vali, S. A., 2010)

Dietary Information & Nutrient Intake

24 hour's dietary recall method was used to know dietary intake of subjects. Based on this, nutrient intake of diets consumed by subjects was calculated (Gopalan, C. et al., 2007).

RESULTS AND DISCUSSION

Height & Weight

Table 1 shows data on height and weight of subjects.

Very minor differences were observed between girls & boys for their mean heights. Minimum and maximum mean height for girls was recorded as 127.00 to 153.00 cm whereas for boys, it was recorded as 129.00-168.00 cm, respectively (Table 1). Similarly, no great variation between girls and boys for their mean body weights was found (35.48±8.40 kg for girls and 36.80±9.18 kg for boys). However, individual variations were noted for body weights of subjects (minimum to maximum value were 22.00-55.00 kg for girls and 24.00-55.00 kg for boys, respectively).

In comparison with standard values of height & body weight for age and gender, girls and boys under this study were shorter & lighter.

Body Circumferences

Table 2 shows data on body circumferences of subjects like mid upper arm, waist & hip.

Mean MUAC of girls was found to be lower whereas that for boys was found to be greater than standard values, with % deficit & excess of 6.61 & 4.34, respectively. Insignificant differences were noted when means of MUAC of girls and boys were compared with standard values for age & gender (t=0.322 and 0.89, respectively). Minimum value of MUAC both for girls and boys was 18.00 cm whereas maximum MUAC value of girls was 36.00 cm and for boys 38.00 cm as also clear from Table 2.

Mean waist circumference values of girls & boys were found

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to be lower than standards for age (% deficit 10.56 & 4.36 for waist & 9.65 & 3.22 for hip circumference, respectively, Table 2). Very high differences were noted for individual values of waist circumference of subjects. In comparison with standard waist circumference of age, both girls and boys possessed lower means waist circumference (t=3.44 for girls and 1.68 for boys).

Similar to waist circumference, mean hip circumference of girls was found to be less than boys. Both girls & boys possessed significantly lower hip lower than standards for age.

Skinfold Thickness

Table 3 shows data on skinfold measurements of subjects.

Girls and boys did not show greater difference for mean values of all skinfold thickness. In comparison with standard triceps skinfold thickness, it was noted that girls showed significantly lower value (% deficit: 28.62) whereas boys showed significantly greater value (% excess: 3.90)(t=10.95 for girls, significant at both 5% and 1% levels and t=2.53 for boys, significant at 5% level).

Mean values for subscapular skinfold thickness for both girls and boys was found to be significantly higher than standard values for age (t=2.39 for girls and t=7.00 for boys). Similar to subscapular skinfold thickness, mean suprailiac skinfold values of girls and boys were found to be significantly higher than standards for age (t=2.27, significant at 5% level & t=6.2, significant at both 5% and 1% levels, respectively). % excess ranged from 9.27 to 42.54 (Table 3).

Nutrient Intake

Majority of boys were non-vegetarians with minimum of 4 and maximum of 8 meals as common dietary pattern. Majority of subjects (84% girls and 96% boys) reported regular meal timing.

Table 4 demonstrates data on intake of energy & energy yielding nutrients by subjects.

None of the boys were found to be able to meet the RDA for

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energy intake (t=41.86, p<0.01). Mean intake of energy for girls was also found to be significantly less than RDA (t=72.32, p<0.01, Table 4). Higher differences in the intake of energy by subjects were noted. In a study carried out by Coutinho et al. (2016), male swimmers aged 13.5 ± 2.4 yrs consumed less energy than the general recommendations for athletes whereas female participants consumed more energy than those recommendations. Athletes should match their energy intake with expenditure in order to maintain lean body mass (Slattery et al., 2012). Young female swimmers studied by N. Prajakta et al. (2010) showed higher mean intake of fat & protein but lower intake of energy as compared to recommended dietary allowances (RDAs).

Similarly, greater individual differences for carbohydrate intake by subjects were recorded, with mean of carbohydrate intake was calculated as 162.28±41.29 g for girls & 166.65±37.52 g for boys.

Girls showed higher mean protein intake than boys as well as in comparison with RDAs. Girls showed insignificantly higher mean protein intake than RDA (t=0.97, p>0.05). In contrast to this, boys showed significantly lower mean protein intake than RDA (t=2.21, 0.01<p<0.05, Table 4).

Unlike protein intake, mean intake of fat by boys was found to be higher than girls (Table 4).

Deficient consumption of micronutrient at young age by subject engaged in game of swimming can compromise their growth and development.

Table 5 shows data on intake of vitamins by subjects.

With the exception of mean intake of carotene by subjects, it was found that mean intake of thiamine, riboflavin, vitamin C, folic acid and niacin by girls and boys was found to be greater than RDAs (Table 5). Lack of inclusion of rich sources of carotene in the diets on the day of dietary recall resulted in deficient consumption of this important vitamin.

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Henceforth, it is always better to relay on three days dietary recall than one day's. Individual variations for all vitamins are noted by investigator which could be attributed to inclusion of different sources of foods in the diet.

Young female swimmers studied by N. Prajakta et al. (2010) showed excess mean intakes of thiamine, riboflavin, niacin, folic acid & vitamin C.

Table 6 shows data on mineral intake by subjects.

Mean intake of vital minerals by girls & boys like calcium, potassium, magnesium, zinc & sodium were found to be higher than RDAs. Mean intake of zinc by girls was higher than RDA but boys showed deficient intake of zinc. Differences in individual intake of these minerals may be attributed because of differences in food choices (Table 6). Very high intake of iron, magnesium & zinc can be attributed to consumption of oral health supplements rich in these nutrients. Few subjects reported very higher quantities of oral health supplements.

Adolescent male and female swimmers studied by Collins, A. C. et al. (2016) demonstrated inadequate amounts of calcium in daily diets.

Swimmers (55%) studied by Hawley, J. A. & Williams, M. (2011) had calcium intakes below recommended dietary allowances (RDA), while 65% had iron intakes lower than RDA. Young female swimmers studied by N. Prajakta et al. (2010) showed excess mean intakes of calcium, phosphorus & iron.

Table 7 presents data on total dietary fiber intake by subjects.

Mean intake of TDF by girls & boys was found to be 19.60±6.72 g & 20.26±10.81, respectively (Table 7).

From the results of this study, it is concluded that a well balanced diet is needed for young girls & boys engaged in swimming to meet the requirements of energy, macro- & micro-nutrients. Prolonged consumption of diets

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deficit in vital nutrients can compromise the sports performance & in long run, can lead to serious health issues.

Table 1: Data on Height and Weight of Subjects

Sr. No.	Parameters		Girls	Boys
1.	**Height (cm)**	M±SD	140.84 ±7.00	140.56±10.42
		Range	127.00-153.00	129.00-168.00
		Standard	150.85	153.7
		%Deficit	-6.64	-8.55
2	**Weight (kg)**	M±SD	35.48±8.40	36.80±9.18
		Range	22.00-55.00	24.00-55.00
		Standard	40.8	40.95
		%Deficit	-13.04	-10.13

Table 2: Data on Body Circumference of Subjects

Sr. No.	Parameters		Girls	Boys
1.	MUAC* (cm)	M±SD	22.74±25.00	25.72±5.48
		Range	18.00-36.00	18.00-38.00
		Standard	24.35	24.65
		% Deficit/Excess	-6.61	+4.34
2	Waist Circumference (cm)	M±SD	59.92±10.27	63.12±8.56
		Range	25.00-73.00	35.00-81.00
		Standard	67	66
		% Deficit	-10.56	-4.36
3.	Hip Circumference (cm)	M±SD	72.60±10.13	74.76±8.34
		Range	34.00-87.00	47.00-89.00
		Standard	80.35	77.25
		% Deficit	-9.65	-3.22

*-Mid upper arm circumference

Table 3: Data on Skinfold Measurements of Subjects

Sr. No.	Parameters		Girls	Boys
1.	Biceps skinfold thickness (mm)	M±SD	8.28±1.57	8.52±1.42
		Range	5.00-12.00	5.00-10.00
2	Triceps skinfold thickness (mm))	M±SD	9.08±1.15	9.00±1.58
		Range	8.00-12.00	5.00-12.00
		Standard	11.6	8.2
		% Deficit/Excess	-28.62	+3.90
3.	Subscapular skinfold thickness (mm)	M±SD	8.52±1.92	8.96±1.90
		Range	5.00-12.00	6.00-14.00
		Standard	7.6	6.3
		% Excess	+12.11	+42.54
4	Suprailiac skinfold thickness (mm)	M±SD	8.96±1.67	8.36±1.58
		Range	6.00-12.00	5.00-10.00
		Standard	8.2	5.95
		% Excess	+9.27	+40.50

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Table 4: Data on Intake of Energy and Energy giving Nutrients by Subjects

Sr. No	Parameters		Girls	Boys
1.	Energy (kcal)	M±SD	1231.33±380.85	1093.63±164.44
		Range	800.00-2575.60	800.00-2184
		RDA	2170	2470
		"t" Values	12.32*	41.86*
2	Carbohydrate (g)	M±SD	162.28±41.29	166.65±37.52
		Range	89.00-303.60	85.00-246.50
3.	Protein (g)	M±SD	51.05±25.11	39.62±14.65
		Range	26.00-122.80	26.00-82.52
		RDA	46.15	46.1
		"t" Values	0.97	2.21**
4	Fat (g)	M±SD	38.09±13.02	41.59±20.92
		Range	16.43-68.60	20.90-96.40

* - Significant at both 5 % and 1% levels ($p<0.01$); ** - Significant at 5 % level but insignificant at 1 % level ($0.01<p<0.05$); Values without any mark indicate insignificant difference at both 5% & 1% levels ($p>0.05$).

Table 5: Data on Intake of Vitamins by Subjects

Sr. No.	Parameters		Girls	Boys
1	Carotene (µg)	M±SD	1434.02±966.12	825.19±707.08
		Range	339.82-3797.70	194.74-2665.15
		RDA	4800	4800
		"t" Values	17.42*	28.10*
2	Thiamine (mg)	M±SD	1.78±0.83	1.66±0.66
		Range	0.35-4.77	0.66-3.08
		RDA	1.1	1.23
		"t" Values	4.09*	3.25*
3	Riboflavin (mg)	M±SD	2.53±1.41	2.68±2.09
		Range	1.10-7.69	0.76-11.85
		RDA	1.3	1.45
		"t" Values	4.36*	2.94**
4	Niacin (mg)	M±SD	20.85±29.68	55.36±77.31
		Range	1.63-119.40	4.72-255.90
		RDA	13.5	15.5
		"t" Values	1.23	2.57**
5	Vitamin C (mg)	M±SD	106.49±68.20	74.50+-48.23
		Range	46.21-308.98	11.09-186.70
		RDA	40	40
		"t" Values	78.22*	51.33*
6	Folic Acid (µg)	M±SD	201.06±74.18	217.04±50.33
		Range	27.20-413.60	108.42-307.80
		RDA	145	145
		"t" Values	3.77*	7.15*

* - Significant at both 5 % and 1% levels ($p<0.01$); ** - Significant at 5 % level but insignificant at 1 % level ($0.01<p<0.05$); Values without any mark indicate insignificant difference at both 5% & 1% levels ($p>0.05$).

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Table 6: Data on Mineral Intake by subjects

Sr. No.	Parameters		Girls	Boys
1.	Calcium (mg)	M±SD	572.96±272.95	499.12±245.72
		Range	157.56-1217.80	160.25-1056.10
		Standard	800	800
		"t" Values	25.15*	26.43*
2	Phosphorus (mg)	M±SD	1108.28±1195.4	737.23±276.13
		Range	260.75-6629.00	148.90-1477.80
		Standard	800	800
		"t" Values	15.40*	73.56*
3.	Iron (mg)	M±SD	46.12±104.59	28.45±34.68
		Range	6.88-128.87	5.71-148.39
		RDA	27	27
		"t" Values	4.93*	3.99*
4	Magnesium (mg)	M±SD	300.68±170.53	260.22±47.05
		Range	47.54-1033.40	152.57-320.31
		Standard	185	142.5
		"t" Values	3.39*	12.87*
5	Zinc (mg)	M±SD	10.97±27.88	3.55±0.90
		Range	1.78-134.33	1.76-5.23
		Standard	10	10
		"t" Values	0.17	35.83*
2	Sodium (mg)	M±SD	2249.49±105.62	2292.72±122.58
		Range	2077.38-2496.00	2118.59-2599.39
		Standard	2000	2000
		"t" Values	82.88*	69.46*
1.	Potassium (mg)	M±SD	1277.20±384.53	1354.70±521.74
		Range	378.09-2227.19	747.39-3334.12
		Standard	1550	1500
		"t" Values	36.76*	1.39

* - Significant at both 5 % and 1% levels ($p<0.01$); ** - Significant at 5 % level but insignificant at 1 % level ($0.01<p<0.05$); Values without any mark indicate insignificant difference at both 5% & 1% levels ($p>0.05$).

Table 7: Data on Total Fiber Intake by Subjects

Sr. No.	Parameters		Girls	Boys
1.	Total Dietary Fibre (g)	M±SD	19.60±6.72	20.26±10.81
		Range	8.01-34.01	12.54-65.63

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