INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE & TECHNOLOGY
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www.vmsindia.org

ENERGY INTAKE, ANTHROPOMETRIC MEASUREMENTS AND AEROBIC WORK CAPACITY OF YOUNG FEMALE RUNNERS

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ABSTRACT:
This study deals with the determination of the effect of regular sports training on physical indices and aerobic work capacity of young female runners. A total of 40 young female runners (10-15 yrs) were selected from a leading residential sports training Institute of Vidarbha. Runners were studied for a period of one year at the interval of 0, 3, 6, 9 and 12 months. Seven day's dietary recall was used to calculate macro-nutrient intake. Derivation of body fat % (BF %) and fat free mass (FFM) was done using total skinfolds at biceps, triceps, subscapular & suprailiac. Annual increment in height & weight of runners by 5.9 cm & 5.2 kg was noticed. FFM showed an increase while BF % showed a decrease at 12 months indicating positive influence of sports training. There was significantly higher daily mean intake of energy and energy yielding nutrients as compared to recommended dietary allowances (RDAs) ($p<0.01$). Subjects were rated superior for VO2max. The results of this study tend to confirm the fact that regular engagement in sports lead to decrease in BF %, to a corresponding increase in FFM.
Keywords: Energy intake, skinfolds, body fat, lean body mass

INTRODUCTION:

Sports play a significant role in the lives of many people around the world. Sport provides a significant moral function both for the individual and for society at large. Sport may serve as a "social union" in a society. The importance of sports in the life of a young student is invaluable. Sports play a pivotal role in the makeup of a young athlete, especially in the middle school to high school years where student athletes are much more mature and mentally developed.

Running is simply defined in athletics terms as a gait in which at regular points during the running cycle both feet are off the ground (en.wikipedia.org/wiki/Running). Running is both a competition and a type of training for sports that have running or endurance components. As a sport, it is split into events divided by distance. Running races are contests to determine which of the competitors is able to run a certain distance in the shortest time. Today, competitive running events make up the core of the sport of athletics. Events are usually grouped into several classes, each requiring substantially different athletic strengths and involving different tactics, training methods, and types of competitors.

Physical characteristics and body composition have been known to be fundamental to excellence in athletic performance. Specific anthropometric characteristics are needed to be successful in certain sporting events. In athletes, body composition measures are widely used to prescribe desirable body weights, to optimize competitive performance, and to assess the effects of training (Sinning, 1996). It is generally accepted that a lower relative body fat is desirable for successful competition in most of the sports. This is because additional body fat adds to the weight of the body without contributing to its force production or energy producing capabilities, which means a decrease in relative strength. It is obvious that an increased fat weight will be detrimental in sporting activities where the body is moved against gravity (e. g. high jump) or propelled horizontally (e. g. running). Physical characteristics and body composition have been known to be fundamental to excellence in athletic performance (Mathur & Salokun, 1985). Specific athletic events require different body types and weights for maximal performance (American Dietetic Association, 1987). Today, it has been widely accepted by the experts that top performance in sports is achieved if an athlete possesses the basic anthropometric characteristics suitable for the event.

For all ultra-runners, the critical determinant of success is their ability to sustain a constant high rate of energy output for a prolonged period of time. During such prolonged efforts, nutrition increasingly impacts on running performance. Carbohydrate is the prime fuel needed to sustain high rates of prolonged exercise. However, carbohydrate stores in the muscle and liver are limited. With specific ultra-endurance training the body adapts to spare

muscle carbohydrate reserves and favors using fat energy reserves as a prime fuel source during running. Adequate intake of protein & micronutrients are key factors for the success in sport performance. Appropriate rest and nutrition between sessions support the needs of the runners (www.ultrarunningltd.co.uk/.../nutrition/nutritional-demands-of-ultra-run...& Sawka et al., 2007).

Utilization of data on body measurements for the evaluation of nutritional status and general health of players is very much in need. The objective of this research was to determine the effect of physical activity through running on dietary intake, body composition and aerobic work capacity (AWC) in young females

METHODOLOGY:

A total of 40 girls (10-15 yrs.) engaged in regular practice of running and participating in different sport tournaments were selected from Vidarbha's (Maharashtra, India) leading residential sports training institutes. The runners who were regularly undergoing training and practice schedules were of main choice.

Dietary (seven day's recall), anthropometric (height and weight) and body composition (total skin folds) measurements were assessed at tri monthly periods for one year using standard methods. Body density was estimated based on total skin fold measurements from biceps, triceps, subscapular and suprailiac (Durnin and Rahaman, 1967). BF % & FFM (kg) of runners was calculated using the methods of Siri (1956) and Cole et al. (1997), respectively.

Mean data on dietary intake and anthropometric measurements of runners were compared with reference standards & RDAs (Satyanarayana, 1991; Whitney and Rolfes, 1994; Gopalan et al., 2012; Indian Council of Medical Research (ICMR), 2009). Correlations between various parameters were derived using Pearson's Product Moment Coefficient of Correlation. A level of probability at both 0.05 and 0.01 levels of significance was assumed to draw conclusions.

RESULTS AND DISCUSSION:

Data on mean height & weight of runners is shown in Table 1. Annual increment in height & weight of runners was noted as 5.9 cm & 5.2 kg, respectively (Table 1). Mean height of runners during 0 & 3 months was found to be less than the reference height for age; however, during 6, 9 & 12 months of study period, mean height of runners was found to be more than the standards ($p>0.05$).

Periodical mean body weights of runners were found meeting the standards for age, however, differences were insignificant ($p>0.05$). In the present study, correlation between height and weight was stronger and highly significant in players. Runners were young and growing and hence, gain in weight over a period of one year was noticed.

Mean values for body composition measurements of runners are shown in Figure 1.

Reduction in mean total skinfolds (biceps + triceps + subscapular + suprailiac) and BF content was noticed at the end of study period for runners. Mean FFM increased at the end of study period (3.05 kg). Increasing trend was noticed for body weight and FFM whereas decreasing trend was noticed for total skinfolds and BF content of runners. A physically active life is stated to develop lean body mass at the expense of fat (Parizkova, 1973; Fox, 1984; Walberg, 1984; Khanna et al., 1996) as has also been observed from the results of the present study. An increase in FFM reflected a simultaneous decrease in BF % indicating a beneficial effect of regular sport training on health. FFM reflected high and positive correlation with body weight (r 0.95, $p<0.01$).

Table 2 demonstrates overall mean values of energy and major nutrient intake of players.

Mean energy intake of runners was 5765±422 kcal with 71.35% more than their respective RDAs. Deuster et al. (1986) reported lower caloric intake among female runners. The overall mean values of major nutrients were found to be significantly higher than their respective RDAs. Maximum portion of dietary energy was found to be derived from carbohydrates with % excess calculated as 139.14 (Table 1). Mean values of protein & fat intake of runners were found to be more than RDAs (% excess: 32.99 & 92.33, respectively). Intake of energy, protein and carbohydrate reflected high negative correlation with BF % (r -0.87, r -0.90 and r -0.95, respectively, $p<0.01$). In contrast, LBM reflected very high and positive correlation with the intakes of energy, protein and carbohydrate (r 0.66, r 0.78 and r 0.79, respectively, $p<0.01$). Intake of energy, protein and carbohydrate reflected high negative correlation with BF % (r -0.85, r -0.90 and r -0.91, respectively, $p<0.01$). In contrast, FFM reflected very high and positive

correlation with the intake of energy, protein and carbohydrate (r 0.69, 0.74 and r 0.71, respectively, $p<0.01$).

Fitness can be measured by the volume of oxygen one can consume while exercising at one's maximum capacity. VO_2max is the maximum amount of oxygen in millilitres one can use in one minute per kilogram of body weight. Those who are fit have higher VO_2max values and can exercise more intensely than those who are not as well conditioned. The result of aerobic work capacity of runners judged by the twelve minute run test and VO_2max is shown in Table 3.

Mean distance covered in a 12 minute run test and VO_2max were found to be higher during 12 months of study period than that during the start of the study period ($0.05<p<0.01$). In comparison with the standard norms, performance assessment of runners based on the mean distance covered in 12 minutes was found to be superior during both 0 month & 12 months.

Aerobic work capacity reflected a high positive and significant correlation with FFM (r 0.91, $p<0.01$). Aerobic work capacity showed a very low and positive correlation with BF % (r 0.19, $p>0.05$).

CONCLUSION:

The results of this study tend to confirm the fact that regular engagement in sports like running lead to decrease in BF %, to a corresponding increase in FFM which clearly depicts a relationship between sports training and a tendency towards a healthier life. Regular athletic training coupled with proper nutrition can contribute significantly to physical fitness and sports performance.

Table 1: Mean Height and Weight of Runners

Study Periods	Height (cm)	Annual Increment in Height (cm)	Weight (kg)	Annual Increment in Weight (kg)
0 Month	148.8		41.5	
3 Months	149.6		43.1	
6 Months	151.20	**5.9**	44.1	**5.2**
9 Months	153.30		44.9	
12 Months	154.70		46.7	

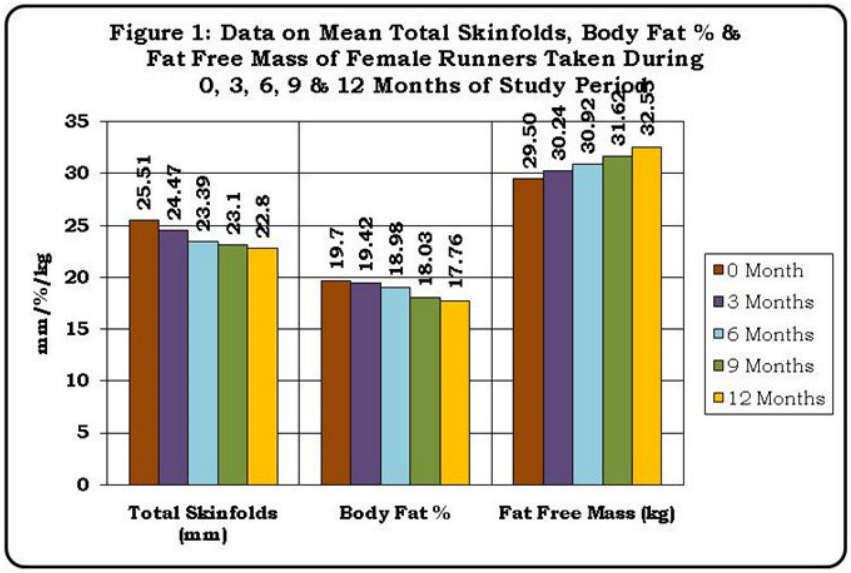

Table 2: Data on Mean Daily Energy and Major Nutrient Intake of Runners							
Energy (kcal)		**Carbohydrate (g)**		**Protein (g)**		**Fat (g)**	
M±SD	**% Excess of RDA***	**M±SD**	**% Excess of RDA■**	**M±SD**	**% Excess of RDA***	**M±SD**	**% Excess of RDA***
5765±422	+71.35	889±52.44	+139.14	155.11±9.67	+32.99	162.6±8.76	+92.33
* RDAs referred from **Satyanarayana (1991);** ■ RDAs referred from **Whitney and Rolfes (1994).** All values are significantly different from RDA, $p < 0.01$.							

Table 3: Results of Field Test and VO_2max of Runners				
Parameters	**Distance Covered (meters)**		**VO_2max (ml/kg/min)**	
	0 Month	**12 Months**	**0 Month**	**12 Months**
M ± SD	3104 ± 207	3235 ± 263	58.11	61.04
Range	2000-3400	2000-3600	33.42-64.72	33.42-69.20
Performance Assessment	Excellent	Excellent	Superior	Superior

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