Effect of Eight Weeks Swimming Training on Health Related Physical Fitness and Selected Biochemical Parameters of Adult Males

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ABSTRACT

Introduction: Increment of physical activity levels and exercise training modified body composition and decrement of body fat and body mass. Creating an active lifestyle with physical activity is the best prevention of obesity and its risk factors in heart disease. The aim of the present study was to find out the effect of training on health related physical fitness and biochemical variables of male swimmers.

Methods: Fifteen male residential, non-swimmers age between 22-25 years were volunteered for the study. 8 weeks swimming training was imparted and prior and after the swimming training the criterion parameters viz. Health related physical fitness and biochemical parameters were measured following standard testing protocol.

Results and discussions: Body mass index (BMI), Physical efficiency index (PEI), endurance, flexibility increased significantly as a result of swimming training and body fat percentage decreased after swimming training whereas, strength remains unaffected. In case of biochemical parameters Cholesterol , Triglyceride and high density llipoprotein cholesterol (HDL) were increased significantly whereas, very low density lipoprotein cholesterol (VLDL) and low density lipoprotein cholesterol (LDL) decreased significantly and fasting blood sugar (FBS), serum albumin and serum globulin remain unaffected following 8 weeks of swimming training.

Conclusion: Thus it can be summarized that as swimming involves most of the major muscle groups to perform, it can be considered as a single training element to reduce the risk factor of heart disease and obesity.

Key words: Health related physical fitness, BMI, PEI, Cholesterol, Triglyceride, HDL, LDL, VLDL, FBS, albumin and globulin.

INTRODUCTION:

Increment of physical activity levels and exercise training modified body composition and decrement of body fat and body mass. Creating an active lifestyle with physical activity is the best prevention of obesity and its risk factors [3, 4]. The results of previous study indicated that long-term physical activity and exercise training are the best way in primary and secondary prevention of chronic diseases, especially obesity and metabolic disorders in men and women with different age ranges. The results of previous study indicated that long-term physical activity and exercise training have beneficial effects on body fat and body mass [4-13]. Conroy (2007) showed in a 10 years period study about the role of sports and physical activity in prevention of cardiovascular disease risk factor that increased physical activity levels would lead to decrease these risk factors. Active women also have a healthier life, lower body mass and better risk factor pattern compared to inactive women. Body mass index is lower in active women compared to inactive women [7]. Some researchers studied aerobic, anaerobic and combined training on body composition, physical fitness and health related metabolic factors levels in women. Results showed that decrement of weight in aerobic groups was significant, but weight changes in combined and anaerobic training groups weren't significant. There was a significant decrease of body fat percent and significant increase of Vo_{2max} in combined and anaerobic training groups. They concluded that aerobic training, anaerobic training and combined training had positive effects on fitness, body composition and metabolic risk factors related to obesity in females [4,5, 8, 9, and 10]. Mora (2006) showed that aerobic training would lead to significant changes in cardiovascular fitness, body composition and weight. Aerobic training would lead to significant decreased in body weight, waist circumference and sub skin folds fat [12].

Water exercise, such as swimming, is one of women' most preferred methods of exercise. Swimming is the exercise of choice for many women who decide to start a fitness program. This is a form of exercise that is done in the water involves using rhythmic movement performed at different levels of intensity or difficulty. Swimming increases cardiovascular conditioning and, at the same time, help to tone muscles in the body. Today, women make up the majority of swimming participants. It is the women's population's increased interest in this form of exercise that has caused the greatest growth in water exercise fitness programs. Swimming, exercise is a good exercise choice for women. Many women refrain from physical activity because they are afraid of injury. Many women suffer physical impairments that limit their ability to participate in land exercise. There is less chance of injuries to occur when exercising in the water. A swimming workout causes less compression on the joints than is experienced during land exercise. The buoyancy of water reduces the muscular-skeletal stress put on the body. Buoyancy also helps to protect women from dynamic and fast moving. It puts less strain on the body and helps to prevent many of the injuries that women receive during land aerobics that produce jarring and bumping movement. Buoyancy also allows for strengthening and toning in muscles with less fatigue and soreness. These results induced by the use of all the major muscles in the body. In the water, women can perform many exercises that would be impossible for them on the land. Swimming is becoming more and more popular with women and, in the future, many women, decide to join this type of fitness program [1, 2, and 3].

Several studies have been conducted to determine whether water exercise produces benefits for the women participants. Takeshima et al. (2002) conducted a study on women and reported that swimming helped to improve the cardiovascular fitness, muscle strength, power, agility, flexibility, pulmonary functions, and blood lipids of the women [14]. Wininger (2002) and Wantanabe, Takeshima, Okada, and Inomata (2000) conducted studies on women in swimming programs and concluded that swimming helped to reduce the rate of obesity among the participants [18,19]. Swimming trainings would cause decrease in body composition factors such as body mass, body mass index, body fat percent and waist circumference [4, 9]. In conclusion, water exercises, such as swimming, are many positive outcomes that can be attained from this form of exercise, including physiological, psychological, and other benefits. Swimming is a form of exercise that helps to increase strength, endurance, flexibility, and fitness levels.

Swimming is one of the most exciting of the Olympic sports. The tournament competitive schedules of top swimmers and their training programs are arguably more severe than in any other sports. Training can improve the performance of the swimmers [16].

The training induced changes observed in various biochemical variables can be attributed to appropriate load dynamics. This would enable the coaches to assess the current status of an athlete and the degree of training adaptability and provide an opportunity to modify the training schedule accordingly to achieve the desired performance [12]. Assessment of blood lactate levels during pre and immediately post exercise can be useful to determine the lactate threshold level during training and competition [18]. Hemoglobin represents the iron status of the body [18,19]. Oxygen is transported to muscle primarily by hemoglobin [18, 19]. During aerobic exercise the demand of oxygen increases at the working muscle, so an optimum level of hemoglobin is required to perform at the highest level with high intensity. As swimming performance depends much on the aerobic component of the athlete, therefore the players need to maintain a normal hemoglobin level to optimize performance. The serum level of urea and uric acid are used for assessment of training related stress [20]. During the training these parameters may be evaluated at regular intervals to assess the training load imposed on the athlete [20]. In addition, the urea and uric acid accumulation are most frequently used as a measure of protein catabolism and degradation of adenonucleotides [21, 22]. Lipids have important beneficial biological functions that include the use of triglycerides, for energy production or as stored fat in adipose tissue and the use of cholesterol as a component, in conjunction with phospholipids of cellular membranes or in the synthesis of steroid hormones [23, 24]. Elevated plasma cholesterol concentrations have been implicated in the development of coronary artery disease (CAD) [23, 24, 25,26]. Therefore, monitoring of lipid profile in athletes can provide valuable information about their metabolic and cardiovascular status. The present study has been focused on elite swimmers as the sport is popular throughout the world, but limited studies are available for swimmers. Although some of the studies reviewed on the physiological characteristics and the training aspect of the swimmers at the international level [3], limited studies have been reported on the biochemical parameters of Indian swimmers. Aerobic exercise stimulates heart, lungs and all working groups of muscles and produces valuable changes in body and mind. Many physiological changes are determined by daily aerobic exercises [42].

Considering the current literature, the purpose of the study was to investigate the effects of 8 weeks of swimming training on selected health related physical fitness and biochemical parameters of adult males.

METHOD:

Subjects: Fifteen male residential, non-swimmers were volunteered for the study. The age group of the subjects was between 22-25 years.

Measurements of personal data:

Height : Height of the subjects was measured with the help of stediometer and it was recorded in centimeters.

Weight: Weight of the subjects was measured with the help of electronic weighing machine and it was recorded in kilogram.

Body Mass Index (BMI): Body mass, weight in kg / height in m^2 [28]

Measurement of Health Related Physical Fitness:

Cardiovascular Endurance: Cardiovascular endurance was measured by the bench step test as described by Bill Tancred [29].

Body Fat Percentage: Body fat percentage was measured following sum of three site skin fold measurements with the help of Astrand's Nomogram [29].

Flexibility: Flexibility of the subjects was measured through Sit and Reach test and it was measured in inches [28].

Muscle Strength: Muscle Strength of the subjects was measured by Leg lift strength test using strength dynamometer [28].

Muscle Endurance: Muscle Endurance was measured by sit-ups test.

Measurement of bio-chemical parameters:

Estimation of, Lipids and Lipoproteins A 5ml of venous blood was drawn from an antecubital vein after a 12 hrs fast and 24 hrs after the last bout of exercise for subsequent determination of total cholesterol (TC), triglycerol (TG), high density lipoprotein-cholesterol (HDL-C) and low density lipoprotein-cholesterol (LDL-C). Serum total cholesterol [29], serum triglycerol [30]. Fasting blood glucose has been measured through glucometer. Albumin and globulin were measured through pathologically.

Table -1. Swimming training protocol:

Week	Frequency	Duration	Distance
1st and 2nd	3days/week	45 minutes	25x 2 mts
3rd and 4th	3days/week	45 minutes	25x 3 mts
5th and 6th	4days/week	60 minutes	25x4 mts
7th and 8th	5days/week	90 minutes	25x6mts

N.B. Before and after the swimming training programme 20 minutes of warming up and 10 minutes of cool down programme was applied to the students.

Statistical Analysis:

For statistical purpose Student "t" was applied to the study and the level of significance was fixed at .05 level of confidence.

RESULT AND DISCUSSION:

Table-2 Personal Characteristics of the students

Variables	Pre test		Post test		t value
	mean	sd	mean	sd	
Weight (kegs)	56.8	7.03	55.2	6.36	2.95 *
BMI (kg/m^2)	21.28	2.15	20.6	1.89	4.19 *
RHR (beats/min)	72.33	1.72	66	3.05	4.25 *

* Significant at 0.05 level

Table -2 represent the personal characteristics of the subjects. The weight of the subjects was significantly improved whereas BMI and resting heart rates of the students were significantly decreased.

Table-3 Health related Physical Fitness of the students

Variables	Pre test		Post test		t value
	mean	sd	mean	sd	
Body fat % (mm)	21.77	4.56	20.77	4.45	5.80 *
PEI	78.117	14.65	82.31	13.54	2.65 *
Flexibility (inc)	3.83	1.24	4.07	1.37	5.55 *
Strength (kgs)	119.53	20.92	133.53	21.86	.00037
Endurance (No)	52.4	18.39	57.4	19.46	8.62 *

* Significant at .05 level

Table-3 reveals that body fat percentage of the subject significantly decreased after 8 weeks of swimming training. The body weight decreased as a result of Significant decreased in body fat percentage of the trainees. 8 weeks swimming training requires prolonged efforts which facilitate the significant decreased of the fat percentage of the students. Physical efficiency index is an indicator of cardio respiratory efficiency of an individual, which is depends upon the resting bradycardia and vo$_{2\,max}$ .In the present study PEI of the subject improved significantly due to resting bradycardia. Flexibility is a highly trainable aspect. Due to regular participation of swimming protocol for 8 weeks the mobility of the joints improved which facilitated the significant improvement of the subjects. On the other hand, strength which was measured by strength dynamometer did not show any change after swimming training.

Table 4. Bio-chemical parameters of the students

Variables	Pre test		Post test		t value
	mean	sd	mean	sd	
Cholesterol (mg/dl)	188.33	14.04	136.07	6.44	5. 06*
Triglyceride mg/dl)	98.73	10.28	85	5.8	2. 8*
HDL (mg/dl)	27.33	1.75	32.73	2.49	3. 98*
LDL (mg/dl)	84.33	9.95	72.64	6.13	5. 52*
VLDL (mg/dl)	21.2	3.12	16.6	1.04	3. 53*
Fasting Blood sugar (md/dl)	85.27	6.97	76.81	5.35	.000
Albumin (mg/dl)	4	.33	4.03	.31	.37
Globulin (mg/dl)	3.14	.28	3.16	.16	.42

 * Significant at .05 level

Table 4 revels that all the lipid profile parameters were improved significantly following 8weeks of swimming training. Serum cholesterol, triglyceride, LDL and VLDL were significantly decreased following swimming training. The body fat percentage of the subject significantly decreased, which resulted in significant reduction of serum cholesterol, triglyceride, LDL and VLDL of the subject following swimming training. On the other hand, HDL or good cholesterol increased following training.

Lipids and lipoprotein profile indicate the cardiovascular and the metabolic status of the athlete [21,22]. In the present study, a significant elevation (P < 0.05) in high density lipoprotein cholesterol (HDL-C) level was noted among the swimmers in preparatory and competitive phases of training when compared to baseline data. On the other hand, the significant reduction (P < 0.05) in total cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol (LDL-C), ratios of TC/HDL-C and LDL-C/HDL-C levels were observed among the swimmers in the preparatory and competitive phases of training when compared to pre training data. Further, significant (P < 0.05) decline in TC, TC/HDL-C and LDL- C/HDL-C was noted among the swimmers when comparing the preparatory phase with that of the competitive phase of training. These changes might be due to training. As the training load increased from pre-training period to preparatory phase and competitive phase, the level of total cholesterol, triglyceride and LDL-C was decreased, and the level of HDL-C increased gradually. The possible reason for the reduction in total cholesterol, triglyceride and LDL-C; and elevation in HDL-C was exercise. Especially endurance exercise increases metabolism and utilization of blood lipids and lipoprotein for energy production [21,22]. Our findings are in conformity with the observations of other researchers in their recent studies. Cross-sectional studies reported an increase in HDL-C level and decrease in triglyceride level after exercise [31,32]. FBS, serum albumin and serum globulin remain unaffected following 8 weeks of endurance training.

CONCLUSIONS:

Within the limitations of the present study the following conclusions were drawn

1. The body mass index of the subject was significantly decreased following 8weeks of swimming training.
2. Body fat percentage was significantly decreased following swimming training.
3. PEI was improved significantly following swimming training.
4. Flexibility improved following swimming training.
5. Strength remains unaffected following 8 weeks of swimming training.
6. Endurance increased significantly following 8 weeks of swimming training.
7. Cholesterol and Triglyceride were increased significantly following 8 weeks of swimming training.
8. VLDL and LDL decreased significantly following swimming training.
9. FBS, serum albumin and serum globulin remain unaffected following 8 weeks of swimming training.

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