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Effects of Swimming Combined Training on Lipid Profiles in Male Adolescent Swimmers

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Abstract
Background: *The present study was carried out with a view to investigate the effects of swimming combined training on lipid profiles in male adolescent swimmers.*
Methods & Materials: *The study followed a pre test and post test design without control group. The study was conducted in the YMCA college of Physical Education, Chennai for a period of two months. The students included in the study are 18 male adolescent swimmers of age group 13 to 15 years who were inmates of YMCA sports school hostel .The students height, weight was taken and BMI calculated and Lipid profile was taken before at the beginning of the aerobic training period and finally at the end of the study period of two months with their consent.*
Result: *There was a significant increase in height, weight, BMI and HDL ,VLDL and triglycerides when compared to Total Cholesterol and LDL , after two months. The statistical procedures were performed with help of the statistical package namely IBM SPSS Statistics-20. The P values less than or equal to 0.05 (P≤ 0.05) were fixed as level significance and treated as statistically significant.*
Conclusion: *Regular monitoring of the biochemical variables of the swimmers is essential optimize their general health, metabolic and cardiovascular status which has direct relation with their performance.*
Keywords: *Swimmers, BMI, Lipidprofile. Aerobic training.*

Introduction

Swimming is a method of propulsion through water, the value of which, as a physical activityand as a recreation, is regarded as second to none [2]. Swimming is one of the most exciting of the Olympic sports. To achieve the best possible performance, the training has to be designed according to the principles of periodization [2]. 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 [2].

Biochemical parameters like blood lactate, hemoglobin, urea, uric acid and lipid profiles have an advantage in regulating the training load. Lipids have important beneficial biological functions that include the use of triglycerides, for energy production or as stored fat in adipose tissue and use of cholesterol as a component, in conjunction with phospholipids of cellular membranes or in the synthesis of steroid hormones [3,4]. Elevated plasma cholesterol concentrations have been implicated in the development of coronary artery disease (CAD) [3,4,5,6]. The primary function of high density lipoprotein cholesterol (HDL-C) is to serve as the cholesterol acceptor in the reverse transport and excretion of cholesterol [5,6]. On the other hand low density lipoprotein cholesterol (LDL-C) is directly associated with cholesterol [3,4,5,6]. It has been reported that LDL-C has the greatest correlation to severity of coronary atherosclerosis [3,4,5,6]. Therefore, monitoring of lipid profile in athletes can provide valuable information about their metabolic and cardiovascular status.

The present study has been focused on swimmers as limited studies are available on 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.

So the present study was undertaken to investigate the effects of swimming combined training on lipid profiles in male adolescent swimmers.

Methods and Material

The study was conducted at YMCA College of Physical Education, Nandanam, and was approved by the Ethical Committee of the Institute. The study was conducted in the YMCA swimming pool for a period of two months. The students included in the study are 18 male adolescent swimmers of age group 13 to 15 years who were inmates of YMCA sports school hostel. The study followed a pre test and post test design without control group. After obtaining prior permission from the headmaster, the subjects included in the study were briefed about the study and its importance by the investigator so that they would cooperate and make possible the collection of the necessary data related to the study. The participants were studied for body measurements, biochemical indexes, initially at the beginning of the aerobic training program and finally at the end of the study period of two months.The participants were asked to assemble on a stipulated day and time , preferably in the morning and their body measurements were taken by the investigator to establish accuracy and validity.

Height of the subjects was determined using the stadiometer and recorded in metres.

The subjects were weighed bare feet with their exercise suits on and correction for clothing was done by weighing the common exercise suits and determining the average, which was subtracted from the weight recorded. The weight was recorded in kilograms.

Body mass index (BMI) was calculated using the formula

Body Mass Index = Weight (kg) / Height (m^2)

Training program was performed for two months ,8 hours per day in two sessions daily.The training was divided into 4 hrs in the morning and 4 hrs in the evening which were followed for 5days per week. Total time of training program divided as swimming program (4hours), conditioning (3 hours)warming up (30 min), and cooling down (30 min) in the morning and evening .Subjects eating habits and other daily physical activity in groups didn't change. Dependent variables included lipid profiles such as TC, TG, LDL_C, and HDL_C measured at beginning and the end of training program in all the subjects. Fasting blood sample was taken for measuring serum concentration of TC, TG, LDL_C and HDL_C with enzymatic endpoint method after 9 to 12 hours of fasting, from left Antecubital vein at medical diagnosis laboratory. The samples were separated by centrifugation at 2400 rpm. Lipid profile was analysed in kone lab 60 using commercially available kit by erba. For adequate quality control both normal, abnormal reference control serum solutions & calibrators were run before each batch. Other factors influencing the quality, like proper functioning of instrument, temperature, glassware, cuvettes, distilled water were taken care.

The LDL cholesterol can be measured using both direct and indirect method.

The Friedewald's equation is the most widely used indirect method. Cholesterol, TGL and HDL cholesterol are measured and LDL cholesterol is calculated from the primary measurement using the empirical equation of Friedewald et. at.

LDL Cholesterol = Total cholesterol – (HDL cholesterol - TGL / 5)

Statistical analysis and interpretations:

The continuous variables like height, weight and BMI were analysed in terms of averages. The lipid profiles were also analysed in terms of averages. The difference from before to after was interpreted by Students paired "t" test. The above statistical procedures were performed with help of the statistical package namely IBM SPSS Statistics-20. The P –values less than or equal to 0.05 ($P \leq 0.05$) were fixed as level significance and treated as statistically significant.

Results

The height and weight of the students before and after exercise was compared. Based on the height and weight the BMI of the students was computed. The table-1 shows the results of the subjects before and after the intervention.

The mean age of the study subjects was 14.3±0.8 years.

Table-1: The height, weight and BMI of the students before and after exercise.

Variables	Before (n=18)		After (n=18)		Improvements		Paired "t"	df	Sig.
	Mean	SD	Mean	SD	Mean	SD			
Height	156.6	9.7	158.6	9.5	1.9	0.6	12.907	17	P<0.001
Weight	45.9	8.1	47.6	8.2	1.7	1.6	4.461	17	P<0.001
BMI	18.4	2.0	21.0	2.1	2.6	1.1	9.436	17	P<0.001

Table 1, shows the height, weight and BMI before and exercise of the students. The mean height before exercise was 156.6±9.7 cm and after exercise was 158.6±9.5 cm. The mean improvement 1.9±0.6 was statistically very highly significant (P <0.001). The mean weight before exercise was 45.9 ± 8.1 kg. The mean weight after exercise was 47.6 ± 8.2 kg. The improvement of the mean weight was statistically very highly significant (P <0.001). The BMI (Body mass Index) before exercise was 18.4 ± 2.0 .The mean BMI after exercise was 21.0 ± 2.1.The improvement of the mean BMI was statistically very highly significant (P<0.001).

Table-2: The lipid profiles of the students before and exercise:

Variable	Before n=18		After n=18		Difference		't'	df	Sig P=
	Mean	SD	Mean	SD	Mean	SD			
Tot. Cholesterol	159.8	21.5	155.4	20.6	4.3	14.4	1.276	17	.219
HDL	67.2	3.6	63.8	3.0	3.4	4.3	3.420	17	.003
LDL	65.0	21.0	71.6	21.6	-6.7	16.5	1.715	17	.105
VLDL	26.7	5.6	22.2	2.7	4.6	5.1	3.820	17	.001
Triglyceride	133.9	27.9	110.8	13.3	23.1	25.3	3.871	17	.001

The above table -2 states the lipid profile of the children before and after exercise.

Mean differences of serum concentration of TC (159.8 ± 21.5 vs. 155.4 ± 20.6 mg/dl) before and after exercise was not statistically significant (P = 0.219).The mean HDL before exercise was 67.2 ± 3.6 mg/dl. The mean HDL after exercise was 63.8 ± 3.0 mg/dl. The difference of the means was statistically highly significant (P <0.003). The mean LDL before exercise was 65.0 ± 21.0 mg/ dl. The mean LDL after exercise was 71.6 ± 21.6 mg/ dl. The difference of the means was not statistically significant (P =0.105). The mean VLDL before exercise was 26.7 ± 5.6 mg/dl. The mean VLDL after exercise was 22.2 ± 2.7 mg/dl. The difference of the means was statistically very highly significant (P <0.001). The mean Triglyceride before exercise was 133.9 ± 27.9 mg/dl. The mean Triglyceride after exercise was 10.8 ± 13.3 mg/dl. The difference of the means was statistically very highly significant (P <0.001).

Discussion

Lipids and lipoprotein profile indicate the cardiovascular and the metabolic status of the athlete [4,7]. In the present study, a significant elevation (P < 0.05) in height, weight, BMI, high density lipoprotein cholesterol (HDL-C) ,triglyceride (TG), Very low density lipoprotein cholesterol (VLDL-C)level was noted among the swimmers. These changes might be due to training. The possible reason for the reduction in total cholesterol, LDL-C; and elevation in HDL-C, and triglyceride was due to exercise.

Especially endurance exercise increases metabolism and utilization of blood lipids and lipoprotein for energy production [4,5]. 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 [3,4,7]. A recent study showed significant increase in HDL-C and decrease in LDL-C level, with no change in triglyceride after 9 weeks of training [8]. Another study reported that 4 weeks of aerobic exercise training significantly decreased the levels of total cholesterol, LDL-C; and increased HDL-C [4].

Conclusion

The Lipid profile should be taken into consideration while administering training to the swimmers. Therefore, the results of this study indicated that swimming combined training was significantly modified lipid profiles in male adolescent swimmers, Therefore, more studies need to be done to show the optimum levels of intensity, duration and type of combination training for desirable effects on lipid profiles.

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