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The Effect of Diving in the Sea in the Morning and Evening on Blood Serum Fibrinogen of Diver Men

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Abstract: The aim of this study was to evaluate the effect of diving in the sea in the morning and evening on fibrinogen of men divers. Therefore, ten divers of Kohgiluyeh and Boyer Ahmad Red Crescent and Rescue volunteered to participate in the study with an average age of 32.83±2.63, weight 81.5±7.12 kg and height 178.73±2.88 cm. In the implementation of the present study, repeated pre-test and post-test with measuring were used. At 9 o'clock in the morning and three in the evening, the subjects shuttle dived for 20 min at a depth of 10 meters with an intensity of 40-50% of heart rate. Participants had a safety stop at a height of three meters to the water surface for five min. Before and after diving, seven cc blood samples were taken from all subjects. To analyze the results using descriptive statistics mean and standard deviation are offered and then fibrinogen is statistically analyzed in subjects using descriptive statistics (mean and standard deviations and drawing tables) and inferential statistics (independent t test and affiliates). To analyze the results, statistical analysis of variance with repeated measurements is used ($0.05 \geq \alpha$). During this research, it was proved that environmental pressure increase caused by diving at sea (10 m) does not have a significant effect on blood fibrinogen of the diver.

Key words: Diving, sea, fibrinogen, morning, evening

INTRODUCTION

Man has always seen sea and its endless sights t as a place full of surprises. Understanding the physical laws related to the underwater environment is important and any wrong choices and wrong method can lead to accidents and even death. Understanding these rules is as the base of how to act in underwater environments.

Calm world of waters with its silence take human to the depth of life and its wonderful harmony. Beauty, peace and tranquility of the underwater world with its animals have attracted human attention for many years and he is always searching for ways to penetrate into this mysterious world and understanding how marine life is (Bagherian, 2011). In each individual in swimming sport and diving, due to the sport-specific conditions, the body and its compounds especially blood sugar compounds undergo significant changes (Tetzlaff *et al*., 2006).

Fibrinogen: This is of the acute phase proteins synthesized in response to pro-inflammatory cytokines in the liver. Its changes in plasma levels is used to assess inflammatory responses. fibrinogen is derived from liver and has three chains of alpha, beta and gamma which have been linked with Di sulfate bonds.

Encoded by different genes, they are placed on chromosome four. Beta chain synthesis is the limiting step of fibrinogen synthesis and reacts to cytokine such as interleukin-6. Fibrinogen is the largest plasma protein and makes up 5.5% of total concentration of plasma proteins. Plasma fibrinogen level in the blood depends on genetic and environmental factors. There are two views about the plasma fibrinogen. Fibrinogen is not only as an inflammatory marker but as a part of hemostasis system dependent on thrombosis processes or a strong risk factor for cardiovascular diseases and as one of the main determinant of blood rheology by the effect on the accumulation of red blood (Abedi *et al*., 2014). Fibrinogen has a pivotal role in the initiation and progression of atherosclerosis. Fibrinogen directly increases the activity of endothelial cells and expression of adhesion molecules and leads to impaired endothelial function. Moreover, the main feature of fibrinogen is as the cofactor of accumulation of platelets and also the key ingredient of thrombin in blood coagulation. A significant inverse relationship has been observed between levels of plasma fibrinogen and thick fibrous covering atheroma plaque that leads to rupture and thrombosis (Hosseini *et al*., 2009). Based on the studies, it is suggested that patients with progressive atherosclerotic lesions show increased

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inflammatory activity which by measuring the plasma fibrinogen, it can be determined and used for predicting cardiovascular events in the future to (Edge *et al*., 2005).

Fibrinogen is a protein of high molecular weight whose plasma concentration is 100-700 mg dL^{-1}. Fibrinogen is produced in the liver and sometimes due to liver diseases its concentration reduces.

Based on the studies, it is suggested that patients with progressive atherosclerotic lesions show increased inflammatory activity that can be determined by measuring the plasma fibrinogen and use in general to predict cardiovascular events in the future (Sureda *et al*., 2009; Abedi *et al*., 2012b).

It has molecular fibrinogen, so in normal mode, trivial amount of it leaks to interstitial liquid through the blood vessels. Thus, considering that fibrinogen is a fundamental factor in blood coagulation process, the interstitial fluid usually does not coagulate. However if microvascular permeability increases pathologically so much fibrinogen leak into the interstitial fluids that this liquid can clot like plasma and whole blood. Several studies have been conducted regarding diving and its effects on the composition of the body's internal environment (Fougia *et al*., 2002). Diving is a sport that has many fans for recreational and professional and there many places for diving in Iran and given the importance of controlling antioxidant parameters, the need for knowledge and information giving is felt in the field and more importantly, muh research has not been done in this area. This study is among the first studies to examine the effects of 20-minute dive on fibrinogen. It is the first study that examines changes in levels of fibrinogen due to diving. In the present study, diving was for 20 min with an intensity of 40-50% of maximum heart rate at a depth of 10 meters. Among the inflammatory markers, fibrinogen is discussed in this study.

Uncontrollable limits:

- Failure to control weather conditions during the day diving
- Failure to control fixed-position for divers underwater without stress
- Decline in the number of samples
- Failure to control the speed of the water at a depth of 10 m

Research territory:

- Gender of participants: Divers were chosen from among men divers
- Age of participants: Divers were chosen aged 30-45 years
- The subjects of nutrition: Nutrition of divers was similar
- The area of conducting research was at the sea level of south coasts of Iran in Geshm Island

MATERIALS AND METHODS

With regard to the purpose and nature of research methods in this study was based on semi-empirical trial and thus carried out via pre and post-test in research variable (fibrinogen) and research plan was three in two.

Population, sample and sampling method: The population of the research team was Red Crescent and Rescue Divers of Kohgilouye Boyer Ahmad. Ten individuals were selected at random and after filling in the health questionnaire and consent form were chosen consciously.

Method of implementing research: At first, before conducting research, participants completed health questionnaire and general information and consent form. The subjects of this study were 10 divers all of whom have two star Sims degree of diving.

It should be noted that these divers were divers of Red Crescent and Rescue Divers of Kohgilouye Boyer Ahmad. It should also be noted that due to the fact that diving requires knowledge of techniques and skills and having certifications, researchers selected the sample from among the ones with the mentioned properties. To conduct the study, these participants will perform certain dives while monitored.

The method of diving was that the subjects dived for 20 min at a depth of 10 m with intensity of 40% reserved heart rate. Diving time (20 min) was from the beginning of entering water until getting out. It is also remarkable that at the depth of 3 meters to the water surface, they had safety stop for five min (Abedi *et al*., 2012a).

The intensity of the activity (40% of reserved maximum heart rate) was measured. This research was conducted in the waters of Qeshm. Activity heart rate = 40% (rest heart rate-maximum heart rate)+Resting heart rate.

Description of the demographic characteristics of the subjects:

- Digital scale (Kern PLS 400 Made in Germany)
- Buoyancy control devices

- Means of blood sampling (sterile needles and syringes, test tubes, medical cotton, alcohol and tape)
- Diving mask
- Height gauge to measure the height of subjects
- Diving fin
- Electrical transmitters heart rate (belt)
- Athletic belt
- Questionnaires to measure health status of participants
- Help rope to sweep divers underwater
- Diving tanks: with volume of 12 liters
- First-aid kit and oxygen
- Regulator
- Digital depth gauges to calculate the depth

RESULTS AND DISCUSSION

Statistical methods of descriptive analysis of data: Information obtained from the measured variables were described based on measures of central tendency and dispersion. To test the hypothesis, independent and independent tests were used. Significance level for all calculations was considered ($\alpha \leq 0.05$).

Description of the demographic characteristics of the subjects is shown (variables have been reported based on mean±standard deviation).

In Table 1 and 2, pretest and posttest of the levels of fibrinogen in the morning and evening are provided. Pre and post-test levels of fibrinogen in the morning and evening (results have been reported based on mean and standard deviation).

Table 1: Pretest and posttest of the levels of fibrinogen in the morning and evening are provided

	Group	
Variable	Morning	Evening
Age (years)	8.2±83.25	3.4±83.26
Height (cm)	88.5±33.173	88.2±73.178
Weight (kg)	16.7±6.77	12.7±5.81

Table 2: Pretest and posttest of the levels of fibrinogen in the morning and evening are provided

Group	Before diving	Immediately after diving
Diving in the morning	69.33±60.327	60.53±40.293
Diving in the evening	64.28±20.291	24.26±20.307

Table 3: Dependent and independent t-test results: fibrinogen changes in the group diving in the morning and evening

Group statistic	Timing	SD±M	Dependent (t)	Independent (t)
Diving in the morning	Pre-test	327.60±33.69	t = -1.16 p = 30.0	t = -1.35 p = 0.21
	Post-test	293.40±53.60		
Diving in the evening	Pre-test	291.20±28.64	t = 0.70	
	Post-test	307.20±26.24	p= 0.52	

Inferential analysis of data: The null hypothesis: diving at a depth of 10 m in the morning and evening does not have the same effect on men divers fibrinogen levels. In analyzing the effects of diving at a depth of 10 meters in the morning and evening, dependent t-test results in Table 3 show that the 20 min diving at a depth of 10 m in the morning has no significant effect on serum fibrinogen of men divers t (4) = -1.16 p = 0.30).

Moreover, dependent t-test results in this table show that the 20-minute dive at a depth of 10 meters in the evening has no significant effect on serum fibrinogen of men divers t (4) = 0.70 p = 0.52). Moreover, the independent t-test results in Table 3 show that the 20 min diving at a depth of 10 m in the morning and evening has the same effect on serum fibrinogen of men divers t (4) = -1.35 p = 0.21).

CONCLUSION

Given that sports activities can affect the fibrinogen, research on the effectiveness of diving can provide appropriate information for divers. However, there have been studies that examine changes in fibrinogen after a period of diving. Thus, this study seeks to answer the following question. Does 20 min of diving in the morning and afternoon at a depth of 10 m have a significant effect on fibrinogen?

The results of this study showed that increasing environmental pressure caused by deep-sea diving (10 m) in the morning and evening has no significant effect on fibrinogen. In relation to the effect of diving on these variables, there have been some studies the results of which are consistent with the present study. The 20 min dive with intensity of 40-50% of maximum heart rate at a depth of 10 m in the morning and evening does not have a significant effect on fibrinogen of men divers.

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