

## The Effects of Daily Rhythms on Sports Functions and Physiological Variables of Immune Elite Swimmers

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### Abstract

#### Introduction

Daily rhythm as one of the biological rhythms with a period of about 24 hours on various body systems and physiological responses affect on them. Body temperature is a fundamental variable as one of the specifications used daily rhythms The main purpose of this study was evaluating the effect of circadian rhythms on exercise performing and physiological variants of security system in swimmers.

#### Materials and Methods

In one study, before and after the 12 men swimmers in the league, of Fars Province with an average age of  $19.80 \pm 1.87$  years, had been invited, and after explaining the situation and also completed a written consent form purposefully participated in the study. To measure the length of 400m and 50 meters breast stroke timer QQ model CR2032 (China) was used. The one-way analysis of variance (ANOVA) was used to this study.

#### Result

Results showed body temperature significantly increased from 6:00 to 18:00. Circadian rhythms significantly showed increase from 6 to 18 ( $P < 0.05$ ); circadian rhythms significantly showed effect on performing record in 400m and 50m chest crawl swimming with decrease of influence in 18:00 rather than 6:00; also circadian rhythms significantly showed influence on Immunoglobulin A (IgA) in resting after 400m and after 50m swimming with increasing from morning to evening ( $P < 0.05$ ). But in Immunoglobulin G (IgG) not significant increase in 6:00 until 18:00 in three conditions. The effects of activities in IgA in 6:00 showed decrease after 400m swimming and increasing after 50m, and in 18:00 increasing after 400m and 50m, but not significant activity in 6:00 showed significantly increase effects in IgG after 400m and 50m swimming and not significant decrease in 18:00 the received ( $P > 0.05$ ).

#### Conclusion

In this study, the body temperature exercise performance and IgA variant of security system, were influenced by circadian rhythms and kinds of practicing programs in 18:00 change IgG. So in the time of measuring body temperature exercise performance and variants of salivary of security system must be paid attention to influence of circadian rhythms.

**Key word:** Circadian rhythms, Elite swimmers, Exercise, IgA, IgG.

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## Introduction

Study of the body's biological clock is called Chronobiology, and according to Raili et al., all parts and systems of the body has its own separate biological clock and their implementation have changed and controlled in accordance with the rhythmic hours of biological cycles. The major changes in physiological performances come from specific biological clocks which directly created and affect the Earth's rotation period. Biological rhythms are changes that occur in the form of chemical or physical cycles and include two sets of internal biological rhythms which controlled by an internal biological clock like temperature cycle and external biological rhythm synchronization which controlled by external stimuli such as sleep-wake cycle, or the cycle of day and night. Melatonin hormone which secreted from Pineal glands in darkness affects in the central nervous system and is responsible for launching and controlling biological rhythms. The rhythms are all examples of each type during the course of less than a day, weekly, monthly, quarterly, annually and psychological. Circadian rhythms included cyclical changes in a regular rhythm which occurs approximately 24-25 hours and when these rhythms are synchronized and accommodate with the cycle of day and night, it called the circadian rhythm. The word "Circadian" in lexical meaning means a day which is combination of circa meaning about and Dian days. Daily rhythms in humans and other mammals Super charismatic nucleus of the central nervous system with categories including 10 thousands of cells which located in the brain hypothalamus. Daily rhythms are coordinated by light and dark cycle, external social factors and consistent manner is called the circadian rhythm. Orchestrate of daily rhythms are influenced by factors such as: jet lag, shift work, and age and a broken rhythmic

harmfully affect to health, mental state and physical performance. Daily rhythm as one of the biological rhythms with a period of about 24 hours on various body systems and physiological responses affect on them. Body temperature is a fundamental variable as one of the specifications used daily rhythms (1). According to reports of Raili et al., many sports performances in day performance with changes in daily rhythms of body temperature as one of the basic variables (2). A lot of sports functions in accordance with changes in body temperature during the day is one of the key variables in the circadian cycle is changed (1, 3). Observations on the rail and colleagues performed exercise in the evening, when the temperature is at the highest level, more and more desirable, and this causes the athletes to compete in the evening's best performances in the preferred and subsequently it's time to get morning runs faster and in less time (1,5). Rail and colleagues (1984) corresponded to the change in the daily temperature curve was observed even at Sprint (6).

According to Baxter and Rail (1983) the 400 m breast stroke swimming (endurance) and 50 m (speed) at 17:30, 6:30, respectively, compared to 6.3 and 9.1% faster respectively (7). Note that the best performance and the most world records in the evening peak hours in that heat is obtained. Therefore, more and more deeply on the different functions in different sport science expertise in designing training programs to better help. Borgon and colleagues stated that the daily rhythm with high activity on endurance performance in the evening than in the morning as much as 2 percent more (8). Layng and colleagues found that the salivary concentration of approximately 2 hours after exercise was reduced to 43% of pre-exercise levels (9). Furthermore, no significant difference was observed

between the two sessions. Dimitriou et al. showed the effect of different times of day on cortisol and salivary IgA levels before and after swimming the maximum time a significant effect on the concentration of IgA, IgA and serum IgA secretion rate was observed as compared with Lee and Gleeson daily variation in the concentration of IgA was significantly higher in the afternoon and lowest values in the morning, a significant increase in saliva flow rate and IgA secretion and subsequent changes in the Practice report (11), as was also the changes IgA responses in saliva and relax after a 3 hour practice goes back to the original condition at rest (11). Due to the changes affecting sports records disturbed times a day, the rhythm of the performances can be identified coaches, athletes, sports scientists and planners in the design and implementation of sports and eventually training programs, competitive performance, and help with minimize energy costs and damage to achieve maximum performance and efficiency at the appropriate day. Due to the changes affecting sports records disturbed times a day, the rhythm of the performances can be identified coaches, athletes, sports scientists and planners in the design and implementation of sports and eventually training programs, competitive performance, and help with minimize energy costs and damage to achieve maximum performance and efficiency at the appropriate day. On the other hand, according to the doctors, trainers and athletes who want to maintain the health of athletes during competition and exercise, there is a belief that they think hard performance have bad results on athletes and during the time it will effect on them and also decrease their performance.

### Materials and Methods

In one study before and after, the 12 men swimmers in the league, from Fars Province with an average age of

19.80±1.87 years, Weight: 66.33±6.26 kg, height: 182.5±6.44 cm, and Body mass index( BMI) 20.02, non-smokers and non-endocrine diseases, diabetes, chronic heart problems had been invited, and after explaining the situation and also completed a written consent form purposefully participated in the study. The survey results were confidential, and the study of hormonal studies, each athlete was given to them.

The limitations of this study, lack of impulse control and lack of control subjects was hidden diseases. The subjects were asked to do research before running the test, normal sleep patterns (at least 8 hours of sleep), daily activity patterns and diet (12 hour fasting before the test) to observe the investigation and any vigorous physical activity, dietary supplements, drugs, coffee, tobacco and cocoa until 48 hours prior to the test and collect blood samples that have an influence on the system performance and safety, which they may not.

The main test for every subject on two occasions 6 am and 6 pm on both days and a total of 4 sessions and the results were recorded by the researcher. Test was performed on the first day just like morning. Speed and the other in the saliva samples collected after swimming the 50 meter breast stroke.

Each of the variables measured. To determine the temperature of the thermometer under the tongue UEBE Model Digital Pen Type (Germany) with an accuracy of 0/01 ° C was used. C depending on the temperature was measured at rest and in the sitting. Salivary IgA and IgG to determine the device model Nephelometry Minineph TM United kingdom (UK) were used. To measure the length of 400m and 50 meters breast stroke timer QQ model CR2032 (China) was used. One-way ANOVA of the activity was used and p value less than 0.05 was statistically considered significant.

## Results

Table 1 shows the values of temperature records in sports (swimming 50 meters and 400 meters) and physiological variables immunity (IgA, IgG) at different times of the day (6:00 and 18:00).

**1** - Sublingual temperature with 43.0 ° C increased from morning to evening showed a significant daily rhythm (P= 0.001.)

**2** - Running endurance by reducing the time to run 400 m breast stroke in the morning until the evening of 31 seconds showed a significant daily rhythm (P = 0.001).

**3** - In running, reducing the time to swim 50 m breast stroke in the morning until the evening of 59.0 S, the rhythm of day was significant (P=0.002).

**4** - The rhythm of the day from morning to evening in the immune globulin salivary at rest and 51.0 mg/ per deciliter (dl) increased (P = 0.002), after swimming 50 meters with 68.0 mg/dl increased (P = 0.002) and the 400 meter breast stroke with a 19.1 mg/dl increase was significant (P=0.006).

**5** - The rhythm of the day from morning to

evening in a safe globulin salivary glands at rest with 96.0 gram per liter increase (P =0.179), after swimming 50 m with 37.0 gram per liter(g/l) increase (P = 0.165), after swimming 400 m with 22.0 g/l increase was not significant (P = 0.180).

**6** - A salivary immune globulin given up at 6 am 13.0 mg/dl after swimming 50 meters and dropped 13/0 mg/dl after 400 m significant difference compared to resting not (P=0.825).

**7** - Immune globulin in saliva at 6 pm A affects activity despite an increase of 30.0 mg/dl after swimming 50 meters higher than the rest and 55.0 mg/dl after 400 m than the rest, there was no significant difference (P=0.438).

**8** - Glands salivary immune globulin at 6 am with 0.10 gram per liter, after swimming 50 meters and 12.0 mg per liter (mg/l) significant changes were observed in the 400 m breaststroke (P=0.02).

**9** - Immune globulin at 6 pm with a reduction in salivary glands 49.0 g/l after swimming 50 m and 62.0 mg/l after the 400 m breaststroke was no significant difference (P = 0.543).

**Table 1:** Value of Temperature Records and Physiological Variables Immunity in Swimming

Variables		Daily rhythm					
		6AM			6 PM		
		Mean	SD	P value	Mean	SD	P value
Body temperature C <sup>0</sup>	Variables	91.35	0.17	0.95	36.34	0.27	0.32
Record of swimming	50m(SECOND)	31.64	1.13	0.99	31.05	1.37	0.57
	400m(MINUTE)	5.59	0.35	0.47	5.28	0.17	0.76
IgA (mg/dl)	Resting	4.54	1.22	0.78	5.05	1.31	0.98
	After 50m	4.67	0.71	0.96	5.35	1.03	0.11
	after 400m	4.41	0.99	0.97	5.6	0.89	0.96
IgG (mg/dl)	Resting	1.98	0.78	<b>0.00</b>	2.94	2.31	<b>0.006</b>
	After 50m	2.08	0.13	0.27	2.45	0.81	0.08
	After 400m	0.00	0.13	0.52	2.32	0.41	0.69

## Discussion

Sports performances includes, 400 meters and 50 meters breast stroke record with a rundown of the afternoon of 31 seconds in the 400 meters and 59.0 in 50 meters per second, there is a significant daily rhythm confirmed. The lowest temperature of the body and the worst run one hour before and after low temperature, Arendt et al., based on a positive alternative high body temperature, warm-up exercises volume, Edwards and colleagues emphasized that there is a significant positive relationship between temperature and performance. Samuels impaired negative effect on the daily rhythms of sleep and then run towards the negative rail and Baxter that runs a significant linear trend in direct contact with the daily rhythms and increasing the body temperature of 5.3 percent run the 100 meters breaststroke, and 5.2 percent of the 400 meters breaststroke afternoon matches (12-16). Besides the sports world records have been registered by athletes are usually in early evening so that the day-time temperature is a direct effect of value is in hours, this time is generally between the hours of 7 to 11 night has been reported (1).

Several factors affect the time of day and day will change the rhythm pattern that fits Remy stated that their performance is affected. Nerve to the 4.2 meters per second increase (17) to 7 pm peaks. Mesenteric and Kanstric powers showed the same powers and scope of the change from morning to evening, with max power in the period. According Rail and Marshall (1991), the average and peak power output in green swimming breast stroke under controlled conditions in a range from 14 to 11% over a 24 hour period with a maximum at about 6 pm have been reported (18). Flexible joints bend and opening of the lumbar, anterior rotator arm bent in front of the whole body with a range of 20%, the highest rate in the

evening, the show changes. A general summary of the best time of day to exercise 30 minutes on the bicycle ergo meter was 7 pm to 7 percent range.

Daily rhythm of salivary IgG, IgA salivary variables in the rhythmic pattern of the type of immune globulin A, G, daily rhythms in sleep mode, the 50 meter breaststroke and the 400-meter breaststroke was studied. A type of immune globulin in saliva increases from morning until the evening of 51.0 mg dl at rest, 68.0 mg dl eater after swimming 50 meters and 19.1 mg/dl of Eater. There was a daily rhythm 400 m salivary Ig G in spite of the increase of the afternoon of 96.0 g/l at rest, 37.0 g/l after swimming 50 m and 22.0 g/l and after 400 m/ liters of significantly higher.

Finally, there was a daily rhythm in saliva was variable. Consequences of such a step, however small, are taken to investigate this issue. Ranton and Myorman showed a significant increase in salivary IgA between the hours of 8 am to 8 pm and are reported as the change over a period of 12 hours that remain constant (19).

Atosky and colleagues conducted tests on samples of saliva IgA concentration changes in the morning was midday and in the evening as most of the afternoon and evening than in the morning, so there was an increase in the daily rhythm of the afternoon to confirm (20). The lack of studies and reports on specific result may vary due to the low concentration of IgG in saliva is negligible. Tokara and Park investigated the changes in salivary IgA with day time as it fit the pattern of expression as that of core body temperature, when the body temperature is at its highest possible concentration of salivary IgA reaches its highest value, and vice versa. The lack of studies and reports on specific result may vary due to the low concentration of IgG in saliva is negligible. However, recent studies have reported results consistent with the findings of the present study Temperature

changes; all point in the opposite direction, there is salivary IgA significant daily rhythm.

*Activity and salivary immunoglobulin A, G (IgG, IgA)*

A type of immunoglobulin salivary swims 50 meters and 400 meters respectively, after hours of 6 am and 13/0 mg/dL decrease at 6 pm with a 3.0 and 55.0 mg/dL and increase differences was not significant. The changes in the immunoglobulin salivary type G, respectively, after swimming 50 meters and 400 meters at 6 am with a 1.0 and 12.0 mg/l increase significantly while at 6 pm with 49.0 and 62.0 gram. There were no significant differences in liter decreases. The non-athletes after exercise, Klintro and colleagues with a reduction in salivary IgA levels and concentration during and after the exercise and improvement of infection Malaguarnera and colleagues that reduced salivary IgA following a program of endurance exercise-induced the increase in parasympathetic activity and transient increase after low-intensity activities, Laying and colleagues based on 42 percent reduction in salivary IgA concentration immediately after exercise and decreased after prolonged exercise. Viglison with reduced immune variables after exercises of Fila and colleagues based on changes in the variables of IgA and IgG and other hematological parameters following training programs in football players was inconsistent (25). In examining a month long defense and damaging effects of exercise on the immune system, Nymin Impacts overactive immune system and weaken the immune system after heavy endurance activities, Mueller et al. reducing lymphocytes T, a defect in the immune system, increasing the reaction time and poor performance ultimately influenced two months of heavy endurance training, Gleeson the pressure and stress of training and competition, weakening the immune system play a significant

reduction in the serum IgG and IgA after the protocol, reports Bruce as intense aerobic activity (26-29).

**Conflict of interests:** None

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