

## The Effect of One Sleeplessness Period on Salivary Full Protein and Cortisol Density and on Agility and Muscular Power in Male Soldiers

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**Abstract:** The present research has been designed and performed to study the effect of one sleeplessness period, due to military guard, on salivary full protein and cortisol density and some movement-performance factors. Salivary sample of 24 soldiers in Sepah force were collected from experimental and control groups. This selection was randomly and was done with a substitute between 8:30 to 9 am two days before sleeplessness exertion start to determine basic levels. After sleeplessness exertion, salivary sampling was done once more between 8:30 to 9 a.m. from 60<sup>th</sup> groups. Salivary sampling was done again after measuring agility, muscular power and aerobic. All samples were freeze in 20°C after being collected to be tested at a proper time full salivary protein and cortisol were determined in duplicate from using (ELISA) method. Agility, muscular power and aerobic performance of the testes were measured as performance indicators. Experimental groups testes guarded with military equipments for two hours, they were equipped for two hours and then slept for two hours according to guard board. This process continued until 6 am on the other day. Control group slept naturally during this time. The results of unilateral variance analysis showed that one sleeplessness period, due to military guard, did not have a significant effect on full protein and cortisol density. Independent t-test showed that any effect was not seen among muscular power, agility and aerobic performance time in experimental and control groups. The general result showed that one sleeplessness period, due to military guard, did not have a significant effect on salivary full protein, cortisol density and some movement-performance factor. Therefore we can suggest that this sleeplessness pattern does not derange cortisol density and salivary full protein and also physical work capability.

**Key words:** Sleeplessness • Cortisol • Salivary full protein • Agility • Muscular power

### INTRODUCTION

In many professional places including military centers, hospitals and factories sleep deprivation is a public condition, which is resulted from extended job periods, shifts and night shifts. In some conditions such as was for militarists and night shifts for doctors and nurses, the need for high levels of physical, movement and psychological actions can be seriously in danger by means of sleep deprivation and need increase for sleep [1]. The recognized psychological disorders related to inadequate sleep including being sleepy increase, vigilance decrease, temper decadence and problem in focusing that all have shares in action delay, mistakes increase and accidents risk increase and finally being in doubt in doing missions [2]. The harmful effects of sleep deprivation on action are clearly in relation with sleep reduction so that the longer the sleep deprivation, the clearer the disorder will be [3].

The symptoms of sleep deprivation are in the form of tiredness, anxiety, disease increase, disorder in awareness, hallucination, delirium, stimulation, vigilance level decrease, Sensitivity to pain increase, slow reaction, disability in doing repeated actions, temperature rise and fall and chemical condition change. If the sleep deprivation continues, the above symptoms lead to making mistakes in perception, emotional-rational actions disorder, visual and auditory hallucinations [2, 4].

Scientists have found that sleep disorders can lead to health serious problems. In fact every kind of difficulty in sleeping can be a red light based on a serious disease appearance risk. Physiological researches indicate that the lack of sleep puts the body in a kind of high vigilance state and increases stress hormones production and brings about high blood pressure level [2], that is they are exactly the same factors which pave the way for heart attacks and brain failures. The researches have shown that sleep deprivation can create a large portion of

psychological and physiological changes [5]. It has been cleared that long sleep deprivation periods (Till 65 hours) cause disorders in an individual's temper and reduce her/his recognition performance. It must be mentioned that these cases increase when sleep deprivation gets longer. [6, 7]. In each organization, some people are usually predicted to protect and look after that organization. In military organizations, this method is usually followed with much sensitivity too, because military forces are responsible to protect country boundaries and every carelessness in this case can cause country's safety threat and endanger compatriot's life. Also in operations, the military forces have to move in long distances to do operations or probably deceive the enemy, or some people have to guard night to morning and start their operations or take the actions which require vigilance and proper and on time reactions or do the activities that need aerobic exercises, agility and muscular power, so it is necessary that they take the action with required care and sensitivity to do the related duties. Therefore the effects of sleeplessness can not be ignored since it may affect the action and decrease people's efficiency. In general, sleeplessness is a strong stress that causes many changes in physiologic systems [8]. In military garrisons, the soldiers guard alternately from night to morning to protect the localities and installations. Doing this duty, probably cause their vigilance to decline and their movement action get weak. On the other hand, the effect of sleep deprivation and its resulted sleeplessness are natural matters in military professions, guarding and watching. Sleep deprivation in military guarding, like other careers, which need care and attention, is also important. Since guardians are in the charge of responsibility and guarding predicted targets, the importance of the matter becomes confirmed. Because the smallest mistake can cause failure in doing the tasks and may endanger some people's life. The effects of sleeplessness on movement actions and physiologic variables in military atmospheres are not obvious yet. The studied sleeplessness in previous studies has been different from duration and alternation points of views. [9, 10]. Considering the limitations of previous studies and unstudied questions existence about the effects of sleeplessness resulted from military guard in two hours periods, in a twenty four period, the present study has tested the effect of a sleeplessness period resulted from military guardians.

## **MATERIALS AND METHODS**

Considering the essence and targets of the research that was studying the effect of a sleeplessness period resulted from military guard on cortisol and salivary full protein density and some movement performance factors, choosing some testes that had lived in military conditions and in general has the same life conditions, was necessary. Therefore, 24 soldiers were chosen among the personnel of saber in Islamic revolution Sepah guardians force unit.

The soldiers' age average was  $20.69 \pm 1.60$ , their size average was  $178.72 \pm 6.78$  cm and their weight average was  $70.33 \pm 9.59$  kg. They were chosen randomly with substitutes.

The target and stages of the research were explained in detail for them in a meeting when the testes had been specified. Then all of them signed the letter of satisfaction that its sample has been presented in appendix 1. An agreement was done with public health assistance of Sepah force and it became clear that all testes has psychological and physical health card and none of them had hormonal disorders background and they were not being treated by drugs at the time of information collecting.

**Saliva Collecting method** Salivary samples were collected from experimental and control groups between 8:30 60 9 a.m. two days before exerting sleeplessness to determine the basic levels.

After exerting sleeplessness, salivary sampling was done once more from both groups between after measuring agility, dynamometer power-gauge and aerobic actions. Each testis drank about 200 ml water to prevent lack of water.

They washed their mouth after some minutes and poured 4 ml of their saliva in stimulated form into sample collecting special pipes. All samples were free zed in  $-20^{\circ}\text{C}$  after being collected to be tested in a proper time. With due attention to the matter that cortisol secretion obeys 24 hours rhythm, all salivary samples were collected between 8 60 12 P.M. Also sampling was done in an identical condition from all testes to prevent every kind of destructive effect.

**Hormonal Measurement:** Salivary cortisol density was determined in the form of duplicated and by means of ELISA method.

Salivary cortisol density was determined by means of ELISA business Kate made by HVMAN German company with a sensitivity of  $1.1 \text{ } 1.5 \text{ ng ml}^{-1}$ . Salivary protein density was determined by means of endpoint, Colorimetric and using its private Kate made by Ziestchem Diagnostics in Iran with 0.2gr in 100 ml. AS it was mentioned before, collected samples were freezes in  $-20^{\circ}\text{c}$ . When experimental period finished, in the experiment day the samples were put in the room temperature to go out of freezes state. After santrifiojth, the existent mucus in it deposited to be able to measure cortisol density from the existent liquid in the upper part of the test tubes. To prevent the effects of environmental factors, all samples were experimented in an identical environmental condition (identical time, place and tester).

More over the used method and Kate was the same for experimenting all samples.

**Agility:** The testes agility was measured using 8 direction test set made in Iran metal satrap company and with 0.001 seconds accuracy.

**Muscular Power:** Testes muscular power was measured using digital claws power measurement set made in Iran metal satrap company based on maximum claws power in kilogram scale with 0.1 accuracy.

#### **Aerobic Performance**

**3200 Metres Running Test:** Aerobic performance time of the testes was measured in track and field paste. Each running race is 400 meters according toe 400 meters.

**Sleeplessness and its Exertion Method:** The sleeplessness used in this study was sleeplessness resulted from a military guard period as is described below:

With due attention to this matter that all testes in this research were soldiers, a day before sleeplessness exertion, the soldiers slept from 10:30, that is called off hour in military garrisons, until 5 a.m. All testes woke up at 5 a.m. and did their office affairs including service, office and reparatory works and they were free to test in sanatorium or do their other activities inside the place.

The testes in control group were free after eating dinner and slept at 10:30 when off hour started. But the testes in experimental group guarded for two hours according to guard board and they used military equipments. This process continued until 6 am. on the other day.

**Data Collecting Method:** After choosing the testes in a meeting, the necessary in formation about the targets and the research performance method was explained to them. Then the testes were divided randomly into two experimental and control groups to avoid every kind of partiality by the research, another person was requested to choose the groups. As it was already mentioned, both groups passed the days in an identical condition during data collecting process.

The only difference between them was the subject that the testes in experimental group had experienced a special kind of sleeplessness for a night due to guarding. The day after exerting sleeplessness, salivary samples were collected from both groups.

After that agility, muscular power of claws and aerobic performance of the testes were measured (Table 1).

**Statistical Analysis:** Dispersion and central indicators were used for describing the dates. Variance unilateral analysis (ANOVA) was applied to study cortisol density and salivary full protein in control and experimental groups.

T independent method was used to analyze movement-performance factors (agility), muscular power and aerobic performance). The dates were analyzed with 95 percent confidence level and by means of SPSS software.

## **RESULTS**

**The First Hypothesis:** One sleeplessness period does not have a significant effect on salivary cortisol density of the guardians.

The results of unilateral variance analysis on salivary cortisol density in three stages such as 48 hours before test before test start and after sleeplessness have been presented in Table 1.

The results of table 1 shows that the obtained F has been less than critical  $F = 2.29$  in ( $p < 0.05$ ) level and no significant difference was observed between guardians salivary cortisol density mean in three stages including, 48 hours before test, before lest start and after sleeplessness. Of course salivary cortisol density of experimental group was less than control groups. This amount was 2.10 i.e. 11.7 %. ( $p < 0.05$ ).

**The Second Hypothesis:** One sleeplessness period does not have a significant effect on the amount of guardians' salivary full protein.

Table 1: The period of data collecting stages

48 hours before test	Test start	After sleeplessness
Saliva sampling	Saliva sampling physical performances test	Saliva sampling

Table 1: Unilateral variance analysis results on guardian's salivary cortisol density in three stages

The resources of salivary cortisol density change	Squares ss	df	Squares mean variance	Ratio F	Quantity P
Between the groups	108.72	5	21.75	2.285	0.557
Intra group	599.65	63	9.52		
Grand total	708.37	68			

Table 2: The results of unilateral Variance analysis on guardians' salivary full protein in three stages

The resources of salivary full protein amount change	Squares sum ss	df	Squares mean variance	Ratio F	Quantity P
Between the groups	0.063	5	0.013	1.291	0.279
Intra group	0.611	63	0.010		
Grand total	0.674	68			

Table 3: calculated statistical indicators for studying agility difference between control and experimental groups after sleeplessness in guardians.

Agility (seconds)	Statistical Indicators	Mean	Standard deviation	Mean difference	Difference percentage	Degrees of freedom	Obtained T	Critical t	Quantity
Control group		12.44	1.84	-0.10	0.7%	21	0.113	2.08	9.911
Experimental group		12.54	2.29						

Table 4: Calculated statistical indicators for studying the power between control and experimental groups after sleeplessness in guardians

Power (Newton)	Statistical indicators	Mean	Standard deviation	Mean difference	Difference percentage	Degrees of freedom	Obtained T	Critical t	Quantity
Control group		0.96	97.81	27.74	6.4%	21	0.501	2.08	0.622
Experimental group		0.71	0.79						
			1.62						

Table 5: Calculated statistical indicators for studying aerobic power between control and experimental groups after sleeplessness in guardians

Aerobic power (Min)	Statistical indicators	Mean	Standard deviation	Mean difference	Difference percentage	Degrees of freedom	Obtained T	Critical t	Quantity
Control group		15.13	0.86	-0.12	0.7%	21	0.322	2.08	0.751
Experimental group		12.26	0.99						

The results of unilateral Variance analysis on guardians Salivary full protein amount in three stages including 48 hours before test, before test start and after sleeplessness, have been presented in Table 2.

The results of Table 2 shows that the obtained f is less than critical F= 2.29 in (P<0.05) level and no significant difference was observed Between guardians salivary full protein in three stages including 48 hours before test, before test start and after sleeplessness. Of course the amount of salivary full protein of experimental group was 0.006 i.e. 2.8% which is less than control groups and is no significant (P<0.05).

**The Third Hypothesis:** One sleeplessness period does not have a significant effect on guardians' agility.

The results of independent t student for studying agility difference between control and experimental groups after sleeplessness in guardians have been presented in Table 3.

The results of Table 3 shows that the obtained  $t = -0.113$  is less than critical  $t = 2.08$  in the level of (p<0.05) and there is no significant difference between control and experimental groups agility after sleeplessness. (P<0.05)

**The Fourth Hypothesis:** One sleeplessness period does not have a significant effect on guardians' power.

The results of independent t-student test for studying the power between control and experimental groups after sleeplessness in guardians have been presented in Table 4.

The results of table 4 shows that the obtained  $t=-0.501$  is less than critical  $t= 2.08$  in the level of ( $P<0.05$ ) and there is no significant difference between control and experimental groups power ( $P<0.05$ )

**The Fifth Hypothesis:** One sleeplessness period does not have a significant effect on guardians' aerobic power.

The results of independent t-student test for studying aerobic power between control and experimental groups after sleeplessness in guardians have been presented in Table 5.

The results of Table 5 shows that the obtained  $T=-0.322$  is less than critical  $t=2.08$  in the level of ( $P<0.05$ ) and there is no significant difference between aerobic power of control and experimental groups after sleeplessness.

## DISCUSSION

About the effect of sleeplessness resulted from guarding, the results showed that salivary cortisol density was not affected by this kind of sleeplessness. Salivary cortisol density of sleeplessness group increased 13.64% in after test stage compared to 48 hours before test and 8.08% increase was observed between test start and after test stages.

This increase was significant in both conditions.

In general, sleeplessness is a stress which enters in to body and causes lots of changes in physiological systems. In particular, sleeplessness deranges biological rhythm. In spite of being sleepy state increase to deal with staying awake, psychological stress is generated cortisol increase is expected after sleeplessness since it is one of the most important stress hormones but at the present study cortisol density did not increase probably due to less tiredness and stress which sleep deprivation has had for the testes. In explaining the findings of the research we can add that the testes of the present research, which had passed in average one year of their military service period, had probably been adapted with this kind of sleeplessness. There is a probability that one year sleeplessness period due to military guard prevents the significant appearance of cortisol hormone resultant in the research. The other reason is the matter that most of the studies about this subject have been a full night sleeplessness or between 24 to 34 hours. Even the

sleeplessness or between 24 to 36 hours. Even the sleeplessness used in simonies was 60 hour [10], where as the sleeplessness in this research has been 14 hours in general and based on military pattern and the testes could sleep for two hours, after two hours they guarded and for two hours they were. Equipped considering the matter that sleep stages including ram and non-ram sleep are organized in a 90 minutes cycle, it has been possible for the testes to be able to complete their sleep cycle. Non significant effect of this sleeplessness on physiological variables is possibly related to this cycle completion.

The second finding of the research showed that one sleeplessness period does not have any significant effect on guardians' salivary full protein density.

It has been clear that salivary protein changes are an indicator of sympathies activity and the amount of physiological and psychological stress on organism [11, 12]. The possible reason of change lack in full protein density in this study may be due to the subject that the sleeplessness in this study does not generate stress. The lack of change in salivary cortisol density that is a sign of stress confirms this subject.

The third finding of the study showed that one sleep deprivation does not have a significant effect on the testes performance.

A Variety of studies have studied the effect to different patterns on physical fitness segments.

Some of these studies have reported negative effects of sleep deprivation on physical performance [13] but some others have not been able to find a significant effect of sleeplessness on performance [14, 10, 15]. About this subject, Souissi *et al.* [9] have known the effect of sleeplessness period duration very important on performance and reported that 24 hours sleeplessness have had no effect on power performance climax. But 48 hours sleeplessness has decreased power climax. In an infra analysis it has been mentioned that sleeplessness period duration in one of the effective major factors on performance [16]. The results of the research about the effect of sleep deprivation on physical performance conforms with the results of the studies in Norwegian soldiers who are exposed to sleeplessness for 4 days (2 hours sleep in 24 hours). One of effective factors in this subject is the diet of the testes, so that the soldiers who used low calorie diets had more physical performance weakness than the soldiers who used high calorie diets.

Therefore the lack of sleeplessness effect on physical performance can be justified from duration, kind of sleeplessness and diet, points of views.

In the study, kind of sleeplessness has been totally different from sleeplessness used in previous studies and it is possible that as a stimulus it has not been big enough to derange the internal balance of the body and affect performance. To confirm this Claim, the lack of full protein and cortisol indicates that this kind of sleeplessness does not generate stress. On the other hand, other tests used natural food meal so the possibility of received energy reduction on physical performance is very low after sleeplessness.

### CONCLUSION

The results of the study showed that one sleeplessness period, due to guard, does not have a significant effect on cortisol and salivary full density and some movement-performance factors. So it can be concluded that one night sleeplessness (2 hours guard, 2 hours being equipped and 2 hours sleep) does not have any effect on salivary full protein and cortisol density and on movement-performance (agility, muscular power and aerobic performance) in military guardians.

So we can recommend that this sleeplessness pattern does not affect guardians' capability and commanders can use these people for doing organizational targets without no worry about physical performance weakness, the day after guarding.

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