Case Report / *Olgu Sunumu*

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The Role of 13 Years Insomnia on Physiological Variables of an Active Man: A Case Report

Aktif Bir Erkeğin Fizyolojik Değişkenleri Üzerinde 13 Yıllık İnsomnianın Rolü: Bir Olgu Sunumu

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Abstract

The aim of this study was to monitor role of insomnia on some physiological variables in a man who had 13 years insomnia. In this case report, we had a case with 27 years old, 64 kg body mass index, 167 cm height and 13 years insomnia that participated voluntarily, and performed several physiological and performance variable tests. The major results for performance measures are as follows: bench press strength 80 kg, leg press strength 180 kg, running-based anaerobic sprint test 44.3 sec, 60 m speed 9.63 sec, 4x9 m shuttle run 10.36 sec, vertical jump 53 cm, sit ups 40 rep/min, and sit and reach test 94 cm. The major results also for biochemical measures are as follows: neutrophils 55.1%, lymphocytes 37.5%, monocytes 2.9%, eosinophils 4.2%, basophils 0.3%, fasting blood sugar 92 mg/dL, high density lipoprotein 35 mg/dL, low density lipoprotein 92 mg/dL, C-reactive protein <2 mg/L, ımmunoglobulin E 99.9 IU/mL, testosterone 5.05 ng/mL, insulin 3.7 uIU/mL, adrenocorticotropic hormone 21 pg/mL, cortisol 14.5 ug/dL, and growth hormone 0.05 ng/mL. The results of our case on the physical performance and biochemical tests in this study was generally in normal range and immune system, hormonal secretion and complete blood count were in a good points.

Keywords: Sleep disorder, performance, immune system

Öz

Bu çalışmanın amacı; 13 yıldır uykusuzluk yaşayan bir erkekte, uykusuzluğun bazı fizyolojik değişkenler üzerindeki rolünün izlenmesidir. Bu çalışmada; araştırmaya gönüllü olarak katılan, beden kitle indeksi 64 kg olan, 167 cm boyunda ve 13 yıldır uykusuzluğu bulunan 27 yaşında bir olgu dahil edilmiştir ve çeşitli fizyolojik ve performans değişken testleri yapılmıştır. Performans ölçümleri için başlıca sonuçlar şu şekilde belirlenmiştir; göğüs pres direnci 80 kg, bacak pres direnci 180 kg, koşu tabanlı anaerobik sprint testi 44,3 saniye, 60 m'de hız 9,63 saniye, 4x9 m mekik koşu 10,36 saniye, dikey sıçrama 53 cm, mekik çekme 40 tekrar/dk, otur ve eriş testi 94 cm'dir. Başlıca biyokimyasal ölçüm sonuçları; nötrofil %55,1, lenfosit %37,5, monosit %2,9, eozinofil %4,2, bazofil %0,3, açlık kan şekeri 92 mg/dL, yüksek dansiteli lipoprotein 35 mg/dL, düşük dansiteli lipoprotein 92 mg/dL, C-reaktif protein <2 mg/L, immünoglobulin E 99,9 IU/mL, testosteron 5,05 ng/mL, insülin 3,7 uIU/mL, adrenokortikotropik hormon 21 pg/mL, kortizol 14,5 ug/dL ve büyüme hormonu 0,05 ng/mL olarak bulunmuştur. Çalışmada, olgumuzun fiziksel performans ve biyokimyasal test sonuçları genel olarak normal sınırlarda belirlenmiş olup; bağışıklık sistemi, hormonal salgılama ve tam kan sayımı iyi bir noktada saptanmıştır.

Anahtar Kelimeler: Uyku bozukluğu, performans, bağışıklık sistemi

Introduction

In modern society, reduction of sleep duration and quality is progressively increased. On the other hand, it is believed that sleep deprivation and lack impaired host defense and increased infections (1,2). Recent study has shown a close connection between sleep and the immune system (3). Human studies involving prolonged sleep loss indicated alterations of immune functions. Dinges et al. (1) found that 64 h of sleep deprivation was associated with increases in immune functions such as interleukin-6 and leukocytosis. Irwin et al. (4,5) reported that modest loss of sleep in humans resulted in a significant decreases of activity and number of natural killer (NK) cells and resulting decrements in immune system.

In addition to immune system, evidence suggests that sleep deprivation has effects on physical performance (6) (e.g. anaerobic power, muscle strength, endurance, physiological responses such as heart rate, ventilation, oxygen consumption); however, is not clearly understood in another studies (7,8). Rodgers et al., (8) reported that 48 h period of sleep deprivation significantly decreased the physical work tasks requiring 30-45% VO2 max without affecting anaerobic power. Further, Souissi

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et al., (7) demonstrated that duration of sleepless period may be important as peak power was not affected after 24 h sleep deprivation but significantly decreased after 36 hours of wakefulness.

Regarding the documents about the effects of sleep loss on immune and performance function, role of long term sleep deprivation (i.e., 13 years) on these variables is unclear. Therefore, the aim of this study was to show immune and performance profile of a man how had 13 years insomnia on immune function and exercise performance tests.

Case Report

According to case study approach of this work, an active man (trained at least four sessions per week strength and endurance training) (age, 27 years: height, 167 cm: body mass, 64 kg) who had 13 years insomnia was the subject of this study. The subject was tested in the physical fitness assessment center for four days at 48 hours intervals. Before participating, the subject read and signed an informed consent statement in adherence with the human subject's guidelines of Research Center and approved by the University Ethical Committee.

The subject was familiarized with testing procedures one week prior to initiation of the study, in addition to a 30 min familiarization period before each day of testing. All tests were scheduled over four days (≥48 hours apart) at the same time of day (i.e., morning), under similar weather and field conditions. At first day, the subject recruited to laboratory for blood sampling to analyze biochemical and immune variables. On this day (day one), anthropometrical variables such as body mass, height, leg, foot length, arm span, hand and arm length, hip, lumber, knee and abdominal circumferences were assessed. On day two, upper and lower body strength such as hand grip strength, leg press, bench press, sit-ups test, pull-ups and sit-and reach test were measured. On the third day, 60-m sprint, 4x9-m shuttle run and anaerobic power test (i.e., Running Anaerabic Sprint Test) were collected. At final day, aerobic power (i.e., copper test), balance and vertical jump test were measured. For the analyze of biochemical and hormonal variables, a 10-mL blood sample was collected by venipuncture of an antecubital vein; the resultant samples were allowed to clot at room temperature for 15 minutes and then centrifuged at 1500 × g for 10 minutes. The serum was then pipetted into polyethylene blood tubes and frozen at -80 °C for subsequent analysis. The serum immunoglobulin (Ig) E, testosterone, insulin, adrenocorticotropic hormone (ACTH), cortisol, growth hormone and C-reactive protein levels were measured using commercially available enzyme-linked immunosorbent assays kits (Monobind Inc., Lake Forest, Calif., USA). Complete blood count analyses were conducted using automated hematology analyzer.

Subject anthropometric data is shown in Table 1. The performance measures are presented in Table 2. Table 3 contains testing results for biochemical variables.

Discussion

In relation to performance tests, studies have showed that sleep deprivation had negative effects on performance ability in men and women (1,3). Azboy and Kaygisiz (9) reported that sleep deprivation induced decrements in time to fatigue and impaired power explosive ability. They also addressed that explosive and physical exercises that need to less time could be impaired by sleep loss because of sleep deprivation induced restriction of body to product Adenosine triphosphate resulting in performance decrements. To the authors knowledge a large number of studies addressed that sleep deprivation is in relation to muscle fatigue, impaired neuromuscular coordination and cognitive tasks which induced decrements in physical performance ability (1,3,9,10); however, it seems that physical performance profile of our subject is good and long term (i.e., 13 years) insomnia had not any effects.

Regarding the relationship between immune system and sleep, it appears that sleep deprivation is in relation to over-stimulation of immune system (11). A research indicated that sleep deprivation in rats induced lymphocytes (12). Sleep deprivation resulted in lower resistance to bacterial infections (bacterial blood infections), but no fever or tissue inflammation developed (6). The data deriving from the human studies are inconsistent or contradictory (1,2). While it is evident that sleep loss exerts an influence on the immune system (13) it remains unclear whether the influence is beneficial or detrimental. An Ig concentration was found to increase after sleep loss (8),

Table 1. Subject's anthropometric variables

Variable	Data	Variable	Data
Femur length (cm)	47	Wrist circumference (cm)	17
Calf length (cm)	41	Elbow circumference (cm)	26.5
Leg length (cm)	85	Chest circumference (cm)	94
ARM SPAN (cm)	160	Waist circumference (cm)	77
Elbow length (cm)	26	Thigh circumference (cm)	52
Hand palm (cm)	18.5	Hip circumference (cm)	87.5
Arm length (cm)	69.5	Calf circumference (cm)	38
Sole of foot (cm)	26	Shoulder width (cm)	17
Arm circumference (cm)	35	Chest width (cm)	11

Table 2. Subject's performance tests

Variable	Data	Variable	Data
Hand grip strength (kg)	-	60-m speed (sec)	9.63
Right hand	44	4 x 9-m shuttle run (sec)	10.36
Left hand	45	Vertical jump (cm)	53
Bench press strength (kg)	80	Sit-ups (rep/min)	40
Leg press strength (kg)	180	Sit-and-reach test (cm)	94
RAST (sec)	44.3	Cooper test (min:sec)	15:35
SEBT balance test (cm)			
Anterior	97	Anteromedial	85
Posterior	109	Anterolateral	79
Medial	70	Posteromedial	110
Lateral	100	Posterolateral	109

RAST: Running Anaerobic Sprint test, SEBT: Star Excursion Balance test

Table 3. Subject's biochemical variables		
Variable	**Data**	**Normal ranges**
CBC-index		
WBC (10^3/uL)	6.91	4-11
RBC (10^6/uL)	4.93	4.5-5.9
HGB (g/dL)	15.1	13-17
HCT (%)	43.7	41-53
MCV (fL)	88.6	80-100
MCH (pg)	30.6	27-34
MCHC (g/dL)	34.6	32-36
PLT (10^3/uL)	323	140-450
RDW-SD (fL)	44.2	37-54
RDW-CV (%)	14	9-14.6
PDW (fL)	12.3	9-17
MPV (fL)	9.8	5-10.5
P-LCR (%)	24.2	13-43
PCT (%)	0.32	0.17-0.35
Neutrophils (%)	55.1	40-75
Lymphocyts (%)	37.5	20-45
Monocyts (%)	2.9	2-10
Eosinophils (%)	4.2	1-6
Basophils (%)	0.3	0-1
Biochemistry		
Fasting blood sugar (mg/dL)	92	70-100
Cholesterol (mg/dL)	163	Desirable <200
		Borderline 200-239
		High >239
Triglycerides (mg/dL)	93	Normal <150
		Borderline 150-199
		High 200-249
		Very high >499
HDL (mg/dL)	35	>40: risk factor for CHD
		<60: negative risk factor for CHD
LDL (mg/dL)	92	
LDL/HDL	2.6	Goal: less than 3.5
		Ideal: less than 2.5
C-reactive protein (mg/L)	<2	<10
IgE (IU/mL)	99.9	Up to 200
Hormones		
Testosterone (ng/mL)	5.05	2.5-10
Insulin (uIU/mL)	3.7	Less than 35
ACTH (Pg/mL)	21	6-76
Cortisol (ug/dL)	14.5	5-23
Growth hormone (ng/mL)	0.05	Less than 5

ACTH: Adrenocorticotropic hormone, CBC: Complete blood count, WBC: White blood cells, RBC: Red blood cells, HGB: Hemoglobin, HCT: Hematocrit, MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration, PLT: Platelet, RDW: Red cell distribution width, SD: Standard deviation, MPV: Mean platelet volume, P-LCR: Platelet larger cell ratio, PCT: Procalcitonin, CHD: Coronary heart disease, LDL: Low density lipoprotein, HDL: High density lipoprotein, PDW: Platelet distribution width

and so was the number of leukocytes after sleep deprivation. Other data show a decrease in the number of NK cells after sleep deprivation (12). In relation to Table 2, biochemical and immune system variables are not more or less than reference range which indicates long term sleep deprivation (i.e., 13 years) in this subject did not induce any effects.

There were a close relationship between sleep and hormones. Sleep deprivation induced an increase in T3, T4 and thyroid stimulant hormon concentrations (14). The human studies found that sleep deprivation is in line with increases in corticotrophin-releasing hormone, ACTH and corticosteroids. On the other hand, sleep loss resulted in a slight increase in plasma cortisol level, while plasma aldosterone concentration and renin activity decreased and their release peaks were absent (10). The influence of sleep deprivation on growth hormone and testosterone secretions are particularly interesting. The physiological significance of the growth hormone and testosterone release could play an important role in the homeostasis. In the sleep-deprived subjects increases in the daily release of these hormones could be observed; however, the level of all hormones measures for the subject of this study was in between normal range which indicated adaptation to long term sleep deprivation on hormonal levels.

In conclusion, the results of our subject on the physical performance and biochemical tests in this study was generally in normal range database and immune system, hormonal secretion and cell blood content were in a good points.

Ethics

Informed Consent: Informed consent statement was in adherence with the human subject's guidelines of Research Center.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: H.A., Design: H.A., Data Collection or Processing: M.M., F.T., Analysis or Interpretation: A.A., Literature Search: A.A., Writing: H.A., A.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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