

Research Article

Subjective Sleep Quality and Game Performance in Tournament Level Chess Players

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Abstract

Chess game requires problem-solving skills and is related with all aspects of higher degree cognitive processes. The effects of regular chess practice on subjective sleep quality have not been known yet. In this study, we aimed to investigate the subjective sleep quality of tournament level chess players. In total, 225 chess players (M/F, 185/40; Mean age, 25.7±9.5 year) were included to the study. National and international rating scores and the chess history of all participants were recorded. All subjects completed Pittsburgh sleep quality index (PSQI) and Epworth sleepiness scale. Correlation analyses were performed between the chess parameters and the sleep scores. In addition, we divided the study group into two subgroups based on the PSQI score. Group 1 (n=107) consisted of the subjects with a PSQI score lower than 5 whereas Group 2 (n=118) consisted of the subjects with a PSQI score equal to or higher than 5. We found that there was no correlation between global and component scores of PSQI and chess ratings. The mean national and international ratings of Group 1 and 2 were comparable (National ratings, 1746±249 vs 1715±271; international rating, 1908±197 vs 1869±183; p>0.05 for both). In conclusion, we suggest that regular chess practice does not impair subjective sleep quality and playing chess has the potential to improve subjective sleep quality through increased mental activity.

ABBREVIATIONS

PSQI: Pittsburgh Sleep Quality Index; fMRI: Functional Magnetic Resonance Imaging; ELO: International Chess Rating System; UKD: Turkish National Chess Rating System

INTRODUCTION**“Chess is mental torture”**

Garry Kasparov: Chess is a complex game which includes many cognitive processes such as strategical thinking, problem solving, calculation and decision making. Additionally, chess requires high levels of concentration and a qualified memory. Therefore, playing chess is accepted as one of the most mentally taxing activities [1,2]. As a consequence of these features, chess has gathered the attention of numerous physiologists and psychologists and a lot of researches based on chess were conducted to investigate the cognitive abilities and mental processes [2-5].

Many previous studies evaluated the activity of brain regions during chess tasks by using functional magnetic resonance imaging (fMRI). Campitelli et al. [6] reported that when performing specific tasks, chess experts activated different brain systems from that of novices. They found extended brain activity in bilateral frontal areas such as anterior cingulate and the superior, middle, and inferior frontal gyri [6]. In a recent study, Wan et al. [2] studied the neural basis of the best-next move generation in shogi, a board game similar to chess. They found two activations specific to master players when compared to amateurs. The first activation was related to perception of board patterns and occurred in the precuneus of the parietal lobe, whereas the second activation was involved in quick generation of the best next move and occurred in the bilateral caudate nucleus of basal ganglia [2]. Accordingly, Duan et al. [4] demonstrated anatomical changes in the bilateral caudate nuclei of grandmaster and master level chess players in response to long-term training. The mean volumes of caudate nuclei of grandmasters were

significantly smaller than those of novices [4]. Recently, Rennig et al. [7] showed that fMRI signals in the temporoparietal junction increased during complex visual observation, i.e. playing chess. Some of the above-mentioned brain areas are also involved in sleep. fMRI studies during sleep revealed that BOLD signal was increased in response to slow waves in lateral frontal, medial prefrontal including orbito-frontal, medial parietal including precuneus, and medial temporal lobes [8]. However, no previous study investigated the subjective sleep quality of chess players. Sleep quality has a major role on a human's daily performance and health. For this reason, the factors that affect sleep quality also affect human life. Sleep quality is affected from several external factors such as light, temperature, noise, alcohol, caffeine and nicotine intake, pain, some medications, and some psychiatric and other medical conditions.

Playing chess is related to substantial amount of mental load and activation of cognitive functions, which may in turn affect generation of sleep and its refreshing property. Although, there are many studies on the effects of sleep and/or inadequate sleep on mental activity, only a few studies focused on the effects of mental activity on sleep, and their results are controversial. In an earlier study, Horne and Minard [9] reported that a behaviorally active day spent sightseeing and travelling in an unfamiliar city led to a significant increase in slow wave sleep and participants awoke feeling refreshed the next day. On the other hand, a day filled with deskwork resulted in no difference in the amount of slow wave sleep compared to a relaxing day [10]. Takahashi and Arito [11] investigated the effects of translation from English to Japanese on subsequent sleep period. The control condition was to remain awake in resting state. They found no increase in the amount of slow wave sleep and found depressed slow wave activity during the first sleep cycle [11]. In another study, de Bruin et al. [12] studied the effects of computer-based sustained mental load which included sustained attention, memory, logical thinking, and other type of calculations for 8 hours on sleep variables. Sustained mental work load and light mental activity (watching television) were comparable in terms of sleep parameters [12].

In this study, we aimed to investigate the subjective sleep quality of chess players and to correlate it with success rank of players. We hypothesized that playing chess improves subjective sleep quality and a better sleep quality may improve chess performance of a regular player.

MATERIALS AND METHODS

Study group

We announced the study at the official website of The Turkish Chess Federation (www.tsf.org.tr), and the participants were recruited mostly from chess tournaments. Chess players who were willing to participate in the study contacted the investigators and were directed to fill in the relevant forms, i.e., Pittsburgh sleep quality index and Epworth sleepiness scale in addition to chess questionnaire which included national and international ratings and parameters of chess history. We also prepared a web-based questionnaire using Google Drive® software which was open to members of The Turkish Chess Federation. Exclusion criteria were age below 18 years, conditions which may interact with or

affect sleep/wake cycle such as pregnancy, irregular work hours, shift work, and fasting during Ramadan (as data collection period included the month of Ramadan). Data were collected over a period of 6 months from March to September 2013. A total of 237 chess players completed the questionnaire and the sleep scales. Of these, 12 were excluded due to the following reasons: age < 18 years (n=7), shift work (n=4), pregnancy (n=1). The final statistical analysis included the data of 225 chess players (M/F, 185/40; Mean age, 25.7±9.5 year) who were participating in international and national tournaments regularly during the last decade. The study protocol was approved by the local ethics committee.

Pittsburgh Sleep Quality Index

The Pittsburgh sleep quality index is a validated scale designed to measure a person's subjective sleep quality and disturbance over one-month period [13]. This self – report instrument is composed of 19 questions focusing on the following components: Component 1, subjective sleep quality; component 2, sleep latency; component 3, sleep duration; component 4, sleep disturbance; component 5, habitual sleep efficiency; component 6, the use of sleep medications; and component 7, daytime dysfunction. The 19 questions are used in combinations to obtain seven 'component' scores. Each of these scores ranges between 0 to 3, where 0 corresponds to no difficulty/very good and 3 corresponds to severe difficulty/very bad. In the end, the 7 component scores are added together resulting in one "global" score in the range of 0 to 21, where 0 implies no difficulty and 21 implies severe difficulty in all areas. According to global PSQI score, low scores (below 5 points) are associated with good sleep quality whereas high scores (above or equal to 5) are indicative of clinically meaningful disturbed or poor sleep. A Turkish translation along with the reliability and validity studies of this scale were performed in a Turkish sample [14].

Epworth sleepiness scale

This is a validated scale established to measure daytime sleepiness [15]. It is an 8-item questionnaire investigating the probability to fall asleep during certain activities: Each question is scored in a range from 0 to 3 where 0 indicates no chance of falling asleep and 3 indicates high chance of falling asleep. Total Epworth Sleepiness Scale score varies between 0 to 24. We used the validated Turkish version of the scale [16].

Statistical analysis

Descriptive statistics included means and standard deviations. Relationships between success rates of chess (i.e. ELO) and subjective sleep quality scores were tested by using Spearman's correlation test. We also used regression models to identify the relationship of age, ELO and UKD as the predictors and PSQI score as the dependent variable. We divided the study group into two subgroups based on PSQI score and we compared chess parameters between the two groups by Student's t-test. Significance level was adjusted to a p value lower than 0.05.

RESULTS

Comparisons of demographic, chess and sleep characteristics of good sleeper versus poor sleeper chess players are given

in Table 1. There was no significant difference between the two groups in terms of mean age and gender distribution. The numbers of participants with an international rating (ELO) were 53 and 60 in study groups with PSQI score less than 5 and equal to or higher than 5, respectively. Likewise, the numbers of participants with a national rating (UKD) were 89 and 99 in study groups with PSQI score less than 5 and equal to or higher than 5, respectively. The mean ELO and UKD points in the group with a good subjective sleep quality (i.e., PSQI<5) tend to be higher than the group with a poor subjective sleep quality (i.e., PSQI≥5). However, the difference failed to reach statistically significance level. These two groups were comparable in terms of chess play load which was determined by weekly chess hours in the last month (Question 1 and 2), duration of personal chess history (Question 3), and the number of tournament participations within the last 2 years (Question 4) (Table 1). The results of correlation analysis between sleep quality parameters and chess parameters were given in (Table 2). There were no correlations between international chess rating, national chess rating, weekly average chess hours during the last month, weekly average chess

hours online/offline during the last month, total chess years, and number of tournament participation in the last two years with global PSQI score and component scores. (Figures 1, 2) depict regression analyses between ELO, UKD and PSQI scores.

DISCUSSION

The main finding of this study was that regular chess practice appeared not to impair subjective sleep quality and playing chess has the potential to improve subjective sleep quality through increased mental activity. Subjective sleep quality is associated with the feeling of falling asleep easily, undisturbed sleep continuity, and sufficient amount of sleep [17]. It may be affected from various factors such as physical exercise and mental workload preceding the sleep episode. Long-term moderate physical exercise program improved subjective sleep quality of overweight and/or obese postmenopausal women [18,19]. In another study, a 12-month moderate-intensity exercise program improved some objective and subjective dimensions of sleep in older adults [20]. Unlike physical exercise, the effects of mental exercise or cognitive training on objective and subjective aspects

Table 1: Comparison of demographic, chess and sleep parameters between the good (PSQI<5) and the poor (PSQI≥5) sleeper chess players based on Pittsburgh Sleep Quality Index.

	PSQI<5 (n=107)	PSQI≥5 (n=118)
Demographic		
Age, year	28.9±10.6	26.6±9.1
Gender, M/F	92/15	93/25
Chess		
ELO	1908.58±197.36	1869.42±183.46
UKD	1746.13±249.51	1715.84±271.37
Q1	8.9±9.5	8.0±9.6
Q2	9.3±12.9	8.1±13.1
Q3	15.1±8.8	13.2±7.4
Q4	6.5±7.5	6.1±5.3
Sleep		
Global PSQI score	2.92±1.08	6.92±2.06*
ESS	5.89±3.74	7.93±3.89*

All data are given as means ± standard deviations unless otherwise specified.

Abbreviations: ELO: International Chess Rating Score; UKD: National Chess Rating Score; Q1: Weekly Average Chess Hours During the Last Month; Q2: Weekly Average Chess Hours Online/Offline During the Last Month; Q3: Total Chess Years; Q4: Number of Tournament Participation in the Last Two Years. None of the Comparisons Reached Statistically Significance Level; PSQI: Pittsburgh Sleep Quality Index; ESS: Epworth Sleepiness Score. *P<0.001

Table 2: Correlation coefficients of Spearman correlation analysis between sleep and chess parameters.

	ELO	UKD	Q1	Q2	Q3	Q4
C1	-0.144	-0.007	-0.002	-0.048	-0.160	0.086
C2	-0.089	-0.018	-0.039	-0.025	-0.129	-0.020
C3	0.011	-0.074	-0.043	-0.045	-0.040	0.024
C4	-0.068	-0.043	-0.027	0.016	0.019	-0.003
C5	-0.128	-0.030	0.039	0.074	-0.120	0.084
C6	-0.140	-0.101	0.016	0.032	0.033	0.041
C7	-0.041	0.084	-0.140	-0.118	-0.055	-0.081
gPSQI	-0.128	-0.080	-0.067	-0.067	-0.127	0.003

Abbreviations: ELO: International Chess Rating Score; UKD: National Chess Rating Score; Q1: Weekly Average Chess Hours During the Last Month; Q2: Weekly Average Chess Hours Online/Offline During the Last Month; Q3: Total Chess Years; Q4: Number of Tournament Participation in the Last Two Years; PSQI Components: C1: Subjective Sleep Quality; C2: Sleep Latency; C3: Sleep Duration; C4: Sleep Disturbance; C5: Habitual Sleep Efficiency; C6: The Use of Sleep Medications; C7: Daytime Dysfunction; Gpsqi: Global Pittsburgh Sleep Quality Index Score.

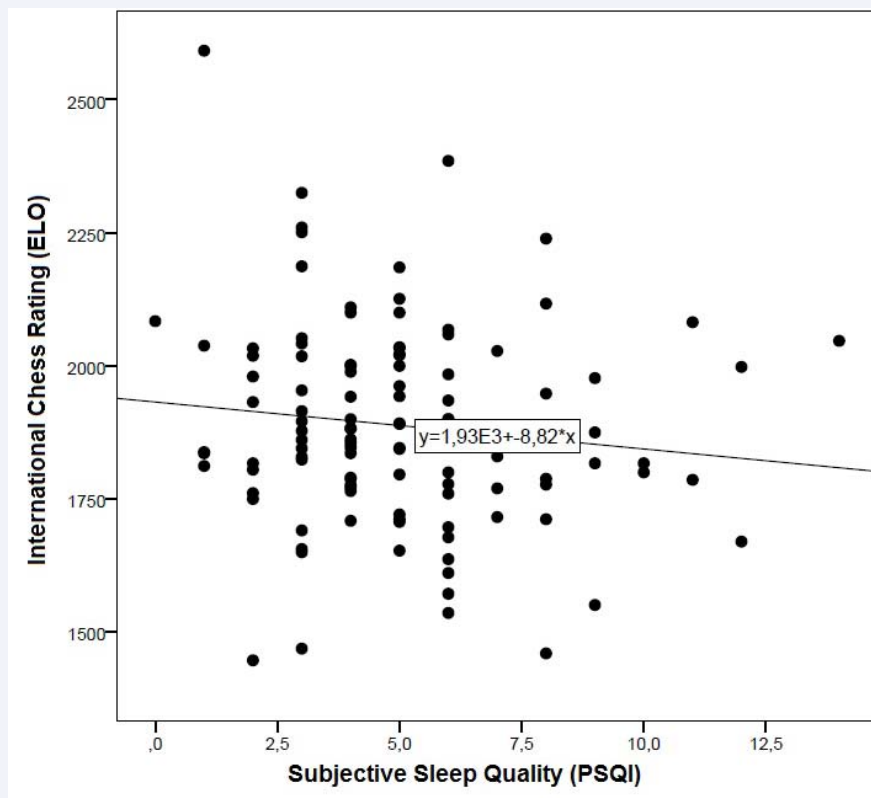


Figure 1 Regression analysis showed no causal relationship between international chess rating (ELO) and subjective sleep quality measured by Pittsburgh Sleep Quality Index (PSQI).

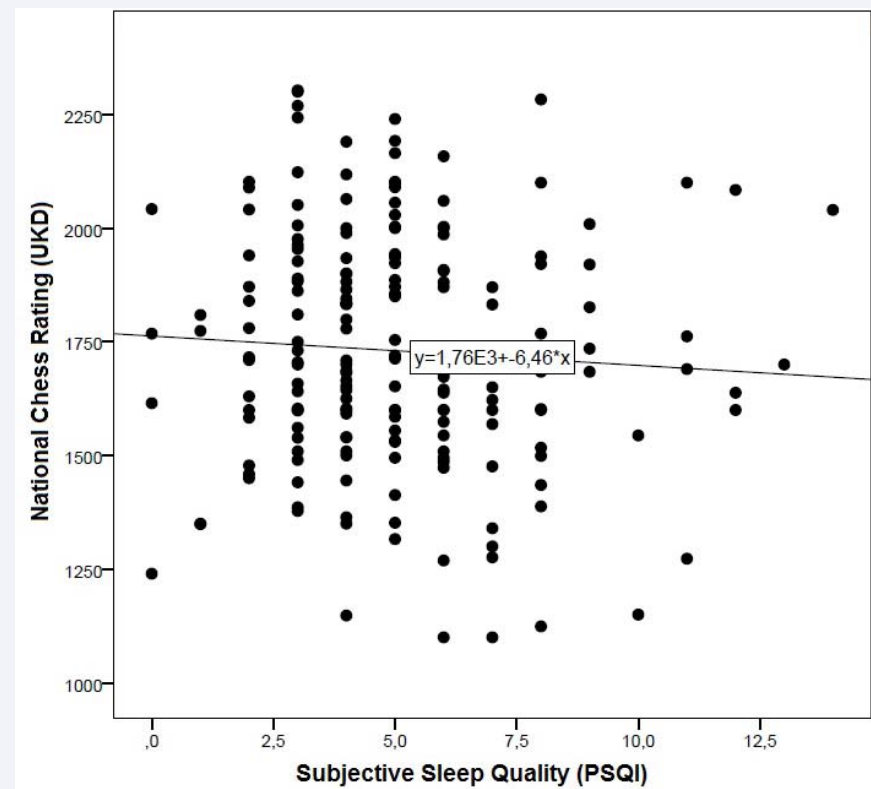


Figure 2 Regression analysis showed no causal relationship between national chess rating (UKD) and subjective sleep quality measured by Pittsburgh Sleep Quality Index (PSQI).

of sleep remain controversial. In an earlier study, Takahashi and Arito [11] investigated the effects of translation from English to Japanese on subsequent sleep period and found no increase in the amount of slow wave sleep and depressed slow wave activity during the first sleep cycle [11]. In another study, de Bruin et al. [12] studied the effects of computer-based sustained mental load which included sustained attention, memory, logical thinking, and other type of calculations for 8 hours on sleep variables. Sustained mental work load and light mental activity (i.e., watching television) conditions were comparable in terms of sleep parameters [12]. Pre-sleep cognitive workloads have been found to affect sleep quality negatively. Both anxious and physiological arousal led to longer sleep onset latency and shorter total sleep time in healthy subjects [21]. Recently, the influence of pre-sleep cognitive arousal induced by Digit Span, Stroop, Recognition, and Symbol Substitution tasks on sleep were investigated, and potentially sleep disturbing effects (i.e. increased sleep onset) were found [22]. But those above-mentioned studies used cognitive tasks as acute interventions, and the effects of regular long-term mental load have not been previously studied in healthy subjects. Playing chess may be accepted as a regular mental load which is also involved in cognitive arousal and training.

Playing chess may be used as a non-pharmacological intervention in treatment of insomnia. Difficulty in falling asleep and sleep fragmentation due to frequent awakenings at night are common problems in society. Despite certain drawbacks such as adverse effects, dependence and rapidly developing tolerance, pharmacotherapy with sleeping pills is one of the most common treatments for adults with insomnia. In an effort to establish a non-pharmacologic instrument, eight weeks of cognitive training was found to promote initiation and maintenance of sleep in older adults with insomnia [23]. Chess requires problem-solving skills. In a recent randomized controlled trial, problem-solving therapy lasting 6 weeks has been found effective in adult insomnia patients and it produced important benefits such as improving efficiency and quality of sleep along with reducing insomnia severity [24]. We suggest that playing chess should be tested as an alternative method of intervention to promote sleep quality in patients with insomnia.

There are several limitations of this study. First, all participants were active chess players and these results may not be extrapolated to general population. In addition, the number of male participants was significantly higher than that of female participants. Second, polysomnographic evaluation of all participants would be beneficial, in order to assess macrostructure of sleep stages. Unfortunately, we were not able to afford 225 polysomnographic recordings. Adding a second group of chess amateurs could show sleep differences in tournament players and amateurs and would maximize the power of the study by amplifying the treatment effect.

CONCLUSION

To the best of our knowledge, this is the first cross sectional study investigating the relationship between chess game activity and subjective sleep quality. Our results suggest that regular chess activity does not impair subjective sleep quality in young adults and playing chess has the potential to improve subjective

sleep quality through increased mental activity and development of problem-solving skills.

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