

# Investigation of the Changes in Perceived Sleep Quality and Quantity among Maritime Students in Relation to Long Term Sea Training

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**ABSTRACT:** Maritime students spend a certain period of their training on board, depending on their qualifications. Deck officer candidates (deck cadets) must perform an open sea internship on commercial vessels for one year. Deck officers are among to member of crew with important responsibilities to cooperate with the Master during voyage including being involved in navigation and port watches as well as maintenance of the ship and its safety equipment. Deck cadets perform their practical training between academic education periods according to general practice in Turkey. They can be subjected to unusual working hours and rest periods during the mission on the ship. Considering the importance of adequate sleep for productivity, vigilance, sustaining attention and even over-all health and well-being, it is not only sleep quantity but sleep quality is critical. The aim of this study was to investigate of the effect of the long-term onboard training (aprox. 7 months) on the sleep quantity and quality of the maritime students. Data regarding sleep quantity and perceptive quality among the subjects were obtained by using Pittsburg Sleep Quality Index (PSQI). PSQI is a scale providing information on type and violence of sleep disorders and the quality of sleep during the past month. A total of 60 maritime students were asked to fill PSQI before and after onboard training. Demographical information such as age, gender, weight, height and information regarding the internship were also obtained. Of the students 43.3% rated as poor sleeper before the internship and this ratio increased to 73.3% after the internship. A prominent decrease in sleep quality was determined. Sleep duration did not change significantly. This study showed a significant negative effect of onboard training on sleep quality among participants and they did not recover within a month after returning from the sea which indicates potential long term consequences.

## 1 INTRODUCTION

Maritime is a profession that involves a lot of physical and mental effort and many risks. Officers play a role in ensuring the safety of life and in the development of the healthy working attitude of the crew. Deck cadets are also marine students trained on board to be watchkeeping officer.

According to the STCW 78 (amended in 2010) training standards, deck cadets are obliged to

undertake 12 months of sea training. In Turkey, the three-part internship system is widely applied in the undergraduate programs that provide the qualification of oceangoing watchkeeping officer. Students studying in related programs perform their first two internships between June-September at the end of each academic year and their third internship between February and September during the third academic year (Turkish Seafarers Regulation 2016).

Jeżewska et al. (2006) stated that students at sea are more vulnerable to the stress compared to experienced officers, due to reasons such as social relationships in the marine environment, physical burdens, lack of control and lack of support. The World Health Organization sees work-related stress sources as determinants of health and illness.

It is known that the shift system and working hours at the ship also affect the health of the seafarers. Many studies in the literature show that working hours cause sleeping problems in seafarers (Hystad & Eid 2016, Jepsen et al. 2015, Yılmaz 2012). An individual should begin sleeping simultaneously with the biological clock for maximum benefit from the sleep. If sleep time is not synchronized with the biological clock, proper sleep becomes difficult.

The schedules of watchkeeping in vessels may conflict with the individual's biological clocks (Hvstad & Eid 2016, Yılmaz et al. 2013, Calhoun 1999, Colquhoun et al. 1988). This situation can disrupt sleeping and sleep quality at a significant level, and adversely affect both the general health and the professional performance of the person due to lack of sleep.

Maritime students have to learn a wide range of tasks and procedures during the limited training period at the ship. They have to work with professional seafarers because they do job based learning. It is well known in the industry that deck cadets are used as "joker" member in reducing the workload of the officers and the crew. They are subjected to unusual working and resting hours for these reasons (Yıldız et al. 2016, Magramo & Gellada 2009).

When the news of the accident on the commercial vessels is examined, it is understood that the cadets are in the tragedical situation. In 2017, trainee Kshiti was found dead in the cargo area of a container ship; in 2016, one of the two trainees was died while unlashng the forward gantry crane with the bosun on a bulk carrier; in 2012, Jonathan Martin, a 14-year-old intern who died on a training ship by falling from high... These events are only a few of the 9210 results that you have seen when you search for web sites related to intern deaths (URL 4-7).

When adaptation problems, stress, workload and working time factors are combined, it can be predicted that lucky trainees -who have not suffered any accidents or survived- continue to their educational life on board and in the academy as "unhealthy".

In this study, it was aimed to investigate the effect of the long-term onboard training (aprox. 7 months) on the sleep quantity and quality of the maritime students. The Pittsburg Sleep Quality Index (PSQI) was administered to 60 students before and after the onboard training period.

## 2 METHODS

### 2.1 Participants

In this study, PSQI was applied to Turkish students who will take a long term internship, and their sleeping qualities during school life were determined firstly. This questionnaire has been applied in relation to the last month that does not include the exam process. Secondly, the PSQI was repeated a month later the students' disembarkation. Data collection was completed in 11 months (December 2015- November 2016).

### 2.2 Demographic Variables

The individuals involved in the study are required to have a seafarer's medical report, have not passed a disease within the past month, have to be taken to a long-term internship and have personal rations.

The participant's age, height, weight, gender data and the duration of internship, ship type, average daily work / rest / sleep / night sleep hours on board were obtained with the help of student information form.

### 2.3 Data Collection and Items

The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire which assesses sleep quality and disturbances over a 1-month time interval. Nineteen individual items generate seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each component takes a score between 0-3 ("0" is very good, "3" is very bad) and the sum of 7 component scores is the global PSQI score. The global score has a value between 0-21. The higher the global score, the worse the sleep quality. A global PSQI score of  $\leq 5$  indicates "good sleep quality" and a score of  $>5$  indicates "poor sleep quality". The poor sleep quality suggests that at least two of the above mentioned components are severely impaired or three of the components are moderate impaired. The index is known to be valid and reliable in Turkish society (Buysse ve ark.,1989; Ağargün ve ark., 1996).

### 2.4 Information of Participants' Internship

Participants in the study were trained in bulk carriers (15%), dry/general cargo vessels (23.3%), Ro-Ro (6.7%), container (11.7%) and tankers (43.3%). The average duration of internship is 6.9 months (SD 0.73).

The average daily study reported by students was between 10 and 21 hours (mean  $15.4 \pm 2.4$ ); mean daily rest between 3 and 14 hours (mean  $8.2 \pm 2.1$ ); mean daily sleep was between 3 and 10 hours (mean  $6.2 \pm 1.4$ ) and mean daily nighttime sleep varied between 0 and 8 hours (mean  $5.2 \pm 1.8$ ). "Daily sleep" refers to all the sleep processes that occur within 24 hours, the "night sleep" expression at midnight and the sleep processes that occur around it.

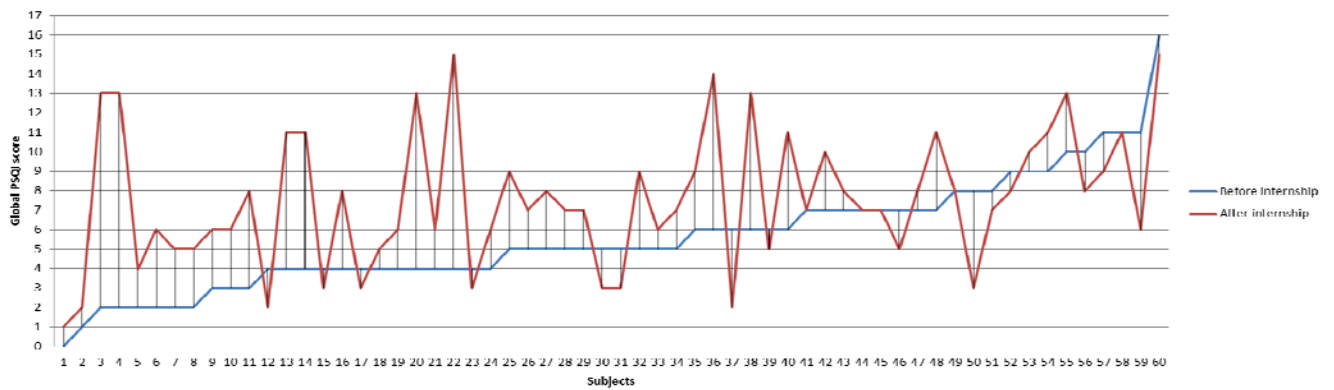


Figure 1. Subjects' global PSQI scores before and after internship

### 2.5 Analysis of Data

Participants' global PSQI scores, subscores, gender, age, type of ship, daily average work/rest/sleep/night sleep hours, watchkeeping system and duration of internship were assessed using excel data analysis tools. Frequency distribution, mean and standard deviations are taken into account in the evaluations.

As the values of the four women who participated in the study did not cause any significant differences in the average PSQI scores, they were evaluated in 60 people without discrimination between men and women in the calculations.

## 3 RESULTS

Sixty individuals (56 men, 4 women) with proper suitability (seafarer's health certificate) participated in the study. The mean age was 23.1 years (21.3-26.8) and the mean body mass index was 24.0 kg / m<sup>2</sup> (18.5-32.4).

The average global PSQI score of the students was  $5.6 \pm 2.9$  before the internship and  $7.6 \pm 3.5$  after the internship.

Before the training, 34 subjects (56.7%) had a global PSQI score of  $\leq 5$  while the remaining 26 subjects (43.3%) had a score  $> 5$ .

After the internship, 16 subjects (26.7%) had a global score  $\leq 5$ , and 44 people (73.3%) had a score  $> 5$ . For each participant, global PSQI scores before and after the internship are shown in Figure 1. When the global PSQI score is  $\leq 5$ , it is evaluated as "good sleep quality" and when it is  $> 5$ , it is considered as "poor sleep quality" (Buysse et al. 1989).

The frequency distributions of the global PSQI scores before and after the internship are shown in Figures 2 and 3.

The mean and standard deviation (SD) values of the participants' global PSQI scores and component scores before and after the internship, are given in Tables 1 and 2. Mean and SD values of PSQI scores were calculated separately according to gender, age, type of ship, daily average work / rest / sleep / night sleep hours, shift system and internship period. If the post-internship scores is more than pre-training

scores that means sleep quality was affected negatively.

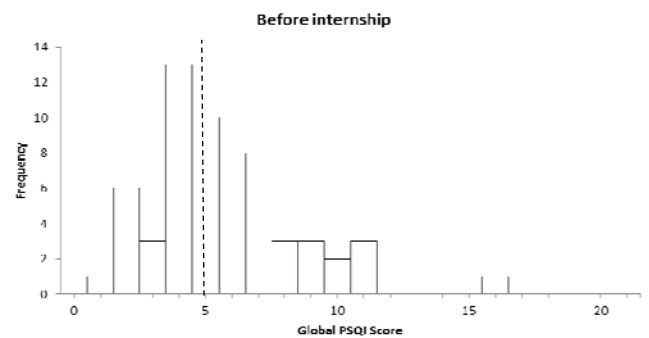


Figure 2. Frequency distribution of global PSQI scores before internship

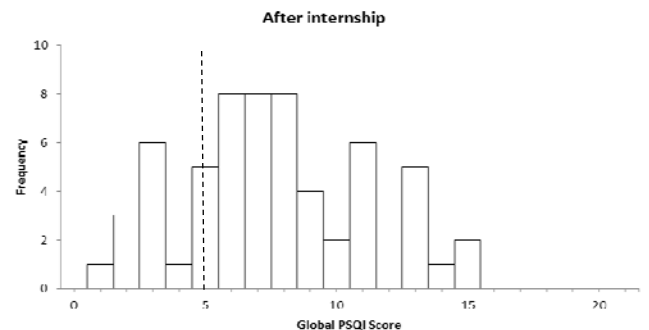


Figure 3. Frequency distribution of global PSQI scores after internship

When PSQI subscores were compared before and after the internship, it was determined that the total subscores for all the individuals changed as provided in Figure 4.

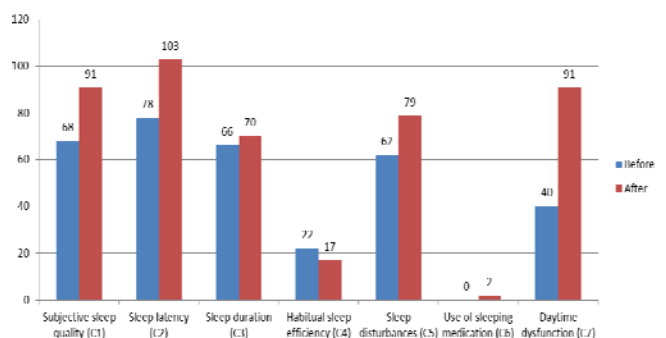


Figure 4. Total scores of PSQI subscales before and after onboard training

Table 1. Scores of global PSQI and subscales before internship (mean, standard deviation)

	Before Internship Scores of PSQI subscales																
	n	Global PSQI		Sleep quality		Sleep latency		Sleep duration		Sleep efficiency		Sleep disturbance		Use of sleeping medication		Daytime dysfunction	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<i>Gender</i>																	
Female	4	3.5	1.0	1.0	0.0	0.5	1.0	0.5	0.6	0.0	0.0	0.8	0.5	0.0	0.0	0.8	1.0
Male	56	5.8	2.9	1.1	0.8	1.4	1.0	1.1	1.0	0.4	0.7	1.1	0.4	0.0	0.0	0.7	0.8
All	60	5.6	2.9	1.1	0.7	1.3	1.0	1.1	1.0	0.4	0.7	1.0	0.4	0.0	0.0	0.7	0.8
<i>Age (Year)</i>																	
21-24	51	5.6	2.9	1.2	0.8	1.3	1.0	1.1	1.0	0.4	0.7	1.0	0.4	0.0	0.0	0.7	0.9
24-27	9	5.4	2.9	1.0	0.7	1.2	1.1	1.1	1.2	0.2	0.4	1.2	0.4	0.0	0.0	0.7	0.7
<i>Type of Vessels</i>																	
Bulk carrier	9	4.8	2.5	0.7	0.7	1.3	1.1	1.3	1.0	0.0	0.0	1.0	0.5	0.0	0.0	0.4	0.5
Dry/General Cargo	14	6.4	3.8	1.4	0.8	1.7	1.1	1.0	1.1	0.6	0.9	1.1	0.3	0.0	0.0	0.6	0.9
Container	7	5.3	2.0	1.3	0.8	1.1	0.9	1.0	1.0	0.1	0.4	1.0	0.6	0.0	0.0	0.7	0.8
Ro-Ro	4	6.5	2.4	1.5	1.0	1.8	0.5	0.8	1.0	0.8	0.5	1.0	0.8	0.0	0.0	0.8	1.0
Tanker	26	5.4	2.8	1.1	0.6	1.0	1.0	1.2	1.0	0.3	0.6	1.0	0.3	0.0	0.0	0.8	0.9
<i>(Chemical/Cruide)</i>																	
<i>Daily Working Hours</i>																	
10-12	9	4.6	1.7	0.9	0.6	1.2	0.8	0.7	0.9	0.2	0.4	0.8	0.4	0.0	0.0	0.8	1.0
13-15	13	6.0	2.8	1.1	0.6	1.6	1.0	1.2	1.1	0.4	0.8	1.1	0.5	0.0	0.0	0.6	0.8
16-18	35	5.8	3.2	1.2	0.8	1.2	1.0	1.2	1.0	0.4	0.7	1.1	0.4	0.0	0.0	0.7	0.9
19-21	3	4.3	2.5	1.0	0.0	1.0	1.0	1.0	1.0	0.3	0.6	1.0	0.0	0.0	0.0	0.0	0.0
<i>Daily Resting Hours</i>																	
3-5	4	5.3	2.8	1.0	0.0	1.0	0.8	1.3	1.0	0.5	0.6	1.0	0.0	0.0	0.0	0.5	1.0
6-8	39	5.9	3.1	1.3	0.8	1.3	1.0	1.1	1.0	0.4	0.7	1.1	0.4	0.0	0.0	0.7	0.8
9-11	11	5.3	2.7	1.0	0.6	1.5	1.1	1.2	1.1	0.3	0.6	1.0	0.6	0.0	0.0	0.3	0.5
12-14	6	4.5	1.4	0.7	0.5	1.2	0.8	0.8	1.0	0.2	0.4	0.8	0.4	0.0	0.0	0.8	1.0
<i>Daily Sleeping Hours</i>																	
3-4	7	5.6	3.2	1.1	0.7	1.3	1.0	1.3	1.1	0.3	0.5	1.1	0.4	0.0	0.0	0.4	0.8
5-6	31	6.1	3.2	1.2	0.8	1.2	1.1	1.2	1.1	0.5	0.8	1.1	0.4	0.0	0.0	0.8	0.9
7-8	20	5.1	2.3	1.0	0.8	1.5	0.9	0.9	0.8	0.3	0.4	1.0	0.4	0.0	0.0	0.6	0.8
9-10	2	4.0	2.8	1.0	0.0	1.0	1.4	1.5	0.7	0.0	0.0	0.5	0.7	0.0	0.0	0.0	0.0
<i>Daily Night Sleeping Hours</i>																	
0-2	4	7.5	3.5	1.5	0.6	1.3	1.5	1.0	0.0	1.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0
3-5	24	5.8	3.2	1.3	0.7	1.3	1.1	1.2	1.0	0.3	0.7	1.0	0.5	0.0	0.0	0.7	0.9
6-8	32	5.3	2.6	1.0	0.8	1.3	0.9	1.0	1.0	0.3	0.6	1.1	0.4	0.0	0.0	0.6	0.8
<i>Schedule of Watchkeeping (Time)</i>																	
00-04/12-16	14	6.1	3.1	1.4	0.6	1.3	1.0	1.1	1.0	0.5	0.7	1.0	0.4	0.0	0.0	0.8	0.9
00-06/12-18	1	5.0	-	1.0	-	1.0	-	0.0	-	0.0	-	1.0	-	0.0	-	2.0	-
04-08/16-20	32	5.6	3.2	1.1	0.8	1.3	1.0	1.2	1.1	0.4	0.8	1.1	0.5	0.0	0.0	0.7	0.9
08-12/20-24	8	4.9	1.9	1.0	0.5	1.4	0.9	1.1	0.6	0.3	0.5	0.9	0.4	0.0	0.0	0.3	0.5
MIXED	5	5.4	2.1	1.2	1.1	1.6	1.5	0.6	0.9	0.2	0.4	1.0	0.0	0.0	0.0	0.8	0.8
<i>Duration of Internship (Month)</i>																	
5.1-6.0	12	5.6	3.5	1.1	0.8	1.3	1.1	1.3	1.0	0.4	0.7	1.0	0.4	0.0	0.0	0.5	0.8
6.1-7.0	21	5.5	2.3	1.0	0.8	1.3	0.8	0.9	1.1	0.2	0.5	1.2	0.5	0.0	0.0	0.8	0.8
7.1-8.0	25	5.8	3.2	1.2	0.7	1.3	1.1	1.2	0.9	0.5	0.8	0.9	0.3	0.0	0.0	0.6	0.9
8.1-9.0	2	4.5	2.1	1.0	0.0	1.0	1.4	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.5	0.7

Table 2. Scores of global PSQI and subscales after internship (mean, standard deviation)

	n	Before Internship Scores of PSQI subscales															
		Global PSQI		Sleep quality		Sleep latency		Sleep duration		Sleep efficiency		Sleep disturbance		Use of sleeping medication		Daytime dysfunction	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<i>Gender</i>																	
Female	4	7.3	5.5	1.3	1.3	1.5	1.3	1.3	1.3	0.3	0.5	1.3	0.5	0.0	0.0	1.8	1.5
Male	56	7.6	3.4	1.5	0.8	1.7	1.0	1.2	1.0	0.3	0.6	1.3	0.6	0.0	0.2	1.5	1.0
All	60	7.6	3.5	1.5	0.8	1.7	1.0	1.2	1.0	0.3	0.6	1.3	0.6	0.0	0.2	1.5	1.0
<i>Age (Year)</i>																	
21-24	51	7.6	3.4	1.5	0.8	1.8	1.1	1.2	1.0	0.3	0.6	1.3	0.5	0.0	0.0	1.5	1.0
24-27	9	7.2	4.3	1.6	0.9	1.3	0.9	1.0	1.0	0.3	0.7	1.4	0.7	0.2	0.4	1.3	1.0
<i>Type of Vessels</i>																	
Bulk carrier	9	7.8	3.5	1.7	0.7	2.0	1.0	1.1	0.6	0.4	0.7	1.3	0.7	0.0	0.0	1.2	0.8
Dry/General Cargo	14	7.6	4.3	1.4	0.8	1.5	1.2	1.4	1.3	0.5	0.8	1.3	0.6	0.0	0.0	1.5	1.2
Container	7	7.4	3.8	1.3	1.0	1.6	0.8	1.1	1.2	0.0	0.0	1.4	0.8	0.0	0.0	2.0	1.3
Ro-Ro	4	7.5	4.5	1.5	1.3	2.5	1.0	0.5	0.6	0.3	0.5	1.3	0.5	0.0	0.0	1.5	1.3
Tanker	26	7.5	3.1	1.6	0.8	1.7	1.0	1.2	1.0	0.2	0.5	1.3	0.5	0.1	0.3	1.5	0.8
<i>(Chemical/Cruide)</i>																	
<i>Daily Working Hours</i>																	
10-12	9	6.1	2.2	1.0	0.9	1.7	1.0	0.6	0.7	0.0	0.0	1.0	0.0	0.0	0.0	1.9	1.2
13-15	13	7.8	3.8	1.5	0.8	1.8	0.9	1.5	1.1	0.2	0.6	1.5	0.7	0.0	0.0	1.4	1.0
16-18	35	7.6	3.6	1.7	0.8	1.6	1.1	1.2	1.0	0.3	0.6	1.3	0.6	0.0	0.2	1.5	1.0
19-21	3	10.0	3.6	1.7	0.6	2.7	0.6	1.3	1.5	0.7	1.2	1.7	0.6	0.3	0.6	1.7	0.6
<i>Daily Resting Hours</i>																	
3-5	4	9.5	3.1	1.8	0.5	2.8	0.5	1.3	1.3	0.5	1.0	1.5	0.6	0.3	0.5	1.5	0.6
6-8	39	7.8	3.6	1.7	0.8	1.7	1.1	1.2	1.1	0.3	0.6	1.3	0.6	0.0	0.2	1.6	1.0
9-11	11	7.1	3.4	1.3	0.8	1.5	0.9	1.3	1.1	0.2	0.6	1.5	0.7	0.0	0.0	1.4	1.1
12-14	6	5.7	2.4	0.8	0.8	1.5	1.0	0.8	0.8	0.0	0.0	1.0	0.0	0.0	0.0	1.5	1.2
<i>Daily Sleeping Hours</i>																	
3-4	7	10.7	2.1	2.3	0.5	2.1	0.9	1.9	0.9	0.6	0.8	1.7	0.5	0.3	0.5	1.9	0.7
5-6	31	7.6	3.9	1.6	0.8	1.7	1.1	1.3	1.1	0.4	0.7	1.3	0.6	0.0	0.0	1.4	1.1
7-8	20	6.6	2.6	1.3	0.8	1.6	1.0	0.9	0.9	0.1	0.2	1.3	0.5	0.0	0.0	1.5	0.9
9-10	2	5.0	0.0	0.5	0.7	1.0	0.0	0.5	0.7	0.0	0.0	1.0	0.0	0.0	0.0	2.0	1.4
<i>Daily Night Sleeping Hours</i>																	
0-2	4	10.8	3.1	2.3	1.0	2.0	1.2	2.0	1.4	0.8	1.0	1.8	0.5	0.0	0.0	2.0	1.4
3-5	24	8.7	3.8	1.8	1.1	2.0	1.1	1.3	1.1	0.5	0.7	1.4	0.6	0.1	0.3	1.6	1.0
6-8	32	6.3	2.8	1.2	0.7	1.5	1.0	0.9	0.8	0.1	0.3	1.2	0.5	0.0	0.0	1.4	1.0
<i>Schedule of Wathckeping (Time)</i>																	
00-04/12-16	14	7.2	3.1	1.4	0.9	1.4	1.0	0.9	1.1	0.2	0.6	1.4	0.5	0.1	0.3	1.8	1.1
00-06/12-18	1	9.0	-	2.0	-	1.0	-	2.0	-	0.0	-	1.0	-	0.0	-	3.0	-
04-08/16-20	32	7.8	3.7	1.5	0.8	1.9	1.0	1.3	1.0	0.3	0.6	1.3	0.7	0.0	0.2	1.4	0.9
08-12/20-24	8	6.9	2.5	1.4	0.5	1.8	1.0	1.4	0.7	0.3	0.5	1.1	0.4	0.0	0.0	1.0	0.8
MIXED	5	7.8	5.2	1.8	0.8	1.6	1.3	0.8	1.3	0.4	0.5	1.4	0.5	0.0	0.0	1.8	1.3
<i>Duration of Internship (Months)</i>																	
5.1-6.0	12	6.2	3.1	1.4	0.8	1.3	0.9	1.0	1.0	0.1	0.3	1.1	0.5	0.1	0.3	1.2	0.9
6.1-7.0	21	7.9	3.4	1.7	0.9	1.7	1.2	1.1	0.9	0.2	0.5	1.4	0.6	0.0	0.0	1.8	0.9
7.1-8.0	25	7.8	3.8	1.4	0.8	2.0	1.0	1.2	1.1	0.4	0.7	1.3	0.6	0.0	0.2	1.4	1.1
8.1-9.0	2	8.5	3.5	1.5	0.7	1.5	0.7	2.0	0.0	0.5	0.7	1.5	0.7	0.0	0.0	1.5	0.7

#### 4 DISCUSSIONS AND FINDINGS

The students studying at the Maritime Transportation and Management Engineering Undergraduate Program are participated in this study. The third-year students' sleep quality was examined before and after internship by considering onboard working conditions.

Aysan et al. (2014) found that the mean PSQI score of the students was  $6.15 \pm 1.9$  and ratio of poor sleep quality (PSQI > 5, bad sleepers) was 59%, in a study they conducted with Turkish university students studying in the field of health sciences. Saygılı et al. (2011) found a general PSQI average of  $6.9 \pm 2.4$  in their study with Turkish university students at different levels of education and in different disciplines (from health to social sciences). 30.5% of

these students were found to be bad sleeper. Baert et al. (2014) found that 30.4% of first-year college students were bad sleepers before the first exam period in Economics and Commercial Sciences in Belgium.

Andruskiene et al. (2016) found that 45.0% of students were bad sleepers in the study they conducted with university students in various maritime departments in Lithuania. In the same study, it was seen that marine students and also third / fourth year students had worse sleep quality than the others. In this study, it was seen that the marine students were "bad sleepers" at a higher rate (43.3%) than the other departments before the internship. However, the overall PSQI average of  $5.6 \pm 2.9$  indicates that the maritime students had lower sleep complaints before the internship for the Turkish population.

After the internship, there was a 2-point increase (deterioration) in overall sleep quality (interval 0-21). While the average sleep quality was close to the "good" limit with a score of  $5.6 \pm 2.9$  before the internship, the average sleep quality was accumulated in the "poor" area with a score of  $7.6 \pm 3.5$  after the internship. 43.3% of the pre-training students were "bad sleepers", but this ratio increased to 73.3% after the internship.

It was observed that the students were subject to shift work procedures during onboard training but continued to work outside shifts. As discussed in the STCW 78 (amended in 2010) and MLC 2006; normal working hours should not exceed 8 hours per day in port and sea in terms of remuneration; from the point of view of fatigue, the maximum working hours shall not exceed 14 hours in a period of 24 hours and 72 hours in a period of 7 days. The students reported that the average daily work-up was between 10 and 21 hours (mean  $15.4 \pm 2.4$ ); the average daily rest between 3 and 14 hours (mean  $8.2 \pm 2.1$ ); the average daily sleep was between 3 and 10 hours (mean  $6.2 \pm 1.4$ ) and the average daily nighttime sleep was between 0 and 8 hours (mean  $5.2 \pm 1.8$ ) in the internship. In general, they have performed against the regulations of STCW 78 (amended in 2010) and Maritime Labor Convention 2006 (MLC 2006).

Karakoç (2009) reported a mean PSQI score of  $6.96 \pm 3.19$  in the study of health workers' sleep quality. The percentage of those with a PSQI score of 5 or higher was 76.5%. Çaliyurt (1998) reported average PSQI scores for shift health workers, nurses, doctors and jet lag were as  $8.26 \pm 3.60$ ,  $6.60 \pm 2.69$ ,  $6.33 \pm 2.69$  and  $7.00 \pm 2.63$  respectively. The mean PSQI score of the control group without any work and shift irregularities was  $3.3 \pm 1.49$ . The mean PSQI score of  $7.6 \pm 3.5$  determined by this study shows that the sleep quality of the students returning to land after onboard training was as bad as the health personnel and jet-lag long flight staff.

Table 1 and 2 show the differences in PSQI scores before and after the internship. According to the tables; there is no significant difference in PSQI changes between individuals aged 21-24 years and 24-27 years.

When ship types are examined, the greatest increase (deterioration) in the average PSQI score was seen in those who practiced on bulk carriers. This is followed by cadets on tankers and containers, dry/general cargo and Ro-Ro vessels. However, when the *n* and *standard deviations* are taken into consideration, it can be concluded that the worst deterioration in sleep quality occurs in individuals performing internships in tankers (*n*:26, the amount of the global change was mean  $2.1 \pm 0.3$ ).

When the daily average working hours are examined, it is seen that the PSQI score increases as working hours increase. The highest increase in the PSQI score was seen in 19-21 hours of employees. This is followed by 16-18 hours, 13-15 hours and 10-12 hours respectively. As the average daily rest time decreased, the PSQI score increased. The highest score increase was seen in those who rested 3-5 hours a day. This is followed by those who rest 6-8 hours, 9-11 hours and 12-14 hours, respectively.

The PSQI score increased as the daily total sleep duration decreased. The highest score increase occurred during 3-4 hours of sleep. This is followed by 5-6 hours, 7-8 hours and 9-10 hours respectively. Similarly, when nightly sleep decreased, the PSQI score increased. The highest score increase occurred in the 0-2 hours night sleepers. This is followed by 3-5 hours and 6-8 hours night sleepers.

Participants reported that they were subject to variable shift systems throughout their onboard training duties. In order to be able to make the classification, the shift hours that have been covered in the last month of the internship are taken into consideration. Accordingly, the individuals were subject to the 00-04/12-16, 00-06/12-18, 04-08/16-20, 08-12/20-24 and MIXED shift systems. The MIXED statement indicates that individuals in that group do not have a shift schedule during their working hours. The increase in PSQI peaked on a person subject to the 00-06 / 12-18 shift system. If this data for one person is ignored, the maximum increase in score has occurred in the MIXED group, which does not have a certain working order. This is followed by 04-08 / 16-20, 08-12 / 20-24 and 00-04 / 12-16 shift systems, respectively.

When the effect of the internship period on PSQI score increase was investigated, it was seen that the increase in the score was most prominent among the students who worked for 8-9 months. This is followed by 6-7 months, 7-8 months and 5-6 month interns, respectively. As the training period increased, the PSQI score increased.

Figure 4 shows the changes in sleep quality index components for all participants. The greatest impairment occurred in the field of daytime dysfunction (C7). This is followed by sleep latency, subjective sleep quality and sleep disturbance components, respectively. Individuals experiencing daytime dysfunction are forced to remain awake during driving, eating, or other social activities, and can not have enough desire to do anything. It is an undeniable fact that the educational life and social life of the students in this situation will be adversely affected. In the habitual sleep efficiency (C4) of the PSQI components, the total score fell unlike other components. Sleep efficiency is roughly calculated as the ratio of sleep time to lying time. The score increase in the sleep duration component (C3) suggests that individuals do not have an increase in sleep times. In this case, it can be mentioned that there is a decrease in lying time after the internship. It is understood that there are individuals who are experiencing sleep latency in the sample population (C2), as well as those who tend to fall asleep as soon as they reach the bed. However, when the total score changes of the components are examined, it is seen that there are no significant changes in the duration and efficiency of sleep.

The information in the literature attracts attention that an individual with a normal nighttime sleep of 8 hours will experience a sleep deprivation with a 5-hour nighttime sleep. The only way to compensate for lack of sleep is to sleep more. For 1 hour of daily sleep loss, sleep deprivation can be corrected by sleeping one or two hours more each night. It is generally said that for short-term

deprivations it can take up to 7 days, and for long-term deprivations it may take several weeks. Sleep deprivation is known to affect health negatively. For example, it increases the amount of cortisol in the blood. Long-term increases in cortisone can also trigger disorders such as depression, obesity, and heart problems (Epstein&Mardon 2006, URL-1, URL-2, URL-3). The components of sleep duration in Figure 4 showed that the students did not tend to sleep too much to compensate for sleep deprivation after they had passed from sea life to land life. This may be thought to be related to the component of sleep disturbances (C5). In addition, the necessity of continuing daily life and educational activities may also be related to this situation.

Figure 4 shows a significant increase (deterioration) in the sleep latency (C2) component. Individuals have more than 15 minutes to fall asleep suggesting that have sleep latency. In addition, the frequency of do not fall asleep in 30 minutes determines the severity of sleep latency.

Sleep disturbance component (C5) indicates that individuals experience problems include waking in the midnight or early morning hours, get up feeling a need for bath/toilet, cannot breathing comfortably, coughing or loud snoring, feeling too hot or cold, have bad dreams and feeling pain. A significant increase was determined in the number of people experiencing toilet/bathroom needs, nightmares and waking in nighttime or early morning respectively, after the internship. And that the most severe complaint is related to waking up at midnight or early in the morning.

The researchers of this study conducted another study on the energy consumption and sleep states of the deck officers on the container vessels (Yılmaz et al., 2018). In that study, the average of bedtimes of the officers was 7.2 hours/day (SD  $\pm$  2.0); average of sleep times 4.7 hours/day (SS  $\pm$  1.4) and average of daily sleep efficiency 66.1% (SS 14.2). The results, carried out with the body tracking monitor and based on objective data, can present an evidence of the reported data by the maritime students in this study.

Studies in the literature show that quality and adequate night's sleep are important in terms of healthy life and cognitive performance and may have an impact on academic achievement (Zeek et al. 2015, Baert et al. 2014, Koçoğlu et al. 2010, Eliasson&Lettieri 2010, Gilbert & Weaver 2010, Perez-Chada et al. 2007, Howell et al. 2004, Wagner et al. 2004). Students in the sample and in the widespread system in Turkey need to continue their academic life at the end of the internship without interruption. The findings of this study show that sleep quality of marine students is negatively affected by the process they are working as deck cadets. It has been observed that the students did not recover in next a month of returning to land and they continued their education life by sleeping problems.

## 5 CONCLUSION

When the data from this study and the data in the literature were considered together, it was found that

the marine university students had better sleep quality (PSQI global score: 5.6 $\pm$ 2.9) than the students in other university departments before the internship; but they had worse sleep quality after the internship (PSQI global score: 7.6 $\pm$ 3.5).

Third-year students who were trained as a oceangoing watchkeeping officer were found to have a significant deterioration in sleep quality after onboard training (mean 6.9 months).

It was observed that the students were subject to shift work procedures during onboard training but continued to work outside the shift (mean 15.4 $\pm$ 2.4). Students were generally in violation of STCW 78 (amended in 2010) and MLC (2006) regulations as deck cadets. Increased working hours have resulted in decreased rest and sleep hours and impaired sleep quality in the individual. As the training period increased, the deterioration of sleep quality increased.

After the internship, daytime dysfunctions were observed to increase significantly indicating the seriousness of the situation.

Additionally, the finding that the students did not recover from the compromised sleep pattern within a month after returning from the sea is also of importance since they have continue to the academic life with this disturbed sleep pattern.

In future studies, it would be useful to review the attendance status and academic achievement of marine students after the internship. In addition, the effects of ship types, shift systems and training periods can be examined in more detail by increasing the number of samples.

It would be useful to reorganize the programs of the maritime schools so that they allow the students to recover physically before the transition to academic life after the internship. In addition, firms employing deck cadets should observe their working hours; it will be useful to do work arrangements in such a way that night rests will not be divided and enough sleep can be attained for at least 1 month before students return to land.

## REFERENCES

- Ağargün, M.Y., Kara, H., Anlar, O. 1996. Pittsburgh uyku kalitesi indeksinin geçerliği ve güvenilirliği (in Turkish), *Türk Psikiyatri Dergisi*, 7(2), 107-115
- Andruskiene, J., Barseviciene, S., Varoneckas, G. 2016. Poor Sleep, Anxiety, Depression and Other Occupational Health Risks in Seafaring Population, *TransNav the International Journal on Marine Navigation and Safety of Sea Transportation*, Volume 10, Number 1, DOI: 10.12716/1001.10.01.01
- Aysan, E., Karaköse, S., Zaybak, A., Günay-İsmailoğlu, E. 2014. Üniversite Öğrencilerinde Uyku Kalitesi ve Etkileyen Faktörler, *Dokuz Eylül Üniversitesi Hemsirelik Fakültesi Elektronik Dergisi*, 7(3),193-198
- Baert, S., Omeij, E., Verhaest, D., Vermeir, A. 2014. Mister Sandman, Bring Me Good Marks! On the Relationship Between Sleep Quality and Academic Achievement, *Institute for the Study of Labor, Germany, IZA DP No. 8232*, Available at: <http://ftp.iza.org/dp8232.pdf>, June-2018
- Buysse, D.J., Reynolds, C.F.3rd, Monk, T.H., Berman, S.R., Kupfer, D.J., 1989. The Pittsburgh Sleep Quality Index: A

- new instrument for psychiatric practice and research, *Psychiatry Research*, May:28(2), 193-213
- Calhoun, R. 1999. Human Factors in Ship Design: Preventing and Reducing Shipboard Operator Fatigue, University of Michigan, Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.604.286&rep=rep1&type=pdf> , June-2018
- Colquhoun, W.P., Rutenfranz, J., Goethe, H. 1988. Work at sea: a study of sleep, and of circadian rhythms in physiological and psychological functions, in watchkeepers on merchant vessels, *International Archives of Occupational and Environmental Health*, 60:321, doi:10.1007/BF00405665
- Çalyurt, O. 1998. Sirkadiyen uyku uyanıklık düzenini etkileyen iş ve çalışma gruplarında uyku kalitesinin değerlendirilmesi (in Turkish), Master Thesis (Supervisor: Abay E.), Trakya University, School of Medicine, Department of Psychiatry, Edirne
- Eliasson, A.H., Lettieri, C.J. 2010. Early to bed, early to rise! Sleep habits and academic performance in college students, *Sleep Breath*, 14:71, doi:10.1007/s11325-009-0282-2
- Epstein, J.E., Mardon, S. 2006. The Harvard Medical School Guide To A Good Night's Sleep, McGraw-Hill E-books, Harvard College, USA, DOI: 10.1036/0071467432
- Gilbert, S.P., Weaver, C.C. 2010. Sleep Quality and Academic Performance in University Students: A Wake-Up Call for College Psychologists, *Journal of College Student Psychotherapy*, 24:295-306, DOI: 10.1080/87568225.2010.509245
- Howell, A.J., Jahrig, J.C., Powell, R.A. 2004. Sleep quality, sleep propensity and academic performance, *Perceptual and Motor Skills*, 99,525-535.
- Hystad, S.W., Eid, J. 2016. Sleep and Fatigue Among Seafarers: The Role of Environmental Stressors, Duration at Sea and Psychological Capital, Safety and Health at Work, 7, 363-371
- Jepsen, J.R., Zhao1, Z., Leeuwe, W.M.A. 2015. Seafarer fatigue: a review of risk factors, consequences for seafarers' health and safety and options for mitigation, *International Maritime Health*, 66, 2:106-117
- Jezewska, M, Leszczyńska, I, Jaremin, B. Work-related stress at sea self estimation by maritime students and officers. *Int Marit Health* 2006; 57(1-4):66-75.
- Karakoç, B. 2009. Uyku kalitesi üzerine bir çalışma: Özel Dal Hastanesi sağlık çalışanları örneği (in Turkish), Master Thesis (Supervisor: Alpar Ş.E.), Marmara University, Institute of Health Sciences, İstanbul
- Koçoğlu, D., Tokur-Kesgin, M., Kulakçı, H. 2010. İlköğretim 2.Kademe Öğrencilerinin Uyku Alışkanlıkları ve Uyku Sorunlarının Bazı Okul Fonksiyonlarına Etkisi (in Turkish) / The Influence of Sleep Habits and Sleep, Problems on Some School Functions of Elementary School 2nd Level Students, Hacettepe University Faculty of Health Sciences Nursing Journal, 24-32
- Magramo, M., Gellada, L., 2009. A Noble Profession Called Seafaring: the Making of an Officer, the *International Journal on Marine Navigation and Safety of Sea Transportation*, Volume 3 Number 4
- MLC, 2006. Maritime Labour Convention 2006, as amended, ILO
- Perez-Chada, D., Perez-Lloret, S., Videla, A.J., Cardinali, D., Bergna, M.A., Fernández-Acquier, M., Larrateguy, L., Zabert, G.E., Drake, C. 2007. Sleep Disordered Breathing And Daytime Sleepiness Are Associated With Poor Academic Performance In Teenagers. A Study Using The Pediatric Daytime Sleepiness Scale (PDSS), *SLEEP*, Vol. 30, No. 12
- Saygılı, S., Çil-Akıncı, A., Arkan, H., Dereli, E. 2011. Üniversite Öğrencilerinde Uyku Kalitesi ve Yorgunluk (in Turkish), *Electronic Journal of Vocational Colleges*, December 2011, pg.88-94
- STCW, 2010. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, with 2010 Manila amendments, IMO
- Turkish Seafarers Regulation 2016. Gemiadamları Yönetmeliği (in Turkish)
- URL-1 <https://www.scientificamerican.com/article/fact-or-fiction-can-you-catch-up-on-sleep/> , June-2018
- URL-2 (<https://www.quora.com/Is-sleep-deprivation-irreversible/>) , June-2018
- URL-3 <https://www.scientificamerican.com/article/fact-or-fiction-can-you-catch-up-on-sleep/> , June-2018
- URL-4 <https://www.marineinsight.com/case-studies/deck-cadet-dies-on-bulk-carrier-due-to-multiple-crush-injuries/> , June-2018
- URL-5 <https://timesofindia.indiatimes.com/india/19-year-old-from-lucknow-dies-in-a-ship-in-brussels/articleshow/57948578.cms> , June-2018
- URL-6 <https://www.telegraph.co.uk/news/9209324/Sea-cadet-plunged-to-death-after-falling-from-rigging.html> , June-2018
- URL-7 [https://www.google.com.tr/search?q=%22deck+cadet%22+%22death%22&ei=4TozW\\_OUHcuWsAHcurWQDQ&start=0&sa=N&biw=1920&bih=947](https://www.google.com.tr/search?q=%22deck+cadet%22+%22death%22&ei=4TozW_OUHcuWsAHcurWQDQ&start=0&sa=N&biw=1920&bih=947) , June-2018
- Wagner, U, Gais, S, Haider, H, Verleger, R, Born, J. 2004. Sleep inspires insight, *Nature*, 427(6972):352-355.
- Yıldız, S., Uğurlu, Ö., Yüksekıldız, E. 2016. Occupational Issues and Expectations of Turkish Deck Cadets, the *International Journal on Marine Navigation and Safety of Sea Transportation*, Volume 10, Number 3, doi: 10.12716/1001.10.03.04
- Yılmaz, H. 2012. Determination of fatigue and sleep states of watchkeeping officers with help EEG and bridge simülator / Vardiya zabitlerinin yorgunluk ve uykusuzluk hallerinin EEG ve köprüüstü simülator yardımı ile belirlenmesi (in Turkish), Master Thesis (Supervisor: Başar E.), Karadeniz Technical University, The Graduate School of Natural and Applied Sciences
- Yılmaz, H., Başar, E., Ayar, A., Velioglu, S.K., 2018. Konteyner zabitlerinin günlük MET,uyku süre ve verimliliklerinin metabolik holter ile belirlenmesi (in Turkish) / Measure of the container officers' daily MET, sleep duration and efficiency via metabolic holter. The Proceeding Book of 16.National Neuroscience Congress, 20-23 May 2018, İstanbul Technical University, İstanbul, pp.158
- Yılmaz, H., Başar, E., Yüksekıldız, E., 2013. Investigation of Watchkeeping Officers' Watches Under The Working Hours Ineligible to STCW Regulation, *TransNav the International Journal on Marine Navigation and Safety of Sea Transportation*, Vol.7, pp.493-500
- Zeek, M.L., Savoie, M.J., Song, M., Kennemur, L.M., Qian, J., Jungnickel, P.W., Westrick, S.C. 2015. Sleep Duration and Academic Performance Among Student Pharmacists, *American Journal of Pharmaceutical Education*, 79 (5), Article 63