Posttraumatic Stress Disorder and Obstructive Sleep Apnoea among Fishermen

DALIA ABDALLAH EL-SHAFEI[1], MARWA BAYOMI AWAD ALLAH[2], AMIRA ELSAYED ABDELSALAM[2], NANEES SALAH ELDEEN GHAREEB[1], GHADA MOHAMED SALEM[2], WAEL ALI KHALIL[3], SHIMAA IBRAHIM AMIN[4]

[1] Department of Community, Environmental and Occupational Medicine, Faculty of Medicine, Zagazig University, Egypt.
[2] Department of Public Health and Community Medicine, Faculty of Medicine, Zagazig University, Egypt.
[3] Department of Cardiology, Faculty of Medicine, Zagazig University, Egypt.
[4] Department of Psychiatry, Faculty of Medicine, Zagazig University, Egypt.

Abstract

Frequent exposure to traumatic situations put fishermen under an increased risk for developing post-traumatic stress disorder (PTSD). A growing body of research has suggested a link between obstructive sleep apnoea (OSA) and PTSD. In patients with PTSD, co-morbid OSA is associated with worsened symptoms. Given the negative impact on outcomes, the possibility of OSA should be considered carefully in patients with PTSD. The objectives of this study were to determine the prevalence and main risk factors of PTSD and OSA among fishermen and to assess the relationship between PTSD and OSA among fishermen. A cross-sectional study was conducted among 162 male fishermen at Eldebah village at West of Port Said, Egypt. All participants in the study were subjected to a semi-structured questionnaire to collect information about personal, socio-demographic data, occupational history, Berlin Questionnaire, and PTSD Checklist-Civilian version (PCL-C). The prevalence of PTSD and OSA among the fishermen was 10.5% and 24.7%, respectively. There was a significantly higher risk of OSA among fishermen with PTSD ($p < 0.001$) with a highly significant positive correlation between them ($r = 0.504$; $p \leq 0.01$). By logistic regression analysis it was found that the most significant predictors of PTSD among fishermen were ≥10 working hours/day (OR = 2.18; $p < 0.05$), overweight (OR = 1.57; $p < 0.01$), current smoking (OR = 1.53, $p < 0.05$) and hypertension (OR = 1.03; $p < 0.05$). While it was found that the most significant predictors of OSA among fishermen were overweight (OR = 5.33; $p < 0.01$), current smoking (OR = 4.72; $p < 0.01$), and chronic respiratory disease (OR = 2.51; $p < 0.01$).

Key Words: Posttraumatic Stress Disorder, Obstructive Sleep Apnoea, fishermen, fishing.

Corresponding author: Dalia A. El-Shafei
Assistant professor of Community, Environmental and Occupational Medicine, Faculty of Medicine, Zagazig University
Phone: 002/01003441083
e-mail: d_elshaf3y_mony@hotmail.com

Received: 18th April 2017
Accepted: 17th May 2017

ABBREVIATIONS

BA: Bronchial asthma
BMI: Body mass index
BQ: Berlin Questionnaire
COPD: Chronic Obstructive Pulmonary Disease
OR: Odds ratio
OSA: Obstructive sleep apnoea
PCL-C: PTSD Checklist-Civilian version
PTSD: Post-traumatic stress disorder.
SPSS: Statistical Package for Social Science

INTRODUCTION

Fishing is an extremely dangerous occupational activity that predisposes fishermen to occupational diseases and accidents. Fishermen were 52 times more likely to have a fatal accident at work compared with others. Internationally, work in the fishing industry has mainly focused on preventing accidents and vessel disasters. Medical conditions have received less attention, while the pattern of hospitalized cases indicates a need to improve working and living conditions in fishing. (Frantzeskou et al., 2016). In Egypt, there are about 210,000 fishermen and around two million people working in the fishing and fish processing industry, many fishermen have either left their job altogether or migrated due to lack of workers' rights and bad working conditions (El-Saadawy et al., 2014).

There are some common features of the fishing occupation, such as: exposure to cold, wind, rough seas, substantial participation of physical effort, frequent injuries during work, unpredictability and abruptness of threats, equipment failure, everyday psychological stress, and constant economic pressure. At the same time, the specificity and variety of hazards, depending significantly on geographical-climate and cultural factors, makes the dissimilarity of problems and solutions substantial in different sectors of fishing (Jeżewska et al., 2012).

Post-traumatic stress disorder (PTSD) is a type of anxiety disorder that involves a psychological response after experiencing a traumatic life-threatening event. In this context, trauma can be defined as damage to the psyche after overwhelming stress that exceeds one's ability to cope, and the American Psychiatric Association has recognized PTSD as a type of anxiety disorder since the 1980s. Furthermore, PTSD is a major anxiety disorder that frequently occurs among professionals who are exposed to traumatic events, such as military veterans, emergency medical technicians and firefighters, as well as people who have experienced large-scale disasters (Lee et al., 2016). Prevention of work-related PTSD includes a sound organizational and psychosocial work environment, systematic training of employees, social support from colleagues and managers and a proper follow-up of employees after a critical event (Skogstand et al., 2013).

Research suggests that PTSD is common, debilitating and frequently associated with co-morbid health conditions, including poor functioning, and increased health care utilization (Greene et al., 2016). So, a feature of PTSD is its extensive co-morbidity (Lockwood and Forbes,

2014). A growing body of research has suggested a link between obstructive sleep apnoea (OSA) and PTSD, potentially due to OSA related sleep disruption, or via other mechanisms (Orr et al., 2016). In patients with PTSD, co-morbid OSA is associated with worsened symptoms. Given the negative impact on outcomes, the possibility of OSA should be considered carefully in patients with PTSD (Lettieri et al., 2016). Population-based studies have also found an increased rate of OSA of up to 50% in patients with PTSD and also OSA treatment may decrease nightmares in PTSD (Conwell and Tsai, 2016).

The objectives of this study were to determine the prevalence and main risk factors of PTSD and OSA among fishermen and to assess the relationship between PTSD and OSA among fishermen.

SUBJECTS AND METHODS

Study design and subjects: A cross-sectional study was carried out among fishermen at Eldebah village at West of Port Said, Egypt, during the period from June 2016 to February 2017 as it was the best weather conditions to collect data from fishermen recommended by Fishermen Association of Port Said City.

The target population included fishermen. One hundred sixty-two (162) fishermen were selected by simple random techniques. The sample size was calculated through Epi-Info (Epidemiological information package) software version 6.1, according to the following collected data:

The total population of fishermen at Eldebah village at West of Port Said was about 20,000 fishermen (Fishermen Association of Port Said City), the least prevalence of PTSD among fishermen in a previous study was 9.4% (Kumar et al., 2007), the degree of precision was 80%, and the confidence interval was 95%, the estimated sample size was calculated to be 131 fishermen. Accounting for a non-response rate of 30%, the sample size reached 171 fishermen. Only 162 fishermen agreed on participating in the study. Fishermen assigned to a permanent work and having worked for at least one year were included in the study and those with past history of psychological complaints before joining the work were excluded.

Data collection

A semi-structured questionnaire was used to collect information on socio-demographic data (age, level of education, marital status, smoking habits), medical history and occupational history (duration of work in current occupation, daily working hours).

Arabic version of the Berlin Questionnaire (BQ), a 10-item instrument was used to assess risk for OSA. Items were clustered into 3 categories: Category 1 had five questions about snoring, Category 2 had three questions about daytime somnolence, and Category 3 had one question about the history of hypertension. In addition, the questionnaire also collected information about age, gender, height, and weight (to calculate the BMI) (Fawale et al., 2016). Final scoring results classified the patients into risk groups for developing OSA: persons with high risk (≥2 categories were positive) and low risk (only 1 or no categories were positive). Cronbach α for the BQ ranged from 0.86 to 0.92 (ElKholy et al., 2012).

Posttraumatic Stress Disorder Checklist-Civilian version (PCL-C): It was used to assess PTSD symptom severity. The PCL-C comprised 17 questions corresponding to the Diagnostic

and Statistical Manual of Mental Disorders (Fourth Edition), PTSD symptom clusters and asked participants to rate how much they were bothered by each symptom in the last month using a 5-point Likert scale that ranged from "not at all" to "extremely." The PCL-C had a possible total score of 17 to 85, with higher scores indicating greater PTSD symptom severity. A cut-off score of ≥ 50 was used to identify those participants who likely had PTSD. The PCL-C demonstrated validity and reliability (Cronbach α = 0.83-0.96) (Felker et al., 2010). The Arabic version used was translated and back translated by the authors of this study with back translation correlation coefficient 0.86.

Pilot study: For testing the study tools, pilot study was conducted during July 2016. It was carried out on 10% of the study sample (18 fishermen) who were chosen randomly and excluded from the final analysis. According to the result of the pilot study, the questionnaires were assessed regarding order of questions, simplicity and language.

Data management: The collected data were computerized and statistically analyzed using SPSS program (Statistical Package for Social Science) version 20.0. Qualitative data were represented as frequencies and percentages. Chi-square test (X^2) was carried out for comparing the qualitative data and the Fisher's exact test was used for an expected cell value frequency less than five. Quantitative data were compared using Student's t-test. The test results were considered significant when p-value was equal or less than 0.05. Logistic regression analysis was carried out to identify significant predictors for PTSD and OSA and correlation coefficient was also calculated.

Human and animal rights and informed consent: All procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all fishermen included in the study.

RESULTS

One hundred sixty-two fishermen were included in the study. More than half of them (56.8%) were ≤40 years old with mean age of 37.85 ± 7.54. Most of them were married (80.2%) and illiterate (71.6%). Most of them were current smokers (72.8%) and normal weighted (62.3%). Regarding chronic health problems, chronic respiratory diseases had the highest prevalence (38.3%), while chronic heart disease had the lowest one (6.8%). As regards occupational history, more than half of the participants (63.6%) had worked in fishing for less than 20 years with a mean of 15.98 ± 5.54, and working for more than 10 hours per day (59.9%) with a mean of 11.47 ± 3.58 hours *(Table I).*

The prevalence of PTSD among the fishermen was 10.5% and the relationship between socio-demographic and occupational characteristics of the studied group of fishermen and PTSD is demonstrated in *Table I.* PTSD showed significantly higher prevalence ($p < 0.05$) among fishermen who were current smokers, overweight, working for less than 20 years with long working days (≥10 hours) and with clinical history of hypertension, chronic respiratory diseases, and HBV or HCV (*Table I*).

Table I

Relationship between socio-demographic and occupational characteristics of the studied group of fishermen and PTSD

Socio-demographic and occupational characteristics	Full sample n (%) (N = 162)	With PTSD n (%) (N = 17)	Without PTSD n (%) (N = 145)	p-value
Age (years):				
≤ 40	92 (56.8)	9 (52.9)	83 (57.2)	N.S.
> 40	70 (43.2)	8 (47.1)	62 (42.8)	
Mean ± SD	37.85 ± 7.54	36.87 ± 8.44	38.71 ± 7.55	
Marital Status:				
- Single	32 (19.8)	6 (35.3)	26 (17.9)	N.S.
- Married	130 (80.2)	11 (64.7)	119 (82.1)	
Level of education				
Illiterate	116 (71.6)	10 (58.8)	106 (73.1)	N.S.
Literate	46 (28.4)	7 (41.2)	39 (26.9)	
Smoking				
Current smoker	118 (72.8)	16 (94.1)	102 (70.3)	< 0.05
Non-smoker	44 (27.2)	1 (5.9)	43 (29.7)	
BMI (kg/m^2)				
Underweight (<18.5)	10 (6.2)	2 (11.8)	8 (5.5)	< 0.01
Normal weight (18.5 – 24.9)	101 (62.3)	4 (23.5)	97 (66.9)	
Overweight (25.0 – 29.9)	51 (31.5)	11 (64.7)	40 (27.6)	
Years of work:				
<20	103 (63.6)	15 (88.2)	88 (60.7)	< 0.05
≥20	59 (36.4)	2 (11.8)	57 (39.3)	
Mean ± SD	15.98 ± 5.54	10.11 ± 4.35	12.86 ± 5.44	
Working hours/ day				< 0.05
<10	65 (40.1)	3 (17.6)	62 (42.8)	
≥10	97 (59.9)	14 (82.4)	83 (57.2)	
Mean ± SD	11.47 ± 3.58	13.17 ± 4.09	10.86 ± 3.21	
Chronic health problems				
- Hypertension	45 (27.8)	10 (58.8)	35 (24.1)	< 0.01
- Diabetes mellitus	36 (22.2)	6 (35.3)	30 (20.7)	N.S.
- Chronic heart disease	11 (6.8)	3 (17.6)	8 (5.5)	N.S.
- Chronic respiratory disease (BA or COPD)	62 (38.3)	11 (64.7)	51 (35.2)	< 0.05

BA: Bronchial asthma; COPD: Chronic Obstructive Pulmonary Disease

N.S.: statistically not significant

Table II

Relationships between socio-demographic and occupational characteristics of the studied group of fishermen and OSA

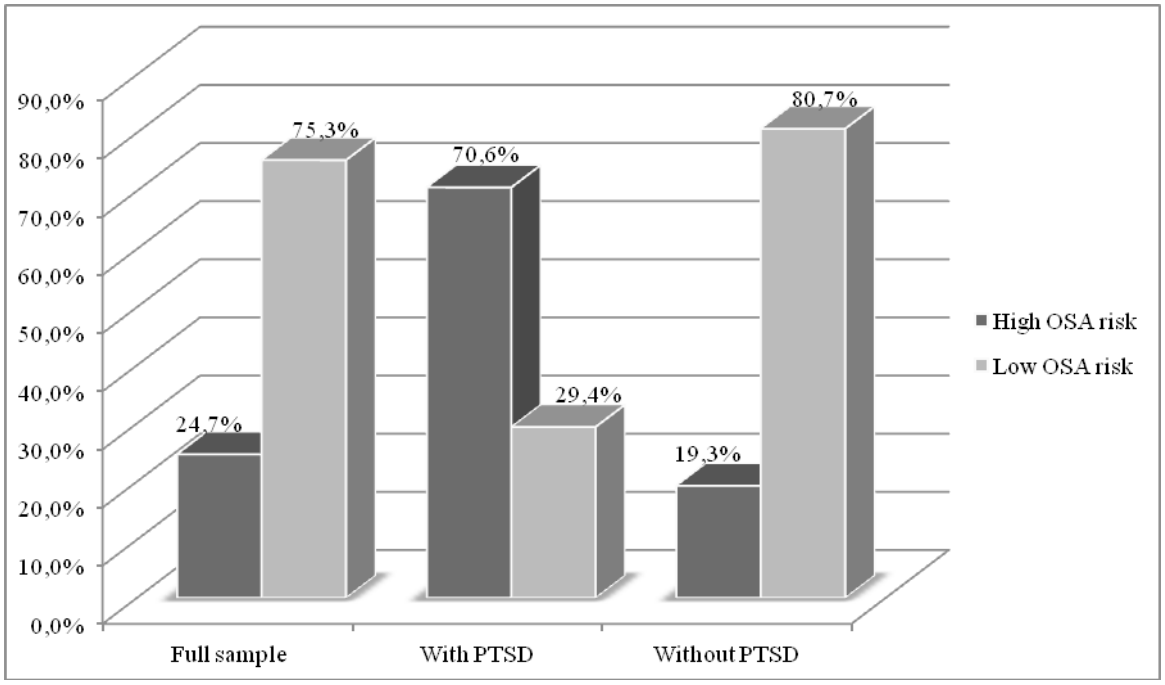
Socio-demographic and occupational characteristics	Full sample n (%) (N = 162)	High OSA risk n (%) (N = 40)	Low OSA risk n (%) (N = 122)	p-value
Age (years):				
- **≤ 40**	92 (56.8)	23 (57.5)	69 (56.6)	N.S.
- **> 40**	70 (43.2)	17 (42.5)	53 (43.4)	
Mean ± SD	37.85 ± 7.54	38.76 ± 11.92	35.83 ± 9.88	
Marital Status:				
- **Single**	32 (19.8)	11 (27.5)	21 (17.2)	N.S.
- **Married**	130 (80.2)	29 (72.5)	101 (82.8)	
Level of education:				
- **Illiterate**	116 (71.6)	24 (60.0)	92 (75.4)	N.S.
- **Literate**	46 (28.4)	16 (40.0)	30 (24.6)	
Smoking:				
- **Current smoker**	118 (72.8)	35 (87.5)	83 (68.0)	
- **Non- smoker**	44 (27.2)	5 (12.5)	39 (32.0)	< 0.05
BMI (kg/m^2):				
- **Underweight (<18.5)**	10 (6.2)	1 (2.5)	9 (7.4)	
- **Normal weight (18.5 – 24.9)**	101 (62.3)	9 (22.5)	92 (75.4)	
- **Overweight (25.0 – 29.9)**	51 (31.5)	30 (75.0)	21 (17.2)	< 0.001
Years of work:				
- **<20**	103 (63.6)	24 (60.0)	79 (64.8)	N.S.
- **≥20**	59 (36.4)	16 (40.0)	43 (35.2)	
Mean ± SD	15.98 ± 5.54	14.33 ± 4.65	16.05 ± 5.12	
Working hours/ day:				
- **<10**	65 (40.1)	10 (25.0)	55 (45.1)	
- **≥10**	97 (59.9)	30 (75.0)	67 (54.9)	
Mean ± SD	11.47 ± 3.58	12.74 ± 3.98	11.26 ± 4.01	< 0.05
Chronic health problems:				
- Hypertension	45 (27.8)	21 (52.5)	24 (19.7)	< 0.001
- Diabetes mellitus	36 (22.2)	14 (35.0)	22 (18.0)	< 0.05
- Chronic heart disease	11 (6.8)	4 (10.0)	7 (5.7)	N.S.
-Chronic respiratory disease "BA or COPD"	62 (38.3)	37 (92.5)	25 (20.5)	<0.001

BA: Bronchial asthma; COPD: Chronic Obstructive Pulmonary Disease

N.S.: statistically not significnt

About one quarter of the fishermen (24.7%) showed high risk for OSA. The relationships between socio-demographic and occupational characteristics of the studied group of fishermen and OSA are demonstrated in *Table II.* The prevalence of OSA was significantly higher ($p < 0.05$) among fishermen who were current smokers, overweight, working for more than 10 hours per day and with clinical history of hypertension, diabetes mellitus and chronic respiratory diseases. (*Table II*).

The relationships between PTSD and OSA among the studied group of fishermen are illustrated in *Figure 1.* There was a significantly higher risk of OSA among fishermen with PTSD ($p < 0.001$).



$\chi^2 = 21.5$; $p < 0.001$

Figure 1: Relationships between PTSD and OSA among the studied group of fishermen

By logistic regression analysis (*Table III.*) it was found that the most significant predictors of PTSD among fishermen were ≥10 working hours/day (OR = 2.18; $p < 0.05$), overweight (OR = 1.57; $p<0.01$), current smoking (OR = 1.53; $p < 0.05$) and hypertension (OR = 1.08; $p < 0.05$). While, it was found that the most significant predictors of OSA among fishermen were overweight (OR = 5.33; $p < 0.01$), current smoking (OR = 4.72; $p < 0.01$) and chronic respiratory disease (OR = 2.51; $p < 0.01$).

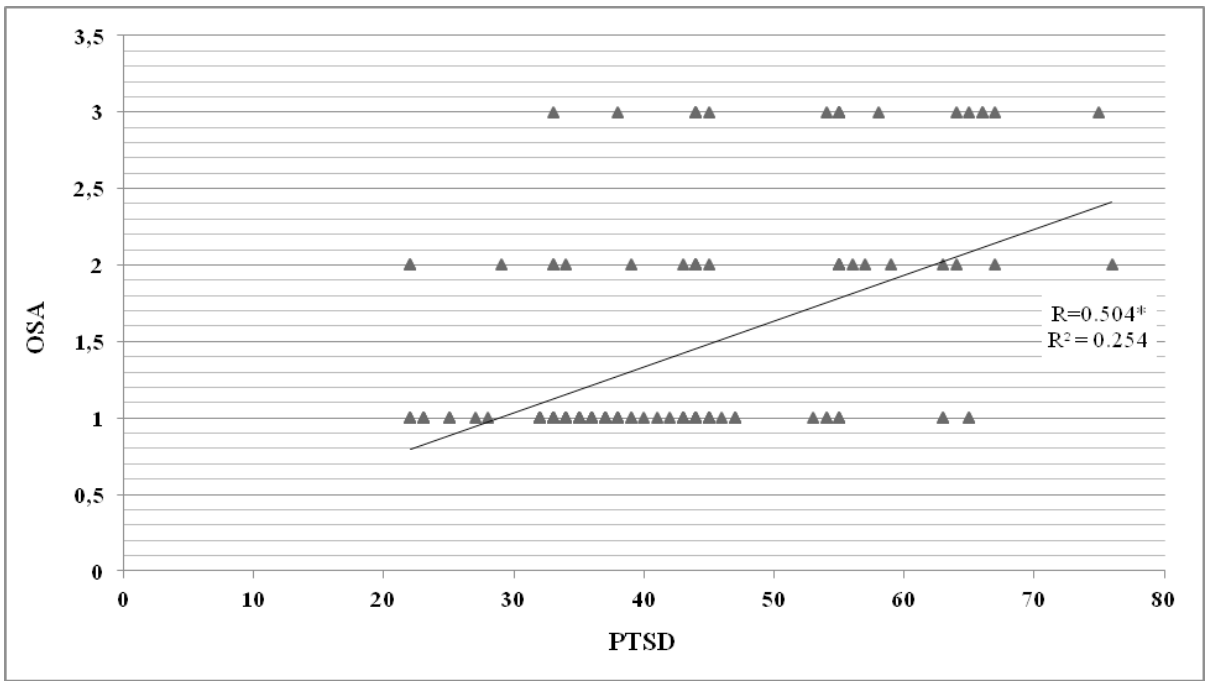
Figure 2 demonstrates a highly significant positive correlation between PTSD and OSA ($r = 0.504$, $p \leq 0.01$).

Table III.

Results of logistic regression analysis for significant predictors of PTSD and OSA in the studied group of fishermen

Dependent factors	Independent factors	OR (95%C.I.)	p-value
PTSD	Current smoking	1.53 (1.33-2.34)	<0.05
	Overweight	1.57 (1.15-2.42)	<0.01
	<20 years of work	0.69 (0.43-1.14)	N.S.
	≥10 working hours/day	2.18 (1.97-3.76)	<0.05
	Hypertension	1.08 (1.01-1.19)	<0.05
	Chronic respiratory disease	0.92 (0.48-1.52)	N.S.
OSA	Current smoking	4.72 (3.48-6.33)	<0.01
	Overweight	5.33 (2.34-9.24)	<0.001
	≥10 working hours/day	0.88 (0.61-1.24)	N.S.
	Hypertension	0.62 (0.41-1.92)	N.S.
	Diabetes mellitus	0,85 (0.80-1.84)	N.S.
	Chronic respiratory disease	2.51 (1.13-4.11)	<0.001

N.S.: = statistically not significant



* Correlation is significant at 0.01 level (2-tailed).

Figure 2: Correlation between PTSD and OSA among the studied group of fishermen

DISCUSSION

Fishing is one of the most dangerous occupations in the world (Jeebhay et al., 2004). Isolated working conditions, adverse weather, long shifts without sufficient rest, lack of safety training, inadequate personal protective equipment, and work related stress have been attributed to the increased occupational hazards, especially psychological risk (Jacob et al., 2013). Unfortunately, fishing industry in Egypt involves more hazardous work conditions and practices resulting in higher morbidity and mortality rates than in other countries (Zytoon, 2012).

A cross-sectional study was conducted to determine the prevalence of PTSD and OSA among fishermen and to assess the relationship between these disorders.

PTSD is a specific anxiety disorder with an estimated lifetime prevalence of 7.8-25.8% in the general population (depending on gender of victim, type of trauma and study methodology) and of 14.7-30.9% in war veteran samples (Trief et al., 2006). *Table I* showed the prevalence of PTSD and its relation to socio-demographic data, and occupational characteristics of fishermen. The overall prevalence of PTSD among the studied fishermen was 10.5%. PTSD was significantly higher among fishermen who were current smokers, overweight, working for less than 20 years with long working hours (≥10) and with clinical history of hypertension, and chronic respiratory diseases. The criteria of fishermen with higher rates of PTSD may reflect the psychological impact on them that increases the fishermen's susceptibility to more risk factors of PTSD, especially being young and not adapted to the stressful work conditions or working for long shift hours. Hapke et al. (2005) and Fu et al. (2007) noted a causal relationship between

PTSD and smoking that may be bidirectional (PTSD symptoms may predispose to smoking and affect cessation attempts). McFall et al. (2007) also recommended integrating smoking cessation into mental health care of PTSD.

Ditlevsen and Elklit (2010) identified age as the main risk factor of PTSD; they demonstrated an increased risk of PTSD during late teens and early 20s. However the period from the 20s to the 40s seems to be characterized by a stable level of PTSD. They explained that this period of life usually characterized by many life changing moments such as getting married, starting a family, in addition to financial issues. Kibler et al. (2009) described a vicious circle between cardiovascular diseases (CVD) and PTSD. However, Lukaschek et al. (2013) found a strong relation between PTSD and type 2 diabetes and they explained this relation by suffering from PTSD can activate chronic stress symptoms and trigger physiological mechanisms leading to type 2 diabetes.

As regards the prevalence of OSA and its relation to socio-demographic and occupational criteria of fishermen, *Table II* demonstrated that the prevalence was 24.7% and significantly higher among fishermen who were current smokers, overweight, working for more than 10 hours per day and with clinical history of hypertension, diabetes mellitus, and chronic respiratory diseases. It can be noted that the above-mentioned criteria may affect the sleep quality in which one of the most important symptoms is OSA. Trenchea et al. (2013) have observed a synergistic effect between smoking and OSA, as one may be a risk factor of the other. Young et al. (2005) found a direct relationship between the epidemic of OSA and that of obesity. Moreover, Lee et al. (2008) attributed more than half of the prevalence of OSA to obesity and Gami et al. (2005) found that each unit increase in BMI is associated with a risk of 1.14 for developing OSA. Working more than 10 hours was higher in the OSA group. This may be explained by stress and fatigue resulting from prolonged working hours. Consistently, Colvonen et al. (2015) identified fatigue as a strong predictor of OSA, and they recommended referral to a sleep clinic when an individual reports significant fatigue, even if other OSA risk factors are not present or severe. Systolic hypertension has been well-established by Sin et al. (2003) as a risk factor for OSA. Zhang and Si (2012) indicated that hypertension was found in about 50% of OSA patients, and about 30% of hypertensive patients also have OSA.

O'Donnell (2007) found a strong relation between OSA and diabetes mellitus and he referred this relation to obesity, and counter-regulatory hormones that should drive up blood sugar. However, Li et al. (2010) connected this relationship to insulin resistance and glucose intolerance. West et al. (2006) noted that in people who have diabetes mellitus, the prevalence of OSA may be up to 23%. On the same line, Handelsman et al. (2011) recommended that clinicians should ask about sleep hygiene regularly during diabetic patient encounters.

Figure 1 demonstrated significant higher risk of OSA among fishermen with PTSD. This association may reflect the common risk factors of both problems. Sharafkhaneh et al. (2005) called OSA as a cardinal symptom of PTSD. Similarly, Krakow et al. (2000) reported a highly increased prevalence of sleep disorders, especially OSA, in trauma patients. Chai et al. (2006) explained this relation by an arousal-based mechanism initiated by PTSD-promoting OSA

development. Consistently, Tamanna et al. (2014) found that untreated OSA worsens the sleep-related symptoms of PTSD. In contrast, Klein et al. (2002) reported no evidence of sleep disturbance when comparing a small sample of trauma patients with or without PTSD.

Smoking and overweight were the shared predictors of both PTSD and OSA (*Table III*). The relation between these factors at one side and PTSD and OSA on the other side may be more psychological and reflect a vicious relation. As exposure to trauma may precipitate to smoking and overeating to overcome the bad memories; Greenberg et al. (2012) linked PTSD's symptoms and its severity to smoking, cigarettes per day, and nicotine dependence. Johannessen and Berntsen (2013) demonstrated that obese individuals may be predisposed to developing PTSD after trauma exposure, and those with PTSD are more likely to develop obesity. Bartoli et al. (2015) found that individuals suffering from PTSD seem more likely, relative to controls, to suffer from obesity.

Foster et al. (2009) and Mysliwiec et al (2014) suggested obesity as a risk factor for OSA and one of its diagnostic criteria. Also, Dempsey et al. (2010) found that 1 point increase in the standard deviation obesity was associated with an increase of 4 times the risk of OSA. In contrast, Lettieri et al. (2005) found that BMI was not associated with OSA in younger age groups.

Neruntarat and Chantapant (2011) mentioned that there is cumulative evidence that smoking and OSA represent a vicious circle. Kjaergaard et al. (2010) explained this relation by the effects of nicotine on upper airway neuromuscular function, and smoking-induced upper airway inflammation and sleep disturbance.

Many studies (Braido et al., 2014; Teodorescu et al., 2015) found strong association between OSA and respiratory disease, especially asthma. National Asthma Education and Prevention Programme (2007) explained this relation by the inflammation of the upper airways caused by respiratory problems, especially asthma that facilitates the collapse of the muscles favouring OSA.

A highly significant positive correlation between PTSD and OSA was demonstrated in *Figure 2*. This may be referred to the shared risk factors between the 2 syndromes. This strong association was noticed by Webber et al. (2011) and they explained that by prolonged sleep deprivation, sleep fragmentation and hyperarousal due to the physical and psychological stressors of work that may contribute to the aetiology of OSA, and separately to PTSD severity. On the same line, Hoge et al. (2004) explained this association by disturbed sleep, which can result from prolonged working hours or lack of quality sleep, which are potential risk factors not only of PTSD but also OSA. Moreover, this relation was referred to the chronic stress from PTSD increasing the possibility of developing OSA, or that the sleep disturbances of OSA may increase the possibility of getting PTSD as mentioned by Bryant et al. (2012).

Although this study was one of the few studies that focus on fishermen, however there were many limitations like the cross-sectional design of the study with the absence of a comparison group, in addition to the limited number of Egyptian studies done among fishermen, which made discussing the results difficult to some extent.

ACKNOWLEDGEMENTS

The authors would like to thank all participants of this study for their great cooperation. This research did not receive any specific grant from any funding agency in the public, commercial or not-for-profit sector.

The authors declare that they have no conflict of interest.

REFERENCES

BARTOLI, F., CROCAMO, C., ALAMIA, A., AMIDANI, F., PAGGI, E., PINI, E., et al. (2015). Posttraumatic stress disorder and risk of obesity: systematic review and meta-analysis. J Clin Psychiatry. 76(10):E1253-61.

BRAIDO, F., BAIARDINI, I., LACEDONIA, D., FACCHINI, F.M., FANFULLA, F., MOLINENGO, G., et al. (2014). Sleep apnea risk in subjects with asthma with or without comorbid rhinitis. Respir Care. 59(12):1851-6.

BRYANT, R.A., CREAMER, M., O'DONNELL, M., SILOVE, D. and MCFARLANE, A.C. (2012). The capacity of acute stress disorder to predict posttraumatic psychiatric disorders. J Psychiatr Res. 46(2):168-73.

CHAI, C.L., PATHINATHAN, A. and SMITH, B. (2006). Continuous positive airway pressure delivery interfaces for obstructive sleep apnoea. Cochrane Database Syst Rev. (4):CD005308.

COLVONEN, P.J., MASINO, T., DRUMMOND, S.P.A., MYERS, U.S., ANGKAW, A.C., and NORMAN, S.B. (2015). Obstructive Sleep Apnea and Posttraumatic Stress Disorder among OEF/OIF/OND Veterans. Journal of Clinical Sleep Medicine : JCSM : Official Publication of the American Academy of Sleep Medicine, 11(5):513-8.

CONWELL, W.D., and TSAI, S.C. (2016). Managing Comorbid Illness in Obstructive Sleep Apnea: What Can We Learn from Other Diseases? Sleep Medicine Clinics. 11(3):313-21

DEMPSEY, J.A., VEASEY, S.C., MORGAN, B.J., and O'DONNELL, C.P. (2010). Pathophysiology of Sleep Apnea. Physiological Reviews, 90(1):47–112.

DITLEVSEN, D.N., and ELKLIT, A. (2010). The combined effect of gender and age on post traumatic stress disorder: do men and women show differences in the lifespan distribution of the disorder? Annals of General Psychiatry, 9, 32.

ELKHOLY, S.H., AMER, H.A., NADA, M.M., NADA, M.A., and LABIB, A. (2012). Sleep-related breathing disorders in cerebrovascular stroke and transient ischemic attacks: a comparative study. J Clin Neurophysiol. 29(2):194-8.

EL-SAADAWY, M.E., SOLIMAN, N.E., EL-TAYEB, I.M., and HAMMOUDA, M.A. (2014). Some occupational health hazards among fishermen in Alexandria city. Gaziantep Med J. 20(1):71-8.

FAWALE, M.B., IBIGBAMI, O., ISMAIL, I., MUSTAPHA, A.F., KOMOLAFE, M.A., OLAMOYEGUN, M.A., et al. (2016). Risk of obstructive sleep apnea, excessive daytime sleepiness and depressive symptoms in a Nigerian elderly population. Sleep Science, 9(2):106–11.

FELKER, B., BUSH, K.R., HAREL, O., SHOFER, J.B., SHORES, M.M., AND AU, D.H. (2010). Added Burden of Mental Disorders on Health Status Among Patients With Chronic Obstructive Pulmonary Disease. Primary Care Companion to The Journal of Clinical Psychiatry, 12(4), PCC.09m00858.

FOSTER, G.D., SANDERS, M.H., MILLMAN, R., ZAMMIT, G., BORRADAILE, K.E., NEWMAN, A.B., et al. (2009). Obstructive Sleep Apnea Among Obese Patients With Type 2 Diabetes. Diabetes Care, 32(6):1017–9.

FRANTZESKOU, E., JENSEN, O.C., and LINOS, A. (2016). Health Status and Occupational Risk Factors in Greek Small Fisheries Workers. Int Marit Health. 67 (3):137-43.

FU, S.S., MCFALL, M., SAXON, A.J., BECKHAM, J.C., CARMODY, T.P., BAKER, D.G., et al. (2007). Post-traumatic stress disorder and smoking: a systematic review. Nicotine Tob Res. 9(11):1071-84.

GAMI, A.S., HOWARD, D.E., OLSON, E.J., and SOMERS, V.K. (2005). Day-night pattern of sudden death in obstructive sleep apnea. N Engl J Med. 352(12):1206-14.

GREENBERG, J.B., AMERINGER, K.J., TRUJILLO, M.A., SUN, P., SUSSMAN, S., BRIGHTMAN, M., et al. (2012). Associations between Posttraumatic Stress Disorder Symptom Clusters and Cigarette Smoking. Psychology of Addictive Behaviors, 26(1):89-98.

GREENE, T., NERIA, Y. and GROSS, R.J. (2016). Prevalence, Detection and Correlates of PTSD in the Primary Care Setting: A Systematic Review. Clin Psychol Med Settings. 23:160.

HANDELSMAN,Y., MECHANICK, J.I., BLONDE, L., GRUNBERGER, G., BLOOMGARDEN, Z.T., BRAY, G.A., et al. (2011). AACE Task Force for Developing Diabetes Comprehensive Care Plan. American Association of Clinical Endocrinologists medical guidelines for clinical practice for developing a diabetes mellitus comprehensive care plan. Endocr Pract. 17 Suppl 2:1-53.

HAPKE, U., SCHUMANN, A., RUMPF, H.J., JOHN, U., KONERDING, U., and MEYER, C. (2005). Association of smoking and nicotine dependence with trauma and posttraumatic stress disorder in a general population sample. J Nerv Ment Dis. 193(12):843-6.

HOGE, C.W., CASTRO, C.A., MESSER, S.C., MCGURK, D., COTTING, D.I., and

KOFFMAN, R.L. (2004). Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. N Engl J Med. 351(1):13-22.

JACOB, J.M., GEORGE, L.S., and SAVITHA, S. (2013). Job Stress and Coping among Fishermen. NUJHS, 3(4):93-6.

JEEBHAY, M., ROBINS, T., and LOPATA, A. (2004). World at work: Fish processing workers. Occupational and Environmental Medicine, 61(5):471-4.

JEŻEWSKA, M., GRUBMAN-NOWAK, M., LESZCZYÑSKA, I., and JAREMIN, B. (2012). Occupational hazards for fishermen in the workplace in Polish coastal and beach fishing--a point of view. Int Marit Health. 63(1):40-8.

JOHANNESSEN, K.B., and BERNTSEN, D. (2013). Losing the symptoms: weight loss and decrease in posttraumatic stress disorder symptoms. J Clin Psychol. 69(6):655-60.

KIBLER, J.L., JOSHI, K., and MA, M. (2009). Hypertension in relation to posttraumatic stress disorder and depression in the US National Comorbidity Survey. Behav Med. 34(4):125-32.

KJAERGAARD, T., CVANCAROVA, M., and STEINSVAAG, S.K. (2010). Smoker's nose: structural and functional characteristics. Laryngoscope. 120(7):1475-80.

KLEIN, E., KOREN, D., ARNON, I., and LAVIE, P. (2002). No evidence of sleep disturbance in post-traumatic stress disorder: a polysomnographic study in injured victims of traffic accidents. Isr J Psychiatry Relat Sci. 39(1):3-10.

KRAKOW, B., LOWRY, C., GERMAIN, A., GADDY, L., HOLLIFIELD, M., KOSS, M., et al. (2000). A retrospective study on improvements in nightmares and post-traumatic stress disorder following treatment for co-morbid sleep-disordered breathing. J Psychosom Res. 49(5):291-8.

LEE, J., KIM, I., WON, J., and ROH, J. (2016). Post-traumatic stress disorder and occupational characteristics of police officers in Republic of Korea: a cross-sectional study. BMJ. 6:e009937.

LEE, W., NAGUBADI, S., KRYGER, M.H., and MOKHLESI, B. (2008). Epidemiology of Obstructive Sleep Apnea: a Population-based Perspective. Expert Review of Respiratory Medicine, 2(3): 349–364.

LETTIERI, C.J., ELIASSON, A.H., ANDRADA, T., KHRAMTSOV, A., RAPHAELSON, M., and KRISTO, D.A. (2005). Obstructive sleep apnea syndrome: are we missing an at-risk population?. J Clin Sleep Med. 1(4):381-5.

LETTIERI, C.J., WILLIAMS, S.G., and COLLEN, J.F. (2016). OSA Syndrome and Posttraumatic Stress Disorder: Clinical Outcomes and Impact of Positive Airway Pressure Therapy. Chest. 149(2):483-90.

LI, C., FORD, E.S., ZHAO, G., CROFT, J.B., BALLUZ, L.S., and MOKDAD, A.H. (2010). Prevalence of self-reported clinically diagnosed sleep apnea according to obesity status in men and women: National Health and Nutrition Examination Survey, 2005–2006. Prev Med. 51(1):18-23..

LOCKWOOD, E., and FORBES, D. (2014). Posttraumatic Stress Disorder and Comorbidity: Untangling the Gordian Knot. Psychol. Inj. and Law. 7: 108.

LUKASCHEK, K., BAUMERT, J., KRUSE, J., EMENY, R.T., LACRUZ, M.E., HUTH, C., et al. (2013). Relationship between posttraumatic stress disorder and type 2 diabetes in a population-based cross-sectional study with 2970 participants. J Psychosom Res. 74(4):340-5.

MCFALL, M., SAXON, A.J., THANEEMIT-CHEN, S., SMITH, M.W., JOSEPH, A.M., CARMODY, T.P., et al. (2007). Integrating smoking cessation into mental health care for post-traumatic stress disorder. Clin Trials.4(2):178-89.

MYSLIWIEC, V., MATSANGAS, P., BAXTER, T., MCGRAW, L., BOTHWELL, N.E., and ROTH, B.J. (2014). Comorbid insomnia and obstructive sleep apnea in military personnel: correlation with polysomnographic variables. Mil Med. 179(3):294-300.

NATIONAL ASTHMA EDUCATION AND PREVENTION PROGRAM (2007). Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma-Summary Report 2007.J Allergy Clin Immunol. 120(5 Suppl):S94-138.

NERUNTARAT, C., and CHANTAPANT, S. (2011). Prevalence of sleep apnea in HRH Princess Maha Chakri Srinthorn Medical Center, Thailand. Sleep Breath. 15(4):641-8.

O'DONNELL, C.P. (2007). Metabolic consequences of intermittent hypoxia. Adv Exp Med Biol. 618:41-9.

ORR, J.E., SMALES, C., ALEXANDER, T.H., STEPNOWSKY, C., PILLAR, G., MALHOTRA ,A., et al. (2016). Treatment of OSA with CPAP is Associated with Improvement in PTSD Symptoms among Veterans. J Clin Sleep Med. pii: jc-00140-16. [Epub ahead of print]

SHARAFKHANEH, A., GIRAY, N., RICHARDSON, P., YOUNG, T., and HIRSHKOWITZ, M. (2005). Association of Psychiatric Disorders and Sleep Apnea in a Large Cohort. Sleep. 28(11):1405-11.

SIN, D.D., FITZGERALD, F., PARKER, J.D., NEWTON, G.E., LOGAN, A.G., FLORAS, J.S., et al. (2003). Relationship of systolic BP to obstructive sleep apnea in patients with heart failure. Chest. 123(5):1536-43.

SKOGSTAD, M., SKORSTAD, M., LIE, A., CONRADI, H.S., HEIR, T., and WEISÆTH, L. (2013). Work-related post-traumatic stress disorder. Occup Med (Lond). 63(3):175-82.

TAMANNA, S., PARKER, J.D., LYONS, J., and ULLAH, M.I. (2014). The Effect of Continuous Positive Air Pressure (CPAP) on Nightmares in Patients with Posttraumatic Stress Disorder (PTSD) and Obstructive Sleep Apnea (OSA). Journal of Clinical Sleep Medicine : JCSM : Official Publication of the American Academy of Sleep Medicine, 10(6): 631-6.

TEODORESCU, M., BARNET, J.H., HAGEN, E.W., PALTA, M., YOUNG, T.B., and PEPPARD, P.E. (2015). Association between Asthma and Risk of Developing Obstructive Sleep Apnea. JAMA, 313(2):156-64.

TRENCHEA, M., DELEANU, O., SUŢA, M., and ARGHIR, O.C. (2013). Smoking, snoring and obstructive sleep apnea. Pneumologia. 62(1):52-5.

TRIEF, P.M., OUIMETTE, P., WADE, M., SHANAHAN, P., and WEINSTOCK, R.S. (2006). Post-traumatic stress disorder and diabetes: co-morbidity and outcomes in a male veterans sample. J Behav Med. 29(5):411-8.

WEBBER, M.P., LEE, R., SOO, J., GUSTAVE, J., HALL, C.B., KELLY, K., et al. (2011). Prevalence and incidence of high risk for obstructive sleep apnea in World Trade Center-exposed rescue/recovery workers. Sleep Breath. 15(3):283-94.

WEST, S.D., NICOLL, D.J., and STRADLING, J.R. (2006). Prevalence of obstructive sleep apnoea in men with type 2 diabetes. Thorax, 61(11): 945-50.

YOUNG, T., PEPPARD, P.E., and TAHERI, S. (2005). Excess weight and sleep-disordered breathing. J Appl Physiol (1985). 99(4):1592-9.

ZHANG, W. and SI, L.Y. (2012). Obstructive sleep apnea syndrome (OSAS) and hypertension: Pathogenic mechanisms and possible therapeutic approaches. Upsala Journal of Medical Sciences, 117(4):370-82.

ZYTOON, M.A. (2012). Occupational injuries and health problems in the Egyptian Mediterranean fisheries. Safety Science, 50(1):113-22.