IMPACT OF ONSHORE OIL DRILLING WORKS ON MUSCULOSKELETAL SYSTEM AND QUALITY OF LIFE AMONG A GROUP OF EGYPTIAN DRILLING WORKERS

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ABSTRACT

Background: Oil drilling industry is generally regarded as a stressful occupation. A significant portion of drilling workers might be seriously exposed to many stressors that include physical, psychosocial and ergonomic stressors that may adversely affect their musculoskeletal system and quality of life. **Objectives:** 1) Determine the prevalence of musculoskeletal complaints among Egyptian onshore oil drilling workers, 2) Identify the occupational, environmental and personal risk factors and best measures practice associated with these adverse health effects, and 3) Clarify the impact of onshore oil drilling works on the quality of life of the studied drilling workers. **Subjects and methods:** This cross-sectional study was conducted during the period from April 2010 till December 2010 on 276 onshore oil drilling workers employed in Egyptian drilling company (EDC), located at 17.5 km, Cairo Suez Desert Road. All participant was interviewed and asked to complete the following pre constructed questionnaires: 1) General personal history questionnaire, 2) Standardized Nordic questionnaire, 3) Self estimated work load questionnaire and 4) SF-36 Quality of Life Questionnaire. **Results:** The prevalence of musculoskeletal complaint over the previous 12 months varied between (31.9 %) for low back region followed by shoulder (28.3 %), wrist (23.2 %), knee (16.3 %), neck (15.2 %), foot (12.3 %), thigh (10.9 %), elbow (10.1 %), while upper back region complaint was the least prevalent one (4.7 %). Lower back, wrist, neck and knee regions complaints were the most troubling regions affecting the daily activities of onshore oil drilling workers (mentioned 44.3 %, 40.6 %, 38.1 % and 37.7 % respectively). Significant associations were found between various physical workload stressors, psychosocial factors and negligence of best measures practice and increased risk of musculoskeletal complaints, while the overall ergonomic factors showed non significant association. The SF-36 mean scores among the studied workers indicated more worse quality of life with increased the distribution of MSK complaints. **Conclusions:** These results suggested that onshore oil drilling workers are at increased risk of developing musculoskeletal disorders predisposed by some items related to physical work load and work pressure factors that adversely affect worker's QOL, with unproved role of the ergonomic factors. **Recommendations:** Applying an effective control program, including engineering, hygienic, and medical measures, is mandatory.

INTRODUCTION

Along with the rapid growth of the petroleum industry, many new techniques have been developed for locating new oil reserves and the recovery of crude oil [(1)].

Egypt has been an oil-producing nation for more than thirty years and a large number of Egyptians are working on oil rigs onshore and offshore. Egypt produced an average of about 664,000 barrels per day (bbl/d) of crude oil in 2007 [(2)].

Oil drilling is generally regarded as a stressful occupation with the possibilities of different occupational hazards. It varies from chemical, physical, psychological, ergonomic hazards and accidents that might inversely affect workers' health on this industry [(3)].

Musculoskeletal disorders are important causes of disabilities and sick leaves among oil drilling workers. Many researchers have reported work-related musculoskeletal disorders among oil drilling industry, and it was found to be up to (47%) [(4)].

The etiology of musculoskeletal disorders is usually multifactorial relating to work tasks, work postures, and aspects of work organization [(5)].

Workers not only want to live a long life, but they also want to enjoy a healthy lifestyle, so quality of life will become a central issue for all health systems [(6)].

Musculoskeletal disorders are one of health related problems in which there is an increasing evidence of impairment of quality of life**,** increasing the number of unhealthy

days and reduction of physical and mental performance [7].

Improved health and safety for oil drilling workers requires a special comprehensive occupational health program with dedicated and collaborative efforts from all concerned partners of this industry [8].

The studies conducted on this field is scarce [3]. So, further studies and researches in this area are highly recommended**.** So this study was conducted to; 1) Determine the prevalence of musculoskeletal complaints among Egyptian onshore oil drilling workers, 2) Identify the occupational, environmental and personal risk factors and best measures practice associated with these adverse health effects, and 3) Clarify the impact of onshore oil drilling works on the quality of life of the studied drilling workers.

SUBJECTS AND METHODS

Study Design and Setting:

The present study was conducted as a cross sectional study on a group of onshore oil drilling workers employed in Egyptian drilling company (EDC), located at 17.5 km, Cairo Suez Desert Road, during the period from April 2010 till December 2010.

Subjects:

The study included (276) male workers, who worked 84 hours per week for two subsequent weeks followed by two other subsequent weeks off work. Twenty three workers refused to participate in this research. An informed consent was obtained from all the participants of this study.

***Inclusion and Exclusion Criteria*:**

The study population including all oil drilling workers in the selected locations except those with positive family history of rheumatic diseases, those with history of non work-related trauma, and those with symptoms preceded their employment period.

***Sample Size Estimation*:**

The sample is drawn from 6500 Egyptian on-shore oil drilling workers. As revealed from the literature, the expected frequency of the factor understudy was around 25 %. The power of the test was 80 % and at a confidence level of 95 %. The estimated sample was calculated to be (276) using a software Epi info (version 6.1).

Methods:

Each participant was interviewed and asked to complete the following pre constructed questionnaires:

A) General personal history questionnaire included:

- ***Demographic data*:** Age, educational level, residence, marital status and special habits.
- ***Work characteristics data*:** Department affiliation, work shift, duration of employment, worked hours per month, official grade, present job and its main duties.
- ***Data about the present musculoskeletal complaints*:** Its site, course and duration. Pain was considered chronic or recurrent for more than 3 months during the last 12 months. According to the 1990 ACR criteria, pain was classified as widespread when present in both the left and right side of the body and also above or below the waist. In addition, axial skeletal pain (i.e. in the upper back or the lower back) should be present. When pain was present, but the criteria for widespread condition were not met, the subject was classified as having regional pain [9].
- ***Data about the best measures practice*:** It contains questions about barrier protection and preventive measures practice by the studied workers.

B) Standardized Nordic questionnaire: [10]

This questionnaire was proved to be a useful tool in detection the different affected regions, the course and duration of work activities affection, ongoing MSK symptoms and absenteeism. This questionnaire was used in previous 100 projects and other routine work of occupational health services. It included:

- ***General part:*** It was designed to answer the question: do musculoskeletal complaints occur in a given population, and if so, in what parts of the body are they localized?. The verbal questions deal with each anatomical area of the body and inquire whether the respondent has, or has not symptoms like pain, ache or discomfort in the respective area during the preceding 12 months.
- ***Specific part:*** It concentrates on the three

anatomical regions which are usually more presentable (back, neck and shoulder regions). It probes more deeply into analysis of the respective symptoms and asks certain questions on the duration of the respective symptoms and its impact over subjects' activity through the last 12 months.

C) Self estimated work load questionnaire: [11]

It asks about work-related risk factors for musculoskeletal complaints in the drilling job regarding:

- ***Factors increase the physical effort:*** Uncomfortable work postures, as standing, walking, awkward, "stooping postures, carrying heavy weights, moving farther than the reach envelop and working in a static posture for a long time.
- ***Factors increase the work pressure:*** Work amount, time pressure factor, inability to take rest, higilly stressful tasks, working slowly and occurrence of sudden unexpected events during work.
- ***Factors of the ergonomic aspect:*** Including unsuitable drilling rig layout and insufficient equipments.

D) SF-36 Quality of Life Questionnaire: [12]

HRQOL of the studied workers in the last four weeks was assessed using short-form 36-item generic questionnaire including one multi-item scale that assesses eight health domains. These domains include physical functioning (10 items), role limitation due to physical problems (4 items), role limitation due to emotional problems (3 items), bodily pain (2 items), social functioning (2 items), mental health (5 items), vitality (4 items) and general health perceptions (5 items). Responses vary from dichotomous (yes-no) to five-points verbal rating scales (ordinal). All item scores were coded, summed and transformed linearly into a possible range of 0 (poor health) to 100 (optimal health). SF-36 mean scores for every domain were calculated.

Statistical Method:

The data were collected, presented and analyzed using SPSS-PC software and Epi-Info (version 6.1) software [13] **(Dean et al, 1994).** Comparisons between measures were done using student t-test for two groups and one way ANOVA for multiple groups, while comparisons between qualitative categories were done by chi- square test. The test results were considered significant when P. value < 0.05.

RESULTS

Table (1) shows that the mean age of the studied group was 33 $\pm$ 4.5 years old, mean of BMI was 27.9 $\pm$ 1.9 kg/m^2, mean duration of employment was 5.5 $\pm$ 3.2 years, and mean hours of work/week was 84 hours (two weeks on and two weeks off working). Most of the studied onshore drilling workers were married (77.2 %), right handed (98.9 %) and non-smokers (55.1 %). Regarding past history and family history, about (9.8 % and 3.6 %) of studied group showed positive history respectively. About (42 %, 47 %, 5 % and 6 %) of the studied workers was in the drilling crew, maintenance section, rig management and other level jobs respectively.

Table (2) shows that low back region complaint was the most prevalent complaint (31.9 %) followed by shoulder (28.3 %), wrist (23.2 %), knee (16.3 %), neck (15.2 %), foot (12.3 %), thigh (10.9 %), elbow (10.1 %), while upper back region complaint was the least prevalent one (4.7 %). It also shows that lower back, wrist, neck and knee regions complaints were the most troubling regions affecting the daily activities of onshore oil drilling workers (mentioned 44.3 %, 40.6 %, 38.1 % and 37.7 % respectively). No statistical significant difference was found in-between different body region complaints as regard daily activity affection

Table (3) shows that the highest prevalence of complaining workers was found among maintenance section (61 %) followed by drilling crew (59.1 %) and the lowest prevalence was among rig management personnel (35.5 %).

Table (4) shows that the prevalence of MSK complaints was significantly higher among workers with age ($\geq$ 33 years), BMI ($\geq$ 30 Kg/m^2), duration of employment ($\geq$ 5 years) and those who are smokers and married.

Table (5) shows highly significant association between MSK complaints and some physical

workload stressors, in particular, working in awkward posture, excessive bending, movement out-reach of joint and carrying heavy objects. While the overall ergonomic factors showed non significant association.

Table (6) shows highly significant association between MSK complaints and work pressure factors especially, doing stressful tasks, increased work amount and working with time pressure.

Table (7) shows highly significant association between MSK complaints and negligence of best measures practice especially as regard not using equipment to facilitate lifting and to avoid awkward posture, working in awkward posture, lifting heavy objects, wrong lifting and carrying, and not to have ergonomic training.

Table (8) shows that most of neck complaints (73.8 %) were of 1-7 days duration, affecting leisure activities more than work activities (54.7 % versus 21.4 %). It caused absence from work 1-7 days through the last year in most of cases (52.3 % of complaining workers) and 28.6 % of these complaints necessitated medical consultation. Most of shoulder complaints (82.1 %) were of 1-7 days duration, affecting leisure activities more than work activities (47.4 % versus 17.9 %). It caused absence from work 1-7 days through the last year in most of cases (39.7 % of complaining workers) and 20.5 % of these complaints necessitated medical consultation. While most of back complaints (48.4 %) were of 1-7 days duration, affecting leisure activities more than work activities (59.8 % versus 28.9 %). It caused absence from work 1-7 days through the last year in most of cases (44.3 % of complaining workers) and 23.7 % of these complaints necessitated medical consultation.

Figure (1) shows the SF-36 mean scores among workers with no MSK complaints, those with regional MSK complaints and those with widespread MSK complaints as regard the eight health domains indicating more worse quality of life with increased the distribution of MSK complaints.

Table (1): Relevant characteristics and data of the studied onshore oil drilling workers

General Characteristics		**Studied Workers N = 276**
Age (Years)	(Mean ± SD)	33 ± 4.5
BMI (Kg/m^2)	(Mean ± SD)	27.9 ± 1.9
Duration of employment (Years)	(Mean ± SD)	5.5 ± 3.2
Smoking habit (Smokers**)**	N (%)	124 (44.9 %)
Marital status (Married**)**	N (%)	213 (77.2 %)
+ ve Past history	N (%)	27 (9.8 %)
+ ve Family history	N (%)	10 (3.6 %)

Table (2): Prevalence of MSK complaints among the studied onshore oil drilling workers (276) in their different body regions through the last year and their impact on the daily activities

Body Region	MSK Complaints				Daily activity affection Among workers with MSK complaints	
	Complaint		No Complaint			
	N	%	N	%	N	%
Neck	42	15.2	234	84.8	16	38.1
Shoulder	78	28.3	198	71.7	24	30.7
Elbow	28	10.1	248	89.9	9	32.1
Wrist	64	23.2	212	76.8	26	40.6
Upper back	13	4.7	263	95,3	3	23.1
Lower back	88	31.9	188	68.1	39	44.3
Thigh	30	10.9	246	89.1	8	26.6
Knee	45	16.3	231	83.7	17	37.7
Foot	34	12.3	242	87.7	12	35.3
Total MSK	159	57.6	117	42.4		

Table (3): Prevalence of the MSK complaints within the different work sections in onshore oil drilling works among the studied group

Work Section (Number)		Neck		Upper limb		Lower limb		Back	
		N	%	N	%	N	%	N	%
Drilling Crew									
(Total workers)	(115)	24	20.9	50	43.5	29	25.2	47	40.9
• Rough necks	(37)	4	10.8	15	40.5	12	32.4	15	40.5
• Driller	(25)	11	44	14	56	3	12	12	48
• Assistant driller	(34)	5	14.7	11	32.3	9	26.5	11	32.3
• Derrick man	(19)	4	21.1	10	52.6	5	26.3	9	47.3
Maintenance									
(Total workers)	(131)	16	12.2	55	41.9	40	30.5	43	32.8
• Roustabout	(45)	5	11.1	19	42.2	18	40	20	44.4
• Mechanics	(29)	5	17.2	13	44.8	9	31.1	11	37.9
• Electricians	(27)	4	14.8	12	44.4	6	22.2	5	18.5
• Scaffolders	(5)	0	0	3	60	2	40	2	40
• Welder	(13)	2	15.4	6	46.1	3	23	3	23
• Crane operators	(12)	0	0	2	16.6	5	41.6	2	16.6
Rig Management	(14)	2	14.3	4	28.6	6	42.9	6	42.9
Other Level Jobs	(16)	2	12.5	2	12.5	6	37.5	8	50

Table (4): The relationship between some relevant characteristics and data to MSK complaints among the studied onshore oil drilling workers

General Characteristics		MSK Complaints + ve (N = 159) N.	%	MSK Complaints - ve (N = 117) N.	%	X^2	P. value	O.R	95% CI
Age (years)									
< 33	(136)	62	45.6	74	54.4	15.86	< 0.01	2.69	(1.6 – 4.55)
≥ 33	(140)	97	69.3	43	30.7				
Duration of employment									
< 5 (years)	(128)	58	45.3	70	54.7	14.7	< 0.01	2.59	(1.54 – 4.37)
≥ 5 (years)	(148)	101	68.2	47	31.8				
Body mass index (kg/m^2)									
< 30	(212)	114	53.8	98	46.2	5.67	< 0.05	2.04	(1.07 – 3.88)
≥ 30	(64)	45	70.3	19	29.9				
Smoking									
Non-smoker	(152)	74	48.7	78	51.3	11.03	< 0.01	2.3	(1.36 – 3.89)
Smoker	(124)	85	68.5	39	31.5				
Marital status									
Unmarried	(63)	29	46.1	34	53.9	4.48	< 0.05	1.84	(1.01 – 3.37)
Married	(213)	130	61.1	83	38.9				

Table (5): The relationship between MSK complaints and both physical work load factors and overall ergonomic factors among the studied workers

Physical work load stressors & Ergonomic factors	MSK complaints (N = 159) N.	%	No MSK complaints (N = 117) N.	%	X^2	P. value	O.R	95% CI
No long standing	70	57.4	52	42.6	0.01	> 0.05	1.02	(0.61 – 1.69)
Long standing	89	57.8	65	42.2				
No excessive walking	94	54.1	80	45.9	2.48	> 0.05	1.5	(0.88 – 2.55)
Excessive walking	65	63.7	37	36.3				
No awkward posture	38	43.2	50	56.8	11.01	< 0.01	2.38	(1.37 – 4.12)
Awkward posture	121	64.4	67	35.6				
No excessive bending	54	46.1	63	53.9	10.91	< 0.01	2.27	(1.35 – 3.82)
Excessive bending	105	66.1	54	33.9				
Adopting different positions	102	54.5	85	45.5	2.23	> 0.05	1.48	(0.85 – 2.58)
Adopting same positions	57	64.1	32	35.9				
No movement out-reach of joint	95	52.5	86	47.5	5.65	< 0.05	1.87	(1.08 – 3.25)
Movement out-reach of joint	64	67.4	31	32.6				
No carrying heavy weights	66	50.7	64	49.3	4.71	< 0.05	1.7	(1.02 – 2.84)
Carrying heavy weights	93	63.6	53	36.4				
Suitable ergonomic layout of rigs	130	56	103	44	2.02	> 0.05	1.64	(0.79 – 3.46)
Unsuitable ergonomic layout	29	67.5	14	32.5				

Table (6): The relationship between MSK complaints and work pressure factors among the studied onshore oil drilling workers

Work pressure factors	MSK complaints (N = 159)		No MSK complaints (N = 117)		X^2	P. value	O.R	95% CI
	N.	%	N.	%				
Adequate work amount	41	39.1	64	60.9	23.91	< 0.01	3.48	(0.61 – 1.69)
Increased work amount	118	69	53	31				
Working without time pressure	20	34.5	38	65.5	16.08	< 0.01	3.34	(0.88 – 2.55)
Working with time pressure	139	63.8	79	36.2				
Available breaks on need	90	52.6	81	47.4	4.56	< 0.05	1.73	(1.37 – 4.12)
No available breaks on need	69	65.7	36	34.3				
No stressful tasks	31	33.7	61	66.3	32.3	< 0.01	4.5	(1.35 – 3.82)
Doing stressful tasks	128	69.6	56	30.4				
Not in need to work slowly	139	56.7	106	43.3	0.68	> 0.05	1.39	(0.85 – 2.58)
Ought to work slowly	20	64.5	11	35.5				
No increase in work pressure	23	38.3	37	61.7	11.6	< 0.01	2.73	(1.08 – 3.25)
Increase in work pressure	136	62.9	80	37.1				
No occurrence of sudden events	37	55.2	30	44.8	0.21	> 0.05	1.14	(1.02 – 2.84)
Occurrence of sudden events	122	58.4	87	41.6				

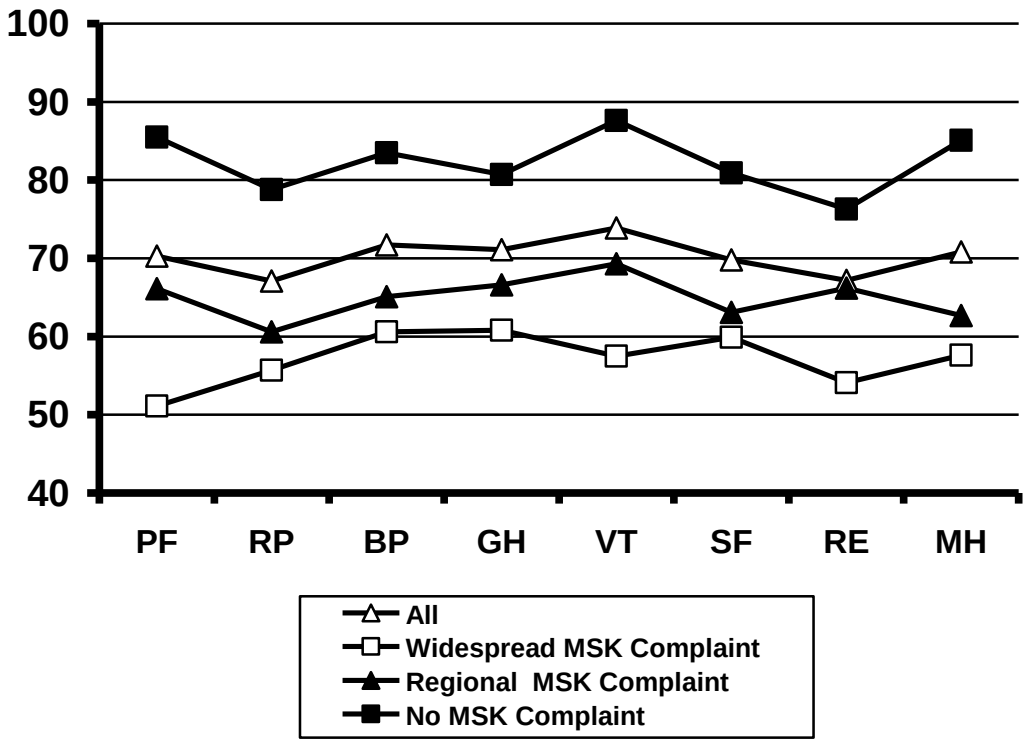
Table (7): The relationship between MSK complaints and best measures practice among the studied onshore oil drilling workers

Best measures practice	MSK complaints (N = 159)		No MSK complaints (N = 117)		X^2	P. value	O.R	95% CI
	N.	%	N.	%				
Right lifting and carrying	79	51.6	74	48.4	5.02	< 0.05	1.74	(1.04 – 2.93)
Wrong lifting and carrying	80	65	43	35				
Lifting suitable weights	123	53.7	106	46.3	8.36	< 0.01	2.82	(1.30 – 6.21)
Lifting heavy weights	36	76.6	11	23.4				
Wearing PPE	148	57.1	111	42.9	0.37	> 0.05	1.38	(0.45 – 4.32)
Not wearing PPE	11	64.7	6	35.3				
Work in right posture	20	39.2	31	60.8	8.67	< 0.01	2.51	(1.29 – 4.9)
Work in awkward posture	139	61.7	86	38.3				
Use equipment for lifting	82	48.5	87	51.5	14.74	< 0.01	2.72	(1.57 – 4.73)
Do not use equipment	77	71.9	30	28.1				
Take rest breaks on need	140	55.8	111	44.2	3.81	> 0.05	2.51	(0.91 – 7.30)
Do not take rest breaks on need	19	76	6	24				
Ergonomically suitable equipment	125	56.6	96	43.4	0.5	> 0.05	1.24	(0.65 – 2.38)
Ergonomically unsuitable equipment	34	61.8	21	38.2				
Have training on ergonomics	80	50.3	79	49.7	8.17	< 0.05	2.05	(1.21 – 3.48)
No training on ergonomics	79	67.5	38	32.5				

Table (8): Work productivity affection and sequences of the neck, shoulder and back region complaints among the studied oil drilling workers in the last year

	Neck complaint (42)		Shoulder complaint (78)		Back complaint (97)	
	N	%	N	%	N	%
Duration of the complaints						
• 1 - 7 days	31	73.8	64	82.1	47	48.4
• 8 - 30 days	8	19.1	9	11.5	41	42.3
• > 30 days	3	7.1	5	6.4	9	9.3
Work activity affection	9	21.4	14	17.9	28	28.9
Leisure activities affection	23	54.6	37	47.4	58	59.8
Duration of absence from work						
• 0 days	10	23.8	36	46.2	39	40.2
• 1 - 7 days	22	52.4	31	39.7	43	44.3
• 8 - 30 days	10	23.8	11	14.1	15	15.5
Consultation and follow up treatment	12	28.6	16	20.5	23	23.7

Figure (1): SF-36 mean scores of eight domains of health for those with no MSK complaints, regional MSK complaints and widespread MSK complaints among the studied workers



PF = Physical functioning, **RP** = Role limitations physical, **BP** = Bodily pain, **GH** = General health, **VT** = Vitality, **SF** = Social functioning, **RE** = Role limitations emotional, **MH** = Mental health

DISCUSSION

Prevalence of MSK complaints (symptoms):

The results of this study showed that the prevalence of the total MSK complaints among the studied onshore oil drilling workers through the last year was 57.6% (table 2). This prevalence is lower than that was recorded by Høivik [14] among oil drilling workers which was about 72 %. In the same time, our prevalence was higher than that found by other researchers in their studies [15 & 4], which were 46 % and 47 % respectively. This difference may be related to using of different research methods and variable demographic or work characteristics of the workers under different studies.

According to different body regions' MSK complaints, the results of this study showed that low back complaints was the most prevalent complaint (31.9 %) followed by shoulder (28.3 %), wrist (23.2 %), knee (16.3 %), neck (15.2 %), foot (12.3 %), thigh (10.9 %), elbow (10.1 %), while upper back region complaint was the least prevalent one (4.7 %) (Table 2). These results are supported by many previous studies [16 & 17].

A similar study, conducted by Chen and colleges [18], showed that low back complaints was also the most prevalent complaint (32.4 %) followed by neck (25 %), shoulder (20.1 %), knee (20 % %), wrist (13.5 %), foot (10.2 %), thigh (8.4 %) and elbow (7.5 %).

On the contrary to our study Morken et al. in their study found that the disorders of upper limbs accounts for 53 % of all complaints, back pain complaints 20 %, lower limb complaints 16 %, and neck complaints 8 % [4]. Variable prevalence rates of MSK complaints among oil drilling workers in the different studies may be accepted due to the different case-definitions used in the various studies as regard to complaint duration or severity. Also may be due to the different quantity or quality of the actual tasks done by the workers under different studies.

Affection of the daily activities of the complaining drilling workers reflected by the severity of their MSK complaints (table 2). The lower back region was the region with more activity restriction (reported by 44.3 %) as it is the site of referred pain in cases of lumbar disc disorders causing (sciatica) which interferes to a large extent with the subjects' activity, followed by wrist region (reported by 40.6 %) This may be because of its incorporation in all daily activities. Next is the neck, knee, foot, elbow and shoulder regions (reported by 38.1 %, 37.7 %, 35.3 %, 32.1 % and 30.7 % respectively) which may be affected by different MSK disorders varied in severity according to the type and degree of the pathological process. Affection of the upper back, knee and leg regions influenced activity to a lower extent (reported by 23.1 % and 26.6 % respectively).

Moreover, from the results of this study, it was noticed that the highest prevalence of MSK complaints was found among maintenance section (61 %) followed by drilling crew (59.1 %) and the lowest prevalence was among rig management personnel (35.5 %) (Table 3). This is consistent with the study of Chen et al., [18] and also with that of Morken et al. [4] Who recorded that about 40 % of all MSK complaints were among maintenance workers and particularly among mechanics, electrician and scaffolders. While, drilling crew (31 %) mainly among roughnecks. And the lowest prevalence was among rig management personnel (17 %).

This results can be accepted because, mechanics, electrician, scaffolders and roughnecks usually deal with occurrence of sudden events that require rapid decision making and maximal coordination of the body movements to do multiple and more stressful tasks while working. In the second order, rig management personnel were the least stressful department because of the simple work tasks, regular fixed duration of the work shift.

Potential risk factors associated with increased prevalence of MSK complaints

A) Individual risk factors:

On studying the effect of many Individual risk factors, the results of analysis showed that, the risk of MSK complaints in drilling workers was significantly higher among those with higher age (≥ 33 year) and longer

duration of employment (≥ 5 year) (OR = 2.69, 95% CI; 1.6 – 4.55) and (OR =2.59, 95% CI; 1.54 – 4.37) respectively (table4).

Regarding the increased risk of MSK complaints in drilling workers with increased age and duration of employment, our results are consistent with the results of Roquelaure et al. [19] who revealed that, the prevalence of MSK complaints was significantly related to age and duration of employment.

This result disagrees with others who reported that age is of no importance when discussing the MSK complaints [20]. Our results can be explained on knowing that, age of ≥ 33 coincide usually with the mid career stage, which is the period of maximal physical activity at work and so higher chance for MSK complaints development.

Also our study, showed that, the risk of MSK complaints in drilling workers was significantly higher among smokers, married workers and those with body mass index (≥ 30 Kg/m^2) (OR = 2.3, 95% CI; 1.36 – 3.89), (OR = 1.84, 95% CI; 1.01 – 3.37), and (OR =2.04, 95% CI; 1.07 – 3.88) respectively (table 5). These results are inconsistent with most of the studies, which found that, BMI and smoking and marital status are poor predictors of MSK disorders [17], On the other hand, Spies-Dorgelo et al., [21], agreed with us in this relationship. They explained it by the associated increase of the spinal loading and momentum at the limbo-sacral joint during work activities.

B) Physical work load:

Our results showed a highly significant association between MSK complaints and some physical workload stressors, in particular, working in awkward posture, excessive bending, movement out-reach of joint and carrying heavy objects (OR = 2.38, 95% CI; 1.37 – 4.12), (OR = 2.27, 95% CI; 1.35 – 3.82), (OR =1.87, 95% CI; 1.08 – 3.25) and (OR =1. 7, 95% CI; 1.02 – 2.84) respectively (table 5). This is consistent with many studies that searched this subject before, and commented about the role of the physical workload in developing MSK disorders [22 & 4].

Working in an awkward posture may reduce capability of the spine to withstand the mechanical load in such twisted position. The arranged order of these postures in enhancing MSK disorders differed between different studies depending upon the actual tasks done by each workers' sections, i.e. Michael et al. found significant high odds ratios for some work postures arranged by, frequent bending, much static work then frequent lifting of objects [23]. On the other hand, Swei-Pi and Shu-Yu, mentioned lifting weights, awkward postures then bending forward position as risky positions for MSK disorders [24].

C) Work Pressure factors:

The results of our study pointed to the overall work pressure factor as a risk factor for developing MSK disorders (table 6). It was of highly significant relationship with MSK complaints as regard many work pressure factors. Increased work amount, working in time-pressure and doing stressful tasks at work got more blaming of drilling workers as great threat to the musculoskleta1 system (OR = 3.48, 95% CI; 2.03 – 5.98), (OR = 3.34, 95% CI; 1.75 – 6.43) and (OR = 4.5, 95% CI; 2.55 – 7.96) respectively. Lesser number of drilling workers related their MSK complaints to the infrequent breaks and increase in work pressure (OR = 1.73, 95% CI; 1.01 – 2.94) and (OR = 2.73, 95% CI; 1.46 – 5.15) respectively. Small portion of workers mentioned, having to work slowly with occurrence of sudden events as contributing factors for developing MSK disorders but it was of insignificant associations (OR = 1.39, 95% CI; 0.60 – 3.24) and (OR = 1.14, 95% CI; 0.63 – 2.05) respectively. Similar results were obtained from many other previous studies as [25].

However, the number of the workers complained from work pressure related factors in this study was more than those mentioned in the study of Chen et al. [1]. This difference may be due to varied circumstances of the work. In Egyptian oil drilling locations, there is a large amount of work that may sometimes exceed the worker's capacity and forces the workers to work harder especially on occurrence of unplanned

events predisposing them to acquire MSK injuries. The role of working under time-pressure was pointed out also by other researchers [26].

D) Ergonomic risk factors:

The present work showed insignificant relationship between the MSK disorders and the ergonomic factors of the work place (OR = 1.64, 95% CI; 0.79 – 3. 46) (table 5). This result is consistent with that of Caroly et al. [27], and differs from that of Tatiana and Helenice [28], who stated that ergonomic factors are weekly associated with the MSK disorders.

In fact, all work-related variables are strongly interrelated and can be confounded with some demographic characteristics, and so it is difficult to define the causal factors definitely [17].

Best measures practice:

On studying the effect of maintaining best measures practice, the results of analysis showed that, the risk of MSK complaints in drilling workers was significantly higher among those not using equipment to facilitate lifting and to avoid awkward posture(OR = 2.72, 95% CI; 1.57 – 4.73), working in awkward posture (OR = 2.51, 95% CI; 1.29 – 4.9), lifting heavy objects (OR = 2.82, 95% CI; 1.3 – 6.21), do wrong lifting and carrying (OR = 1.74, 95% CI; 1.04 – 2.93), and those not having ergonomic training (OR = 2.05, 95% CI; 1.21 – 3.48). Also, the risk of MSK complaints was higher among those not wearing PPE (OR = 1.38, 95% CI; 0.45 – 4.32), not having rest breaks on need (OR = 2.51, 95% CI; 0.91 – 7.30) and as regard ergonomically suitable equipment (OR = 1.24, 95% CI; 0.65 – 2.38), but it was statistically insignificant (table 7). These results are supported by some previous studies [29].

Productivity affection:

The present study, in tables (8), we noticed that most of the neck, shoulder and back region complaints durations lied between 1 - 7 days (73.8 %, 82.1 and 48.4 % respectively). While, back region showed the largest percentage of complaints duration between 8 - 30 days (42.3 % versus 11.5 % and 19.1 % in the shoulder and neck regions respectively). Also, back region showed the largest percentage of complaints duration > 30 days (9.3 % versus 6.4 % and 7.1 % in the shoulder and neck regions respectively). That is because; back region is inevitably strained during any daily activity in contrast to the neck and shoulder strain which may be less severe and less repetitive.

The MSK complaints durations in the three regions were longer than those recorded in the study of Valentic et a1. [30]. They found that (4.9%, 6.6% and 3%) of the workers reported >30 days neck, shoulder and back complaint.) respectively in the last year versus (7.1 %, 6.4% and 9.3%) for the same regions in our study.

In this study we noticed that the effect of MSK complaints upon work activities was lesser than that detected on the leisure activities. That may be due to economic factors (to conserve sick-leaves days). Back complaining workers showed higher work activity affection than those with neck and shoulder regions complaints (28.9 %, 21.4 % and 17.9 % respectively). Also, back complaining workers showed higher leisure activity affection than those with neck and shoulder regions complaints (59.8 %, 54.7 % and 47.4 % respectively). This agrees with the study of Waddell, in which, back complaints affected work activities of 14 % of workers [31].

In this study, neck region affection was the largest region necessitated absence from work as 52.3 % and 23.8 % of the neck-complaining workers needed 1 - 7 and 8 - 30 days absence from work in the last year. While, the back region and shoulder regions-related absence lied between 1-7 days (as reported by 44.3 % and 39.7 % respectively) and 8 - 30 days (as reported by 15.5 % and 14.1 % respectively). This may be related to the painful sequences of neck pain. These characters were noticed in the back complaints by other researchers [32].

In respect to the medical consultation for the three regions, the neck showed higher frequency of medical consultation between them followed by low back region then

shoulder regions (28.6 %, 23.7 % and 20.5 % respectively). These frequencies were lower than those in the study of Hoogendoorn et al., who found it about 42 % [22]. This may be due to decreased medical awareness between the studied workers and their wrong trend to take available analgesics or asking unspecialized doctors.

Quality of life among the studied workers:

Also, in this study we found a highly significant difference in the SF-36 mean scores among workers with no MSK complaints, those with regional MSK complaints and those with widespread MSK complaints as regard the eight health domains especially physical functioning, mental health and vitality. Also, we concluded that that MSK complaints, and especially widespread MSK complaints, had a major impact on both physical and mental aspects of self-reported health status measured with SF-36 indicating that the more affected body regions, the more severe the situation (figure 1).

Other studies have also shown that musculoskeletal pain has severe impact on health status measured with SF-36 [33 & 34]. The impact on the different health concepts has been reported to vary in regional pain syndromes, depending on location. Birrell et al. found that hip pain had impact on physical function and pain, but only a small impact on wider aspects of health status, such as general health, vitality and mental health [33].

The findings in our study suggest a close relationship between health perception and MSK pain. This knowledge could for example be used on group level to examine the risk of developing chronic MSK pain in different onshore oil drilling workplaces. These results are supported by that of Bergman et al., who found that 90% of individuals with chronic pain localized it to the musculoskeletal system [9].

CONCLUSION

From these results we can conclude that: onshore oil drilling work is really accompanied by a risk of developing musculoskeletal disorders predisposed by some items related to physical work load and work pressure factors, duration of employment and mid-career age group in addition to marital status, obesity and smoking habit with unproved role of the ergonomic factors. Also, quality of life is adversely affected by MSK complaints.

RECOMMENDATIONS

The study stresses on the importance of the pre placement and periodic medical examinations as steps for proper placing, and recurrent assessment of the employed workers then modifying the work circumstances to match the capabilities of the workers and avoiding extra-work in time pressure or managing sudden events with insufficient number of drilling crew. The study denied obligating workers to do paid overtime duty and emphasizes the need for application of training programs for skillful drilling work, keeping in mind following the safety roles and best measures practice. Assessment of HRQOL for workers is also recommended to be done regularly as it can be used as a predictor for developing of chronic MSK pain.

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اثر العمل بالتنقيب البري عن البترول علي الجهاز العضلي الحركي ونوعية الحياة لدي مجموعة من عمال الحفر المصريين

المقدمة:

تعتبر عملية التنقيب عن البترول من اكثر المهن الشاقة، والتي تحتاج الكثير من المجهود العضلي والعمل لفترات طويلة تحت ضغط نفسي و عصبي و ظروف بيئية صعبة ، والتي قد تؤثر سلبيا علي الجهاز العضلي الحركي و نوعية الحياة لدي العاملين بهذا المجال.

الاهداف:

1- معرفة مدي انتشار شكاوي الجهاز العضلي الحركي لدي العمال المصريين بالتنقيب البري عن البترول.

2- تحديد العلاقة بين شكاوي الجهاز العضلي الحركي و عوامل الخطورة المقدرة ذاتيا في مهنة الحفر و ممارسات العمل المثلي اثناء عملية الحفر.

3- توضيح اثر العمل بالتنقيب البري عن البترول علي نوعية الحياة لدي عمال الحفر المصريين.

الطرق والوسائل:

اجريت هذه الدراسة علي 276 عامل من عمال الحفر بالشركة المصرية للحفر، تم اختيارهم عشوائيا بعد حساب عدد عينة الدراسة احصائيا، واشتملت هذه الدراسة علي اجراء استبيان للنقاط الاتية:

1- البيانات الشخصية والمهنية للعامل و ممارسات العمل المثلي اثناء العمل بالحفر.

2- شكاوي الجهاز العضلي الحركي في العام السابق للدراسة و خلال فترة العمل بمهنة الحفر.

3- عوامل الخطورة المقدرة ذاتيا لهذه الالام من - عوامل خاصة بالمجهود الجسماني المبذول واوضاع الجسم المختلفة اثناء العمل.
- عوامل ضغط العمل. - عوامل تلاؤم بيئة العمل.

4- نوعية الحياة لدي العمال في الاربعة اسابيع السابقة للدراسة.

النتائج:

وبعد تجميع النتائج و تحليلها، اظهرت الدراسة النتائج الاتية:

1) ان معدل انتشار الام الرقبة، الكتفين، الكوعين، الرسغين كانت (15,2 % ، 28,3 % ، 10,1 % ، 23,2 %) علي التوالي، وكان معدل انتشار الام اعلي الظهر و اسفل الظهر هو (4,7 % ، 31,9 %) علي التوالي، كما كان معدل انتشار الام الفخدين، الركبتين، و القدمين هو (10,9 % ، 16,3 % ، 12,3 %) علي التوالي.

2) وجود علاقة ذات دلالة احصائية بين الحالة الاجتماعية (الزواج) و البدانة و عادة التدخين من ناحية وحدوث الام الجهاز العضلي الحركي في عمال الحفر من الناحية الاخري. فضلا عن ذلك تبين ان السن و مدة العمل التراكمية بالحفر من العوامل الاخري المحددة لهذه الالام، وكانت ذات دلالة احصائية.

3) ذيادة نسبة انتشار شكاوي الجهاز العضلي الحركي بين طاقم الحفر و العاملين في الصيانة عن هؤلاء المسئولين عن ادارة عملية الحفر.

4) ان هناك ارتفاعا ملحوظا في معدل الارجحية لشكاوي الجهاز العضلي الحركي بالنسبة لبعض العوامل الخاصة بالمجهود الجسماني واوضاع العمل الخاطئة خاصة اوضاع الانحناء الخاطئة، اضافة الي عوامل ضغط العمل و علي وجه الخصوص التحكم في كمية العمل و الوقت المتاح لادائه، بينما اظهرت النتائج عدم وجود ارتباط دال احصائيا بين عوامل تلاؤم بيئة العمل و هذه الاعراض.

5) ان هناك علاقة ذات دلالة احصائية بين اهمال ممارسات العمل المثلي و احتياطات السلامة، و بين حدوث الام الجهاز العضلي الحركي في عمال الحفر.

6) وجود ذيادة في نسبة التدهور لنوعية الحياة لدي العمال الذين يشكون من الام بمناطق متعددة، عنها لدي الذين يشكون من الام موضعية، عنها لدي الذين لا يشكون من الام بالجهاز العضلي الحركي، بفارق دال احصائيا.

الخلاصة:

تبين من نتائج هذه الدراسة ان العمل بمهنة الحفر يشتمل علي بعض المخاطر التي قد تؤثر سلبيا علي الجهاز العضلي الحركي و تزيد من حجم التعرض لبعض شكواه من خلال الممارسة الخاطئة لمهام العمل و بعض اوضاع العمل الغير صحيحة والتي تنتج من الاضطرار الي السرعة في الاداء مع عدم مراعاة احتياطات السلامة خاصة خلال الاحداث المفاجئة. ومع تراكم هذه الضغوط و تباعد فترات الراحة او عدم انتظامها تتذايد احتمالات هذه الشكاوي. كما تتاثر نوعية الحياة سلبيا لدي عمال الحفر بذيادة شكاوي الجهاز العضلي الحركي.

التوصيات:

توصي هذه الدراسة بوضع برنامج مناسب للتقليل من مخاطر الجهاز العضلي الحركي لدي عمال الحفر، والذي يجب ان يشتمل علي اجراءات هندسية و صحية و طبية فعالة.