

Biopsychosocial Associated Disorders Among Workers Exposed to Ergonomic stressors

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Abstract:

Background: The biopsychosocial model is an explanatory framework that recognizes the importance of psychological and social factors in determining how workers with musculoskeletal disorders (MSDs) cope with their conditions. The occupational health professionals should assess the interplay between the biological e.g. Musculoskeletal disorders (MSDs), the psychological e.g. anxiety, depression and the social e.g. work demands and drug abuse. **Objectives:** To find out the proportion of anxiety disorders and or depression symptoms among the studied groups, to find out the proportion of drug abusers among the examined cases with MSDs and suffering anxiety disorders and or depression symptoms. **Subjects & Methods:** Case - control study was conducted. 171 workers with MSDs (cases) and another 171 were selected (controls). Both groups were subjected to interview sheet to assess general characteristics, workplace ergonomic status, anxiety disorders and or depression symptoms, factors determined drug abuse and types of drug abuse. **Results:** 22.8% and 2.9% of cases and controls were suffering depression respectively. 26.9% and 3.5% of cases and controls were suffering anxiety disorder respectively. 71.9% and 19.9% of cases and controls were abusing Tramadol respectively while 34.5% and 45.6% of both groups were abusing Cannabis respectively. **Conclusion:** cases with work related MSDs might be complicated with anxiety disorders and or depression symptoms and might develop drug abuse as a result of the interaction between the chronic pain of MSDs, unsafe ergonomic workplace and continuous work load.

Introduction:

The biopsychosocial model is an explanatory framework that recognizes the importance of psychological and social factors in determining how musculoskeletal sufferers cope with their conditions. The biopsychosocial model advocate that clinicians and occupational health professionals should assess the interplay between the biological e.g. Musculoskeletal disorders (MSDs), the psychological e.g. anxiety disorders, depression symptoms and the social e.g. work demands (Waddell and Burton, 2006).

Stressful life events often precede first episodes of mood disorders. Such events may cause permanent neuronal changes that predispose a person to subsequent episodes of mood disorder. According to Freud, unconscious impulses (e.g. pain) threaten to burst into consciousness and produce anxiety. Anxiety is related the fear of an actual (e.g. severe pain) or imagined (e.g. disability) object (Kaplan and Sadock's, 2005).

It is a vicious circle when one worker has a chronic work related pain due to ergonomic stressors inside the workplace and at the same time he is obligated to work at the same workplace for long hours because the workplace hasn't another position for him and there is no near plan for correction of the ergonomic stressors inside the workplace.

It is postulated that a big portion of these exposed workers are at risk of developing anxiety disorders and or depression symptoms and also at risk for drug abuse as they need to relief pain by any mean to work their shifts free of pain.

The hypothesis of the present study is to address that the workers suffering MSDs and exposed to workload associated with ergonomic stressors at their workplaces might be at risk for developing anxiety disorders and or depression symptoms. Also, they might be at risk for developing drug abuse.

Objectives:

-To find out the proportion of the cases suffering anxiety disorders and or depression symptoms among the studied workers.

-To find out the proportion of drug abusers among the examined cases.

Subject and Methods:

Research setting:

This study was conducted within 9 months inside a multinational company for automobile assembly. The plant is situated in 6 October governorate, Egypt. The plant was constructed since about 25 years for assembling cars, vans, and pickups. About 180 vehicles are the daily products of the company. The workplace is divided into two big distinct units: Body shop and Painting shop. The Body shop is subdivided into different stations starting with receiving the materials and end with forming the shell of the vehicle. The automobile body from the body shop enters the paint shop on a conveyer where it is degreased; layers of paint are applied and then cured in an oven.

Study design:

Case - control study was designed. This study passed 3 phases: preparatory phase (site of the study, target population, preparation of checklists, pilot study, sampling and ethical consideration were conducted), Implementation phase (data collection was conducted) and evaluation phase (data entry, statistical analysis, results, discussion, conclusion and recommendations were conducted).

Sample size and target population:

It was calculated that the total number of workers inside the production line inside the studied plant is 1220 workers. The sample size was estimated based on the following data; the proportion of psychological ill health related to workplace conditions was 11% (**Michelsen and Bildt, 2003**), and margin of error (5%) was selected. So, the minimum sample size required was 107(**Vaughan and Morrow, 1989**).

To avoid bias the sample size was increased by more than 50% to reach 171 workers. These workers were suffering MSDs (cases group) and exposed to workload (long working hours per day and unsafe ergonomic workplace). Another 171 workers were selected from the same plant without MSDs and not exposed to workload (control group). Criteria for selection among the cases group were; working at least since 5 years, exposed to long working hours and suffering MSD while the criteria for selection among the controls were; working only 8 hours/day, have no MSD, working since at least 5 years and not exposed to ergonomic stressors in their workplaces. The cases and the controls were selected by simple random sampling technique.

Data Collection, methods and statistical analysis:

All subjects in both groups were subjected to interview sheet containing personal data (age, sex and special habits), occupational history (type of occupation, duration of occupation, working hours/day and past history of other occupations) and history of musculoskeletal disorders.

Posture of legs, trunk, neck and seat were assessed by using checklist modified from (**NIOSH, 1997**). All cases of MSDs were diagnosed after referral to consultants of orthopedics and neurosurgery. Computerized Tomography (C.T.), Magnetic Resonant Imaging (MRI), X-rays and electrophysiological tests were the investigations used to prove the diagnosis of MSDs. These investigations were done for the affected workers by the occupational medicine department of the plant. The checklists were filled while monitoring the nature of the work of each worker included in the study at his workplace during his daily working hours.

Psychological disorders in the form of anxiety disorder (generalized anxiety disorder, panic with and without agoraphobia, specific phobia at work and posttraumatic stress disorder) and depression symptoms were assessed among workers in both groups by using the (**DSM, 2000**).

Accidental investigation of drug abuse was done for the studied workers in both groups. The positive results of drug abuse among the examined workers in both groups were recorded. The workers with positive drug abuse were subjected to interview sheet to

search the causes which led them to abuse these drugs. These interviews were conducted under confidential basis between the researchers and the workers.

The following are definitions for some terms used in the present study, they were obtained from (**Kaplan & Sadock's, 2005**):

Depression: psychopathological feeling of sadness, **Anxiety:** feeling of apprehension caused by anticipation of danger, which may be internal or external, **Generalized anxiety disorder:** massive and persistent anxiety, **Panic:** intense attack of anxiety associated with autonomic nervous system discharge and over helming feeling of dread, **Agoraphobia:** fear of going outside home, **Specific phobia:** fear of specific situations or objects, **Posttraumatic stress disorder:** follows extraordinary life stress and is characterized by anxiety, nightmares, agitation, and sometimes depression. **Cannabis:** an annual plant (cannabis sativa). The preparations that are smoked are called marijuana and consist of crushed leaves and flowers. **Tramadol:** tramadol hydrochloride is a potent preparation for relief of pain. The effects sets in quickly and lasts for some hours. Psychic side effects and dependence are expected on long duration of use.

Data entry and statistical analysis were done by using personal computer (Epi info program). Proportion, z test, and stepwise regression analysis were the statistical methods used for analysis of data. P value < 0.05 was accepted as a level of significance.

Results:

Table (1): shows that there is no statistical significance difference between the different age groups among cases and controls. All studied workers were male. 79.5% and about 86% of cases and controls were smokers respectively without statistical significance difference. Mean duration of work among cases and controls were 18.1 ± 2.1 and 16.8 ± 3.02 respectively with statistical significance difference. Mean working hours/day/week among cases and controls were 12 and 8 respectively. Environmental physical measures inside the studied workplace revealed that; noise level (99.3dB) was above Time Weighted Average (TWA) in workplaces of cases while in workplaces of controls it (83.4dB) was within the permissible TWA. Heat was above TWA in workplaces of cases ($29.7C^{\circ}$) while it was within TWA in workplaces of controls ($19.8C^{\circ}$). Vibration was above TWA in workplaces of cases (5 Hz/Second) while there was no vibration hazard in workplaces of cases. Ultraviolet rays were above TWA (0.5micro watt/cm²) in workplaces of cases while there was no ultraviolet hazard in workplaces of controls.

Table (2): shows that the ergonomic stressors among the exposed workers were sit/stand (85.3%), awkward trunk bending either forward or backward (76.6%), Standing stationary (74.3%), awkward neck bending either forward or backward (69.6%) and repetitive use of the hands and/or wrists (52.04%). As regards musculoskeletal disorders among the exposed workers it was shown that the proportion of these disorders was Cervical disc prolapse (71.9%), Lumbosacral disc prolapse (85.7%), Osteoarthritis (54.4%), Carpal tunnel syndrome (8.2%) and tennis elbow (19.3%).

Table (3) shows that the prevalence rate of depression symptoms among cases group was 22.8% while it was 2.9% among controls group with statistical significance difference and odds ratio=9.8. It was observed that all depression symptoms were statistically significant among cases when compared with controls (p<0.05 & odds ratio ranging from

3.05:16.8). It was noticed that; diminished ability to think, daily sense of fatigue, diminished interest in work and depressed mood were the most prevalent symptoms among cases (43.3%, 39.8%, 32.2%, 31% respectively).

Table (4) shows that proportion of cases suffering anxiety disorders was 26.9% while it was 3.5% among controls with statistical significance difference and odds ratio 10.1. The prevalence rate of generalized anxiety disorder among cases was 9.9% while it was 2.3% among controls ($p < 0.05$ & odds ratio is 4.6). It was found that the most prevalent anxiety disorders among cases were; post traumatic stress disorder and panic without agoraphobia (2.3% and 7.6% respectively) while there were no reported cases among controls group. Also it was noticed that 71.9% and 34.5% of cases were abusing tramadol and cannabis respectively while it was 19.9% and 45.6% respectively among controls group with statistical significance difference. It was noticed that 19.3% and 9.9% of cases and controls respectively were abusing both tramadol and cannabis respectively with statistical significance difference and odds ratio 2.2.

Table (5): shows the proportion of abusing tramadol or cannabis among the examined cases suffering depression symptoms or anxiety disorders. It was noticed that cases suffering psychomotor agitation (79.6%), feeling of guilt (72.7%), diminished interest in work (56.4%) and sleep disorders (52.9%) were abusing tramadol. It was observed that cases with higher proportion of abusing cannabis were suffering the following depression symptoms; feeling of guilt (27.3%), sleep disorder (47.1%), and daily sense of fatigue (51.5%). As regards cases with anxiety disorders it was noticed that all cases suffering phobia at work were abusing tramadol, 64.7% of cases suffering generalized anxiety disorder were abusing tramadol while 35.3% of these cases were abusing cannabis, 25% of cases suffering posttraumatic disorder and 75% of these cases were abusing tramadol and cannabis respectively. It was found that 23.1% of cases with panic disorder without agoraphobia were abusing tramadol while about 77% of these cases were abusing cannabis. It was reported that all cases suffering panic disorder with agoraphobia were abusing only cannabis.

Table (6) shows that killing pain, long working hours and minimizing sick leave days were the significant factors which determined drug abuse among cases group.

Discussion:

This study might claim that the workplace where the cases group are working are not safe ergonomically and include some ergonomic stressors (table 2) and could be considered as a risk factor for the various types of musculoskeletal disorders (MSDs) which reported in the present study. In spite of this claim the affected workers still working in the same workplace with the same ergonomic stressors without any vocational rehabilitation and also still exposed to long working hours table (table 1). This coincides with **Schierhout et al., 1995** who reported that ergonomic exposures in the workplace were significantly associated with musculoskeletal pain of the neck. **Kristensen and Jensen, 2005** in Denmark studied the effect of ergonomic conditions as prognostic factors for musculoskeletal symptoms and they reported that 39% of the symptomatic workers (suffering from neck pain) were exposed to ergonomic stressors. **Guo, 2002** concluded that the number of hours spent on repeated activities at work was associated with the high prevalence rate of back pain.

It was found in the present study that about 23% and 27% of the cases group were suffering from depression symptoms and anxiety disorders respectively table (3 & 4) this in contrast to the control group who has a low prevalence rate (2.9% and 3.5% respectively). This could be allocated to the pain they suffering and they need to work long working hours for long duration to meet with the production needs inside the studied plant (table 1). Also, it was noticed in the present study that workers with depression symptoms and anxiety disorders were suffering drug abuse and this might be attributed to the need for rapid and strong pain killer to feel comfortable during and after the long working hours and also to minimize the sick leave days needed to feel recovery from pain (table 6). This coincide with **(van and Geurts, 2001)** who concluded that long working hours and pressure to work overtime increased 2.2 – 3.4 times the occurrence of psychological disorders. On the other hand **(Duchon et al., 1997)** disagree with the results of the present study when they reported that no significant main effect between 8 and 12 hours shifts on neurobehavioral performance measures but we should consider that Duchon's study was done on healthy workers not on workers with MSDs like in the present study. **(Dickens, 2002)** and **(Parkes et al., 2005)** confirmed the claim of the present study (ergonomic stressors might be a risk factor for depression symptoms, anxiety disorders and drug abuse) when they stated that; Equally, depression and anxiety can be a common side effect of prolonged MSDs. **Merskey and Bogduk, 1994** added more explanation to the relationship between pain of MSDs and development of psychological disorders when they stated; if we accept the definition of pain (unpleasant sensory and emotional experience associated with actual or potential tissue damage) we can see the effects will go beyond physical ability to affect the worker's mood and cognitive capacity. It was concluded from the data obtained through the present study that unsafe ergonomic workplace might aggravate MSDs and thus act as an indirect risk factor for the aggravation or development of depression symptoms or anxiety disorders. The present study might claim that unsafe ergonomic workplace might be a risk factor for psychological disorders. This agrees with **(Coats and Max, 2005)** who reported that some workplace risk factors like: repetitive motion, heavy lifting, non neutral body postures, frequent twisting and mechanical pressure were associated with MSDs and psychological disorders.

It was found in the present study that about 72% and about 35% of workers with MSDs were abusing tramadol and Cannabis respectively table (4). Also, it was clear in table (6) that the most advocating factors for drug abuse were killing pain, overcome long working hours and minimizing sick leave days. This explains why workers with MSDs abusing tramadol in percentage more than double the abuse of Cannabis. The present study might claim that improving the ergonomic status of the workplace and vocational rehabilitating for the workers with MSDs might be a preventive factor for development of depression symptoms and anxiety disorders among these workers. This in line with **(Kraft and Roman, 1994)** who found a positive link between working condition and the drug abuse. **Crow and Hartman, 1992** confirmed the results of the present study when they found a linkage between the presence of pain of MSDs and the drug abuse among the affected workers. **Anderson, 1992** stated that workers with back pain may seek relief by abusing drugs.

The present study might claim that workers with MSDs who still working in unsafe ergonomic workplace and exposed to workload might be at risk for development of drug abuse, depression symptoms and/or anxiety disorders. This coincide with **(John et al., 2006)** who stated that; specific stressors result in certain physical and psychological disorders (depression, anxiety, post traumatic stress disorder) and behavior outcome (substance abuse).

Conclusion:

Depression symptoms, anxiety disorders and drug abuse might be an outcome of biopsychosocial disorders among workers exposed to ergonomic stressors and continuous workload.

Recommendation:

Ergonomic risk management at workplace and vocational rehabilitation for the workers with MSDs are recommended.

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Table (1): General characteristics and workplace environment of the studied groups

General characteristics	Cases group (N = 171)		Control group (N = 171)	
	N	%	N	%
<u>Age (years)</u>				
37-	64	37.4	57	33.3
43-	81	47.4	79	46.2
49-56	26	15.2	35	20.5
<i>Chi2 = 0.9</i>				
<i>P = 0.6</i>				
Mean ± St.D.	37.3 ± 2.1		35.5 ± 1.9	
<u>Sex</u>				
male	171	100	171	100
<u>Special habit</u>				
Smoking	136	79.5	147	85.9
<i>Chi2 = 2.5</i>				
<i>P = 0.1</i>				
Mean duration of work	18.1 ± 2.1		16.8 ± 3.02	
<i>T test = 69.2</i>				
<i>P value = 0.0*</i>				
Mean working hours	12h/day/6days/week		8h/day/6days/week	
<u>Workplace environmental measures:</u>				
Noise (TWA**:<85dB***)	99.3dB		83.4dB	
- Heat (TWA:26.7C°)	19.8 C°		29.7 C°	
- Vibration (TWA:4 Hertz/second)	5 hertz/second		4 hertz/second	
- Ultraviolet rays (TWA:0.1micro watt/cm ²)	0.5 micro watt/cm ²		-	

N.B. no past history of other occupations among the studied groups.

*: significant

** : Time Weighted Average (TWA): was accepted according to decision NO.211, year 2003, Ministry of Manpower, Egypt

***: According to the company regulations; noise should be below 85db inside the workplace

Table (2): Ergonomic stressors and proportion of Musculoskeletal disorders among the exposed workers

Ergonomic stressors	Exposed workers (cases) Total N. = 171	
	N.	%
Standing stationary	127	74.3
Kneeling	91	53.2
Awkward trunk position (forward and / or backward bending)	131	76.6
Awkward neck position (forward and or backward bending)	119	69.6
Repetitiveness: -the job involves repetitive use of the hands and/or wrists.	89	52.04
Sit / stand	146	85.3
Musculoskeletal disorders:		
- Cervical disc prolapse	123	71.9
- Lumbosacral disc prolapse	147	85.7
- Osteoarthritis	93	54.4
- Carpal tunnel syndrome	14	8.2
- Tennis elbow	33	19.3

N.B. one case might has more than one complaint

Table (3): proportion of depression symptoms among the studied groups

Depression symptoms	Cases (N=171)		Control (N=171)		Z test	P Value	Odds ratio
	N	%	N	%			
- depressed mode nearly daily	53	31	11	6.4	33.9	0.0*	6.5
- changed appetite nearly daily	48	28.1	6	3.5	38.8	0.0*	10.7
- feeling of guilt nearly daily	11	6.4	-	-	-	-	-
- recurrent thoughts of death	13	7.6	-	-	-	-	-
- sleep disorder nearly daily	17	9.9	-	-	-	-	-
- Diminished interest in work.	55	32.2	23	13.4	17.1	0.00004*	3.05
- Psychomotor daily agitation	49	28.6	4	2.3	45.2	0.0*	16.8
- Daily sense of fatigue	68	39.8	9	5.3	58.3	0.0*	11.8
- Diminished ability to think or concentrate nearly daily	74	43.3	19	11.1	44.7	0.0*	6.1
Total cases of depression	39	(22.8%)	5	(2.9%)	30.1	0.0*	9.8

*: significant

N.B: Diagnosis of depression was made by 5 or more of the above symptoms (DSM, 2000).

N.B. one case might has more than one complaint

Table (4) proportion of anxiety disorders and proportion of drug abuse among the studied groups

Anxiety disorders and drug abuse	Cases (N=171)		Control (N=171)		Z test	P Value	Odds ratio
	N	%	N	%			
<u>Anxiety disorders:</u>							
- panic with agoraphobia	7	4.1	-	-	-	-	-
- panic without agoraphobia	13	7.6	-	-	-	-	-
- Specific phobia (at work)	5	2.9	2	1.2	1.3	0.2	2.5
- Posttraumatic stress disorder	4	2.3	-	-	-	-	-
- Generalized anxiety disorder	17	9.9	4	2.3	8.6	0.003*	4.6
Total cases suffering anxiety disorders	46	26.9	6	3.5	36.3	0.0*	10.1
<u>Drug abuse:</u>							
- Tramadol	123	71.9	34	19.9	93.3	0.0*	10.3
- Cannabis	59	34.5	78	45.6	4.4	0.03*	0.6
- Both tramadol and cannabis	33	19.3	17	9.9	6.0	0.01*	2.2

*: significant

N.B. Diagnosis was made by using (DSM, 2000).

N.B. one case might has more than one complaint

Table (5): proportion of drug abuse among the examined cases suffering depression symptoms or Anxiety disorders

Depression symptoms	Tramadol		Cannabis	
	N	%	N	%
- depressed mode nearly daily (N=35)	11	31.4	24	68.6
- change of appetite nearly every day (N=48)	17	35.4	31	64.6
- feeling of guilt nearly every day (N=11)	8	72.7	3	27.3
- recurrent thoughts of death (N=13)	4	30.8	9	69.2
- sleep disorders nearly every day (N=17)	9	52.9	8	47.1
- diminished interest in work (N=55)	31	56.4	24	43.6
- Psychomotor daily agitation (N=49)	39	79.6	10	20.4
- Daily sense of fatigue (N=68)	33	48.5	35	51.5
- Diminished ability to think or concentrate nearly every day (N=74)	52	70.3	22	29.7
<u>Anxiety disorders:</u>				
- panic disorder with agoraphobia (N=7)	-	-	7	100.0
- panic disorder without agoraphobia (N=13)	3	23.1	10	76.9
- Specific phobia (at work) (N=5)	5	100.0	-	-
- Posttraumatic stress disorder (N=4)	1	25.0	3	75.0
- Generalized anxiety disorder (N=17)	11	64.7	6	35.3

N.B. one case might has more than one complaint

Table (6): Stepwise regression analysis of factors determined drug abuse among cases group

Factors determined drug abuse among cases group	B-coefficient	F-test	P-value
- killing pain	-0.008	3.1	0.01*
-overcome long working hours	-0.003	2.9	0.01*
-minimize sick leave days	-0.002	2.8	0.01*
-premature ejaculation	-0.005	0.9	0.1
-family problems	-0.002	1.1	0.2
-fatigue	-0.006	0.9	0.1

***: significant**