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CORRELATION BETWEEN MUSCULOSKELETAL DISORDERS AND WORK RELATED POSTURES IN PHYSICAL THERAPISTS

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Abstract

Purpose: To study the relationship between MSDs and work related postures of physical therapists in general hospitals of Cairo, Egypt. **Methods**: Nordic Musculoskeletal Questionnaire (NMQ) was used to survey the physical therapists' musculoskeletal disorders, also Ovako Working Posture Assessment System (OWAS) was applied to evaluate, analyze and categorize the repeated work postures in 130 physical therapists. OWAS method was processed using WinOWAS software, involving 16 work postures. The collected data statistically analyzed using Excel and SPSS. **Results:** NMQ indicated that 72% of physical therapists complained MSDs in at least one part of the nine determined body parts during the last 12 months. The most common disorders were lower back pain (75%), neck (65%) and shoulder pain (58%). Standing for long periods were very strongly correlated with lower back pain and strongly correlated with lower limbs with r = 0.84 and 0.79 respectively. Results of OWAS classified 8 postures (59%) in category 1 with 77 frequencies, 7 postures (35%) categorized 2 with 46 frequencies and one posture (5%) categorized 3 with 7 frequencies. **Conclusion**: The dominant prevalence pains were in the lower back, neck and shoulders. OWAS work posture 4222 (category 3) were highly significant with lower back and upper limbs MSDs, it was partially correlated with neck MSDs. Meanwhile, work posture 2222 and 2221 (category 2) were significantly correlated with lower back, upper limbs and neck MSDs.

Key words: OWAS, Musculoskeletal Disorders and Nordic Questionnaire.

INTRODUCTION

Physiotherapists sometimes need to utilize the manual treatment and some awkward postures during their daily duties. [1] stated that Physiotherapists musculoskeletal disorders mainly caused by work practices and manual handling. The assessment of MSD involves recognizing working environment dangers. Assessment starts with an exchange of the individual's employment and requires a full description of the considerable tasks associated with the patient workday such as the duration and repetitively of each daily task [2]. [3] stated that the NMQ can be used for the screening of musculoskeletal problems. NMQ was used effectively for work related disorders among physical therapists in many previous studies (4); [5]; [6]; [7]; [8]; [9]; [10] and [11]. The Ovako Working Posture Assessment System (OWAS) was formulated in the OVAKOOY Company,

which is one of the biggest European steel bars and profiles producers in Finland [12]. They formulated that system to evaluate the work load in the reform operation of molding steel ovens. The OWAS method was intended to identify the frequency and time spent in the postures adopted in a given task, to study and evaluate the situation, and thus, recommends corrective actions [13]. The OWAS often used to identify the most significant habitual back postures in workers (four postures), three postures in arms, seven postures in legs and weight of the load handgrip four categories. All this implies up to 252 possible combinations. Therefore, each posture assumed by a worker was assigned a 4-digit code that depended on the classification within the previous postures for each part of the body and the load [12]. The procedures to apply the OWAS formed of doing survey of the work tasks, codifying the postures, assigning risk categories and assume the best actions. There are various programs of computer software which have able to apply this method, permit of time saving of work, and which have been already used in more studies [14]. One of the advantages of using OWAS method, it is a simple and useful method, can be used by personnel of different spheres, such as health, engineering, industry, etc., without specialized training [13] and is well documented [12]. Many authors used the OWAS model for studying nurses, nurse's aids and surgeons, who belong to general surgery and the ear-nose-and-throat specialty. Those authors remarked that surgeons and nurses assume harmful postures [15]. [16] also studied the postures adopted by nurses administering narcotic, concluding that the musculoskeletal problems were determined by the organization of the tasks. One year later, [17] found similar results for nurses in surgery, leading to the same statement. Other authors [18] applied two similar methods OWAS and the RULA method to predict the postures required by the new surgical table for spinal column, knees and hips. On the other hand, [19] analyzed the tasks of nurses and surgeons through a number of verification methods including the OWAS, enabling discriminate between various methodologies. In health field the OWAS method has most widely been used as follow [20] applied it to nurses related to orthopaedics surgeries; found that the most repeated postures daily during the work day were dangerous. Furthermore, [21] used the OWAS to confirm the reliability of the observations depend on the OWAS method; utilizing a series of common postures observed in nursing. In this same year, [22] utilized OWAS combined with computer software to minimize the time consumed in the analysis of the results. Moreover, by using the OWAS method [23] and [24] evaluated the postures adopted by nurses before and after receiving training courses. These authors found that the use of mechanical devices decreased the number of harmfully postures assumed during the work day. Finally, the OWAS method has also been applied to evaluate the postures of nurses working by [25] without the use of mechanical equipment to aid in the tasks, and compared these postures to those common when using mechanical devices or machines. There is lake of studies observed the relationship between the MSDs and postures assumed by physical therapists. So, analysis of physical therapists' postures and correlation of the postures to MSDs in physical therapists can help physical therapists field in adapted process economically. Therefore, the main goal of the current work is to analyze the work-related disorders among physical therapists in Cairo general hospitals using OWAS method.

MATERIALS AND METHODS

The study was conducted in Cairo general hospitals, Egypt, 130 physical therapists participated in the study from October to December 2018, to examine the

correlation between musculoskeletal disorders and work postures in physical therapists. The study design was cross section study. Number of physical therapists was determined through power analysis according to [26]. A survey was conducted using Nordic Musculoskeletal Questionnaire (NMQ) checklist printed [27] and [9] to be filled out by the physical therapists during the physical therapy sections and statistical software was installed for later on statistical analyses during the study. Nordic Musculoskeletal Questionnaire (NMQ) is an evaluation questions for detecting and analyzing musculoskeletal disorders of different persons in different countries using indirect methods demands the standardization of the evaluation questions. NMQ was developed by [28] based on a previous medical questionnaire organized by [29]. The physiotherapist participant received NMQ and they were full informed by the whole following procedures. The gathered data included personal information such as their ages, gender, years of employment and the number of shifts per weeks. The NMQ and an increasingly nitty gritty body-part-explicit survey with more specific body zones details was used. Other collected data was observed and NMQ checklist as follow age (years), gender (M) or (F), weight (Kg), height (cm), and work duration per (day). The BMI is a simple index calculated from a person's weight and height. It was calculated using the following formula: weight (kg) / [height (m)]^2. OWAS is one of the analyzing techniques and one of the most significant techniques to confirm safety level and risk level which identified with work posture. It was used to evaluate the work postures in physical therapists; also analyzing repeated postures work and ordering them into deferent categorize using OWAS. The OWAS method is based on ratings of working postures and loads 4 postures for the back, 3 for the arms, and 7 for the lower limbs, and 3 levels for the weight of load handled or amount of force used. Values from the 4 factors are combined to assess 4 categories of risk and recommended actions according to [30] as follow:

Category 1 normal postures, which do not need any special attention;

Category 2 postures must be considered during the next regular check of working methods;

Category 3 postures need consideration in the near future;

Category 4 postures need immediate consideration.

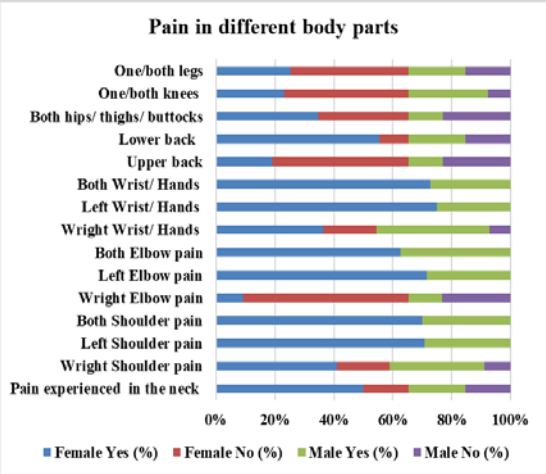
Data was processed by using the computer package of Statistical Package for Social Science version 19 (SPSS) [31] and Excel. Power analysis was used to determine number of physical therapists according to [26]. Descriptive statistics, percentage and frequencies summarized the demographic data of the physical therapists namely gender, age, education level, professional working experience and area specialty. Pearson correlation (r) was used to study the correlation between MSDs and work related postures in physiotherapists in general hospitals of Cairo. Additionally, Pearson's Chi-squared test was used to distinguish the significant differences in the physical therapists' prevalence of MSDs, also to distinguish differences in the demographic data of the physical therapists among subgroups. Pearson's Chi-squared test was given according to [32] and [33]. Significant level was at $p = 0.05$. Additionally, an official endorsement was collected from a considerable number of the participant physiotherapists for the administrative and ethical considerations.

RESULTS:

The prevalence of MSDs in physical therapists:

Pain through the participant whole bodies during the last 12 months showed that 72% of physical therapists reported MSDs in at least one part of the nine determined body parts during the last 12 months. The most common symptoms were in the lower back (75%) followed by neck pain (65%) represented the dominant prevalence pain, and then shoulder pains (58%), wrist/hands (40%) then one/both knees (35%), followed by upper back pain (16%), elbow pain (14%) also one/both legs (6%) and both hips/buttocks were the lowest one with 6% and 5% respectively. The dominant prevalence pain was in the lower back, neck, and shoulder and wrist/hands pain, as shown in Figure (1).

Figure 1: Prevalence pain in different body regions in last 12 months



Results of OWAS analysis

Musculoskeletal disorders survey conducted through NMQ questionnaire showed that the majority of the participant physical therapist had pains on most of their duties. Figure (2) illustrate the physical risk factors correlated to the physical therapy conditions for physiotherapists working at Cairo general hospitals, Egypt. The results showed that 12% of the physical therapists always stand for long periods, 27% often stand for long periods, 53% sometimes stand for long periods and only 8% who never stand for long times.

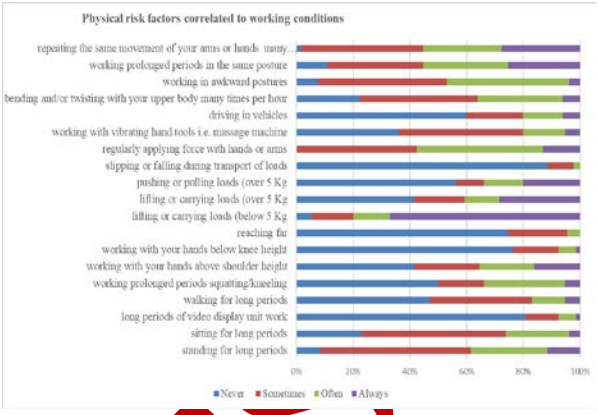


Figure 2: Physical risk factors correlated to the physical therapy working conditions for physiotherapists at Cairo general hospitals.

The physical therapists who always sit for long times were 4%, 22% often sit for long times, 51% sometimes sit for long times and around 23% who never sit for long times. The results also showed that, about 66% of all participants assumed that they never or sometimes working for long times kneeling, 28% of all participants stated that they often working for long times kneeling and 5% only always work kneeling for long time. Furthermore, about 65% of the participants confirmed that they never or sometimes working with their hands above shoulder height and about 35% confirmed that they often or always working with their hands above shoulder height, figure (2).

Results showed that 76% of the physical therapists never worked with their hands below knee height, 16% sometimes worked with their hands below knee height and 8% confirmed that they often or always, worked with their hands below knee height. Moreover, about 96% of all participants confirmed that they never or sometimes reaching far stuffs during their

duties and 4% only always or often reaching far stuffs during their duties; figure (2). Regarding to carrying loads, the results showed that 40% of the participants agreed that they always or often lifting or carrying loads over 5 Kg and about 60% of the participants never or sometimes lifting or carrying loads over 5 Kg. The statistical results also showed that 34% of the participants stated that they always or often pushing or pulling loads over 5 Kg and about 66% of the participants never or sometimes done that. About 57% participants were always or often regularly applying force with hands or arms and only 42% who assumed that they sometimes regularly applying force with hands or arms. Concerning to working with vibrating hand tools such as massage machine, about 20% participants always or often worked with vibrating hand tools and the majority of them with 80 % assumed that they sometimes or never worked with vibrating hand tools.

Correlation of MSDs with the physiotherapists postures

Table (1) illustrate the correlation between MSDs and working conditions of physiotherapists at Cairo general hospitals. The results of Pearson correlation (r) showed that lower back pain had very strong correlation with standing for long periods, pushing or pulling loads (over 5 Kg), regularly applying force with hands or arms, bending and/or twisting with upper body many times per hour and repeating the same movement of arms or hands many times per minute with r = 0.84, 0.88, 0.87, 0.88 and 0.82 respectively. Furthermore, lower back pain had strong correlation with sitting for long periods and working in awkward postures with r = 0.79 and 0.72 respectively.

Table 1: Correlation between MSDs and working conditions of physiotherapists at Cairo general hospitals**.**

Working conditions	Pearson correlation (r)			
	Neck	Upper limbs	Lower limbs	Lower back
standing for long periods	0.12	0.49	0.79	0.84
sitting for long periods	0.19	0.48	0.51	0.79
long periods of Video Display Unit work	0.49	0.49	0.46	0.56
walking for long periods	0.22	0.27	0.38	0.19
working long periods squatting/kneeling	0.24	0.29	0.83	0.32
working with hands above shoulder height	0.49	0.33	0.42	0.56
working with hands below knee height	0.51	0.37	0.4	0.39
reaching far	0.27	0.31	0.34	0.27
lifting or carrying loads (below 5 Kg)	0.29	0.39	0.4	0.32
lifting or carrying loads (over 5 Kg)	0.27	0.34	0.42	0.46
pushing or pulling loads (over 5 Kg)	0.51	0.1	0.38	0.88
slipping or falling during transport of loads	0.31	0.4	0.37	0.18
regularly applying force with hands or arms	0.34	0.81	0.48	0.87
working with vibrating hand tools	0.36	0.79	0.51	0.51
driving in vehicles	0.39	0.42	0.39	0.45
bending and/or twisting with upper body many times per hour	0.84	0.26	0.38	0.88
working in awkward postures	0.79	0.59	0.41	0.72
working prolonged periods in the same posture	0.59	0.51	0.37	0.25
repeating the same movement of arms or hands many times/min.	0.37	0.13	0.41	0.82

Neck disorders were very strongly correlated with bending and/or twisting with upper body many times per hour (r=0.84) and were strongly correlated with working in awkward postures (r=0.79). Additionally, the upper limbs disorders were very strongly correlated with regularly applying force with hands or arms (r=0.81) and strongly correlated with working with vibrating hand tools (r=0.79), table (1). Furthermore, the lower limbs disorders were very strongly correlated with working long periods squatting/kneeling (P=0.83) and were

strongly correlated standing for long periods (r=0.79).

Table (2) illustrate the results of Pearsons's Chi-Square test between MSDs and working conditions of physiotherapists at Cairo general hospitals. The results showed that lower back disorders were significantly correlated with regularly applying force with hands or arms (P=0.02), repeating the same movement of arms or hands many times per minute (P=0.02), pushing or pulling loads over 5 Kg (P=0.03), bending and/or twisting with upper body many times per hour (P=0.03), standing for long periods (P=0.04) and sitting for long periods (P=0.05).

The results also indicated that neck disorders were significantly correlated with bending and/or twisting with upper body many times per hour (P=0.04) and working in awkward postures (P=0.05). On the other hands, the upper limbs disorders were significantly correlated with lifting or carrying loads over 5 Kg (P=0.02), working with hands above shoulder height (P=0.04), regularly applying force with hands or arms (P=0.04) and working with vibrating hand tools (P=0.05). Furthermore, the lower limbs disorders were significantly correlated with working long periods squatting/kneeling (P=0.04) and standing for long periods (P=0.05).

Results of OWAS categories

Musculoskeletal disorders survey conducted with NMQ questionnaire showed that the majority of the participant physical therapist had pains on most of their duties. OWAS calculation showed that there are 8 postures (59%) categorized 1 with 77 frequencies. Moreover, 7 postures (35%) categorized 2 with 46 frequencies and one posture (5%) categorized 3 with 7 frequencies which showed high risk of MSD as shown in table (3).

Table 2: Results of Pearsons's Chi-Square test between MSDs and working conditions of physiotherapists at Cairo general hospitals

Working conditions	p-value			
	Neck	Upper limbs	Lower limbs	Lower back
standing for long periods	0.94	0.19	0.05	0.04
sitting for long periods	0.86	0.17	0.24	0.05
long periods of Video Display Unit work	0.11	0.11	0.28	0.08
walking for long periods	0.73	0.41	0.46	0.19
working long periods squatting/kneeling	0.67	0.59	0.04	0.77
working with hands above shoulder height	0.11	0.04	0.24	0.08
working with hands below knee height	0.09	0.67	0.14	0.27
reaching far	0.62	0.52	0.46	0.34
lifting or carrying loads (below 5 Kg)	0.58	0.61	0.67	0.59
lifting or carrying loads (over 5 Kg)	0.42	0.02	0.29	0.64
pushing or pulling loads (over 5 Kg)	0.09	0.1	0.31	0.03
slipping or falling during transport of loads	0.23	0.14	0.22	0.18
regularly applying force with hands or arms	0.64	0.04	0.79	0.02
working with vibrating hand tools	0.66	0.05	0.09	0.09
driving in vehicles	0.24	0.62	0.59	0.42
bending and/or twisting with upper body many times per hour	0.04	0.32	0.54	0.03
working in awkward postures	0.05	0.07	0.13	0.06
working prolonged periods in the same posture	0.07	0.09	0.49	0.46
repeating the same movement of arms or hands many times/min.	0.56	0.87	0.34	0.02

Table 3: Results of OWAS categories

Category 1					
Posture*	Frequency	(%)	Posture*	Frequency	(%)
1121	23	18	1111	14	11
1222	10	8	3221	10	8
1311	8	6	1112	5	4
1113	5	4	1231	2	2
Category 2					
Posture*	Frequency	(%)	Posture*	Frequency	(%)
2221	12	9	4321	10	8
4111	8	6	1241	7	5
2111	4	3	2222	3	2
1243	2	2			
Category 3					
Posture*	Frequency	(%)	Posture	Frequency	(%)
4222	7	5			

Table key			
(1) Back	(2) Arms	(3) Legs	(4) Load
1 Straight	**1** Both below shoulder	**1** Sitting	**1** < 10 kg
2 Bent	**2** One above shoulder	**2** Standing on two legs	**2** < 20 kg
3 Twisted	**3** Both above shoulder	**3** Standing on one leg	**3** > 20 kg
4 Bent and Twisted		**4** Standing on two bent knees	

*each posture describes body parts with a four digit-code namely (1) Back (2) Arms (3) Legs and (4) Load; e.g. (1121) posture was straight back, arms both below shoulder standing on two legs and load < 10 kg

Observation results of physical therapist working in Cairo general hospitals shown on Figure (3). Recommendations for actions analyses showed that physical therapist' back bent and twisted conditions is on category 2, which need to be enhanced in the near future. Additionally, the arms analyses showed one above shoulder in category 2, therefore it need to be improved. Moreover, work postures of standing on two bent knees is on category 2 which need to be improved.

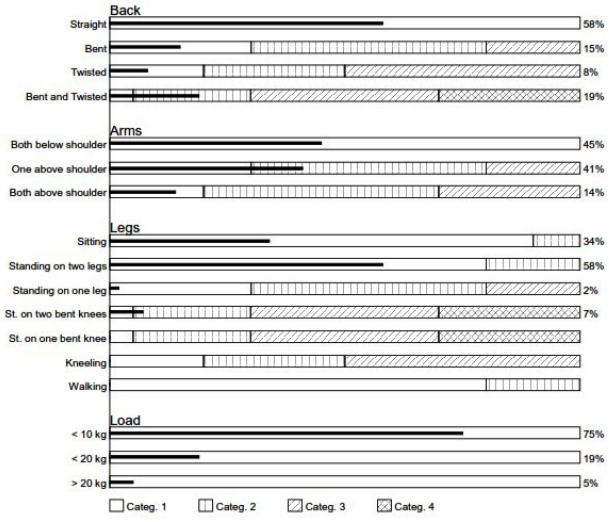


Figure 3: WinOWAS observation.

Correlation of MSDs with work postures OWAS categories

The obtained results from OWAS method and the results of prevalence pain of MSD on physical therapists were used for Pearson chi square test. Table (4) showed the significance of MSDs and work postures assumed by physiotherapists at Cairo general hospitals. The results of Pearson chi square test demonstrated that there was significant correlation between the lower back disorders and one posture classified as OWAS category 3 known as (4222) with p-value = 0.01, the same posture were also correlated significantly with the neck disorders (P=0.05) and upper limbs disorders (P=0.03).

Table (4) correlation of MSDs and work postures assumed by physiotherapists at Cairo general hospitals

Postures	Category	p-value			
		Neck	Upper limb	Lower limb	Lower back
1121	1	0.78	0.46	0.16	0.65
1222	1	0.82	0.51	0.18	0.35
1311	1	0.29	0.82	0.81	0.79
1113	1	0.06	0.26	0.77	0.27
1111	1	0.75	0.49	0.98	0.82
3221	1	0.42	0.82	0.16	0.05
1112	1	0.48	0.24	0.87	0.72
1231	1	0.46	0.59	0.13	0.67
2221	2	0.07	0.04	0.06	0.03
4111	2	0.85	0.04	0.49	0.04
2111	2	0.59	0.06	0.75	0.05
1243	2	0.09	0.08	0.09	0.45
4321	2	0.35	0.05	0.11	0.04
1241	2	0.62	0.09	0.08	0.86
2222	2	0.04	0.05	0.09	0.03
4222	3	0.05	0.03	0.07	0.01

Lower back disorders were also correlated significantly with five postures classified as OWAS category 2 namely 2221 (P=0.03), 2222 (P=0.03), 4111 (P=0.04), 4321 (P=0.04) and 2111 (P=0.05). Additionally, it was partially correlated with P-value = 0.05. Neck disorders were also significantly correlated with posture 2222, category 2 (P=0.04) and partially correlated with posture 4222, category 3 (P=0.05). Upper limbs

disorders were highly correlated with posture 4222, category 3 (P=0.03). Upper limbs MSDs also were significantly correlated with postures classified as category 2 known as posture 2221 (P=0.04) and posture 4111 (P=0.04). Also it partially correlated with posture 4321 (P=0.05) and posture 2222 (P=0.05).

DISCUSSION:

The current work reflected that around 95.6% of the participated physiotherapists completed the questionnaire where they spent about 15 to 20 min. to complete the questionnaire. The obtained results declared that neck pain is a common vocational problem among physical therapists with high rate about 65% and has been previously reported at rates between 63.2% in Egypt [5], 46.5% in Malaysia [8], 41.7% in Egypt [6], 31.1% in Nigeria [10] and 21% in Kuwait [9]. The results of this study disagreed with that of [4], [7] and [9] who showed low prevalence of shoulders pain among physical therapists under investigation with low rates about 19.5%, 15.3% and 13% respectively. The results of posture analyses using OWAS method showed that 59% body postures were classified as Category 1, 35% body postures were classified as Category 2 and 5% body postures were classified as Category 3. The results also indicated that the upper limbs pain was highly correlated with lifting or carrying loads over 5 Kg while, the lower limbs was significantly correlated with working long periods squatting/kneeling and standing for long periods, this results agreed with previous results observed by [6] and [10], who declared that performing a similar task repeatedly and lifting or transferring patients have been noted to be associated with the prevalence of low back pains. Regarding to the significance of MSDs with work postures OWAS categories, there was high significant correlation between the lower back and upper limbs MSDs with posture 4222 (category 3), additionally it was partially correlated with neck MSDs among physical therapists. Meanwhile, posture 2222 and posture 2221 (category 2) were significantly correlated with lower back, upper limbs and neck MSDs. Although there was lake of applied studies of MSD among physical therapists using OWAS analysis, OWAS posture analysis in other similar medical branches performed by [19]; [20] and [25] showed that using suitable mechanical machines decrease the awkward postures to those common manual medical methods. Regarding to our results, sustainable ergonomic training and educational programs appear to be necessary especially for junior physical therapists.

CONCLUSION:

The dominant prevalence pain was in the lower back, neck, shoulder and wrist/hands pain. OWAS work posture 4222 (category 3) were highly significant with lower back and upper limbs MSDs, it was partially correlated with neck MSDs. Meanwhile, work posture 2222 and work posture 2221 (category 2) were significantly correlated with lower back, upper limbs and neck MSDs. Three recommendations for actions are suggested namely to reduce work posture classified in category 3 of standing on two legs with bent twisted back and one arm above shoulder, work posture of standing on two bent knees classified in category 2 that need to be improved and to assure that the weight capacity does not frequently exceed over 15-20 kg.

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