Egyptian Journal of Community Medicine

Factors Affecting Musculoskeletal Disorders among Primary School Teachers in Ismailia, Egypt

Hebatalla Mohamed Aly*, MD   Ayman Ekram Fahim, MD

Department of public health, community, occupational and environmental medicine, Faculty of medicine, Suez Canal University.

A B S T R A C T

Background: Musculoskeletal disorders (MSDs) include a wide variety of inflammatory and degenerative disorders that affect muscles, joints, tendons, and other parts of the musculoskeletal system. Prolonged exposure to unfavorable working conditions and postures during teaching becomes a risk factor for MSD that makes them prevalent health issue affecting 40 – 95% of teachers. **Objective:** To determine the frequency of MSDs and their associated risk factors among teachers in primary schools in Ismailia city, Egypt. **Methods:** A cross-sectional study design was used. The sample included 237 primary school teachers who have been working for at least 2 years. The questionnaire included questions about socio-demographic data, work-related data, and standardized Nordic musculoskeletal questionnaire (NMQ). **Results:** 237 primary school teachers with a mean age of 34.6 ± 5.5, females represent 53% of the sample, and 71% were married. Prevalence of any MSDs in the last 12 months was 87.3%, the most affected regions were the lower back, neck, and shoulders. Risk factors for MSDs were age > 35 years, bending for a long time, turning around frequently and lacking enough rest time between sessions was a protective factor. **Conclusions:** Teachers are at increased risk of MSDs due to their professional requirements that involve prolonged static postures and awkward postures such as bending, twisting, and head-down postures. The most affected region was the lower back. Ergonomic programs should focus on teachers including their training about the ideal use of muscles and the prevention of prolonged awkward postures.

INTRODUCTION

Teachers' work involves not only teaching students, but also preparing for classes, evaluating the work of students, and participating in various school activities and programs. This can result in teachers suffering from adverse mental and physical health problems due to the multitude of job tasks.[1-2] While schools are deemed to be optimal places for teachers to work, the review of the literature indicates that teachers are in danger of developing musculoskeletal disorders. It is also suggested that musculoskeletal disorders among primary school teachers are most probably an under-researched topic. Teachers suffer from musculoskeletal disorder (MSD) and morbidity patterns.[3] Prolonged exposure to unfavorable working conditions and awkward postures during teaching becomes a risk factor for health problems. [2] MSD can be treated in an initial episode of 2–4 weeks.[3-6]

Teachers who are living with long-term musculoskeletal complaints can suffer from different physical, mental, and social effects that adversely affect their teaching employment.[7] MSD is one of the most prevalent and significant occupational health issues in the teaching profession which although has

Corresponding Author: Hebatalla Mohamed Aly, Associate professor of occupational and environmental medicine, Public health, community, occupational and environmental medicine Department, Faculty of Medicine, Suez Canal University, Egypt. Email: dr.hebatalla@gmail.com

been neglected for a long time, in recent years, has attracted a growing concern.[8]

MSD includes a wide variety of inflammatory and degenerative circumstances that affect muscles, joints, tendons, ligaments, nerves, bones, and the localized blood circulation system that may be caused or worsened by work tasks and the impacts of the immediate environment in which work is carried out. School teachers have been shown to report high MSD levels of between 40% and 95% compared to other occupational groups.[7–9] MSD is a major global health problem. The International Labor Organization stated that in the working population, MSD has resulted in increased health problems. MSD is triggered by physical factors including repetitive movements, stressful situations, and unpleasant and static posture.

In addition to relevant literature on musculoskeletal disorders, a few studies have been carried out among teachers in Egypt. The incidence of risk factors, which are specifically associated with musculoskeletal disorders among teachers, and high prevalence in similar groups, make it necessary to conduct research to profile the musculoskeletal morbidity and associated risk factors among teachers in primary schools. This study was conducted to assess the proportion of MSDs and their associated risk factors among teachers in primary schools in Ismailia city, Egypt.

METHODS

This cross-sectional study was performed to identify the prevalence of musculoskeletal disorders (MSDs) and associated risk factors among teachers in Ismailia primary schools. Inclusion criterion included teachers who have been working for at least 2 years. Exclusion criteria included previous history of MSD before employment as a teacher, history of trauma or orthopedic surgery or accidents affecting musculoskeletal system.

The sample size was calculated by using single-population proportion formula with the prevalence of musculoskeletal disorders among teachers in at least one region of the body in the 12 months 67%. [8] With a 6% margin of error (E) and 95% confidence interval (CI). By inserting in the formula n = ((Z$\alpha_{/2}$)^2 p (1-p) ÷ E^2, n = ((1.96)2 *0.67 (1−0.67)) ÷ (0.06)^2 = 236. The 3rd district in Ismailia includes 37 primary schools. The selection of teachers was done by random sampling

method as follows: we got a list of fulltime employment teachers who has been employed for more than 2 years from each school to have a sampling frame of primary schools' teachers in the 3rd district of Ismailia. Then we selected 7 teachers from each school to get a total of 259 teachers. We then excluded 22 questionnaires for teachers who had any of the exclusion criteria. So, we had a total of 237 participants.

Data collection: An interview questionnaire was distributed to all 237 participants. The questionnaire is composed of 3 sections to collect information regarding socio-demographic, work-related characteristics, and general problems of the musculoskeletal system. Section A included socio-demographic characteristics were used to gather some general participants' information such as age, height, weight, and household income. Section B included work-related characteristics, which included the duration of working experience (years), average working hours (day), physical activities involved, and duration of standing and sitting work posture (hours). Section C included standardized Nordic Musculoskeletal Questionnaire (NMQ) and assessed general musculoskeletal system health problems at different positions in the body over the last 12 months and seven days. The NMQ consists of a human body diagram showing different body parts.

Data analysis: The Statistical Package for Social Sciences (SPSS) version 27 was used for analysis. Descriptive analyses such as frequency distribution, mean, and cross-tabulation were conducted. The association between outcome variables (WRMSDs) and independent variables was explored by binary logistic regression analysis and the crude odds ratio (COR) was computed at a 95% C.I. Finally, to determine the independent factors associated with WRMSDs, a multivariate logistic regression analysis was done.

RESULTS

Two hundred and thirty-seven primary schools' teachers were enrolled in the study to assess factors affecting musculoskeletal disorders among them. Teachers' ages range from 25 to 45 years with mean age 34.6 ± 5.5, females represent 52.7% of participants, and 70.5% were married. About 80% of

Table 1: Occupational history among studied teachers (n = 237).

Occupational history	Frequency	Percent
Years of working as a teacher		
< 5	52	21.9
5 – 15	154	65.0
> 15	31	13.0
Average working hours per week		
≤ 40	57	24.1
> 40 – 80	154	65.8
> 80	24	10.1
Number of classes per week		
< 5	6	2.5
5 – 15	98	41.1
16 – 24	63	26.6
> 24	70	29.5
Average time spent per class (in hours)		
< 1	11	4.6
1 – 3	181	76.4
> 3	45	19.0
Number of extra private classes		
None	69	27.0
1 – 4	72	30.4
≥ 5	101	42.6
Enough rest between classes		
No	168	70.9
Yes	69	29.1

participants were non-smokers and 18.6% were diagnosed with chronic diseases before the study.

About 66.7% of participants did not exercise regularly, 23.6% exercised to some extent, and only 9.7% exercised regularly. Regarding participants' perception of general health, 57.8% thought their health status is fine, 37.6% thought their health status is good and 4.6% thought their health status is bad.

Occupational history among study participants is shown in Table 1. Most of study participants (80 %) have been working for more than 5 years and 81.7 % of them work more than 40 hours per week. More than 76 % stated that the average time per class ranges from 1 to 3 hours and about 19 % give classes with an average duration of more than 3 hours. About 71% did not have enough rest between classes.

Participants were asked whether classrooms were furnished/ organized/ well equipped ergonomically or not. More than 58 % stated that their classrooms are organized to some extent, 13.5% stated they are well equipped and furnished ergonomically, 24.5% think they are not organized or equipped ergonomically, and 3.8% do not know.

Participants were asked about positive symptoms of pain or limitation of movement or discomfort in the skeletal system regions listed at any time in the past 7 days and in the last 12 months which lasted for at least 24 hours and can't get relieved after rest. About 73% had experienced MSS in different regions in the last 12 months while 27% did not experience MSS in the last 12 months. As shown in table 2 the most affected region was the lower back affecting more than 56.5% and 57% in last 7 day and last 12 months respectively followed by neck affecting (38% and 29%) of participants. More than half of participants have more than one affected region. Participants were also asked about whether they have visited a physician or took medications/ physiotherapy or sick leave for musculoskeletal condition that was related to work during the past 12 months and 40.5% answered yes.

It is noted that 87.3% of participants had experienced either MSS or physician visits, medications or sick leaves related to the musculoskeletal system, or physiotherapy during the last 12 months, and only 12.7% had not experienced any of the above-mentioned complaints figure I supplementary materials).

Participants were asked to describe their trunk posture, back support, and head to down posture during work (table 3). About 78.5% stated having standing posture most of the time followed by turning round frequently (33%) of participants. More than half of participants (53%) did not have back support during work and 54% had daily head down posture for almost an hour.

Associations between different risk factors and musculoskeletal symptoms in the last 12 months were assessed and significant ones are presented in (table I in supplementary materials). The highest odds ratio for having musculoskeletal symptoms was for bending for a long time (3.78) followed by turning around frequently (2.36). Having enough rest between classes was a protective factor (OR= 0.39). Factors were entered into a binary logistic regression model (table 4). Keep bending for long time was the most significant factor for MSS in the last 12 months with

Table 2: frequency of affected musculoskeletal regions among studied teacher (n = 237).

Regions affected	Frequency	Percentage
MSS in the last 7 days:		
None	54	22.8
Neck	90	38.0
Shoulders	80	33.8
Elbows	3	1.3
Wrist/ hands	39	16.5
Lower back	134	56.5
Knees	65	27.4
Number of affected regions		
0	54	22.8
1	51	21.5
2	57	24.1
3	58	24.5
4	14	5.9
5	2	0.8
6	1	0.4
MSS in the last 12 months		
None	64	27.0
Neck	69	29.1
Shoulders	64	27.0
Elbows	3	1.3
Wrist/ hands	32	13.5
Lower back	136	57.0
Knees	53	22.4
Number of affected regions		
0	64	27.0
1	75	31.6
2	37	15.6
3	38	16.0
4	21	8.9
5	2	0.8
Physician visit/ medications/ physiotherapy/ sick leave for MSS in past 12 months		
No	141	59.6
Yes	96	40.5

MSS: musculoskeletal symptoms.

(OR = 3.38; *p*= 0.017) followed by not having enough rest between classes was a significant risk factor (OR = 2.07, *p*= 0.025). Increasing age > 35 years was also

Table 3: trunk posture, back support and head to down posture during work among studied teachers (n = 237).

Trunk Posture	Frequency	Percent
Standing posture	186	78.5
Sitting posture	64	27.0
Keep bending for long time	47	19.8
Turning round frequently	78	32.9
Bend and turn at the same time frequently	45	19.0
Heavy lifting of instruments ≥ 2 kg	8	3.4
Keeping the same posture for long time	52	21.9
Number of awkward trunk postures during work		
1	86	36.3
2	81	34.2
3	51	21.5
4	16	6.8
5	3	1.3
Back support		
No	80	47.3
Yes	89	52.7
Daily head down posture almost an hour		
No	77	45.6
Yes	92	54.4

significant risk factor (OR =1.93; *p*=0.048)). Other significant association with MSS.

The associations between awkward and static prolonged postures and MSS in different regions are shown in (table II supplementary materials). Neck symptoms were associated with most studied postures where the odds of having neck symptoms among participants with the following postures standing, keep bending for a long time, and keeping the same position for long time was more than 2 times compared to those without these postures. Sitting posture was protective against neck symptoms. The odds ratio for shoulder symptoms was 3 times among those who bend for long time compared to others. Lower back and knees symptoms were significantly associated with turning round frequently.

Table 4: Binary logistic regression model for the best predictor of MSS in last 12 months among teachers (covariates in the model were age, having enough rest between classes, keep bending for long time and turn round frequently)

Covariates	β	SE	OR (95% CI)	*p*-value
Age (25 - 35 years is reference category)	0.658	0.333	1.93 (1 – 3.71)	**0.048**[*]
Not having enough rest between classes	0.726	0.324	2.07 (1.09 – 3.89)	**0.025**[*]
Keep bending for a long time	1.216	0.512	3.38 (1.24 – 9.2)	**0.017**[*]
Turn round frequently	0.620	0.363	1.86 (0.91 – 3.79)	0.088
constant	-0.010	0.484	0.99	0.983
Model x^2= 23.805				**< 0.001**[*]

Statistically significant at p < 0.05.

DISCUSSION

Teaching profession is done under unfavorable circumstances under which teachers had to mobilize their physical, cognitive, and affective capacities to achieve the school production objectives.[1] Teachers are more exposed to work related MSDs.[9] MSD includes a wide variety of inflammatory and degenerative circumstances that affect muscles, joints, tendons, ligaments, nerves, bones, and the localized blood circulation system[8] This study was conducted to assess prevalence of musculoskeletal disorders and their association of different occupational risk factors among primary school teachers.

Two hundred and thirty-seven primary school teachers were enrolled in the study with a mean age 34.6 ± 5.5. All participants were asked about history of musculoskeletal complaints (pain or limitation of movement in different skeletal regions in the last 7 days or in the last 12 months to find out the week and year prevalence of MSS which were found to be 77% and 73% respectively.

This was consistent with the findings of a review by Abudul Rahim and his colleagues published in (2022) which stated that prevalence of MSDs among teachers ranges from 48.7% to 73.7% and in their review they also pointed out that Egypt was the country that recorded the highest MSD among regular teachers (76%). [10] Another 2 studies also reported high prevalence of MSS among teachers the 1st was conducted by Fahmy et al. in Cairo, Egypt and reported a prevalence of 67% among 1ry school teachers[8]. The 2nd study was conducted by Althomali and his colleagues in Hail KSA who reported an overall prevalence of MSS of 87%[9]. Cellablos and Santos (2015) found prevalence of MSD in Brazil 73.5%.[11]

On the other hand, our reported prevalence was higher than the results found by Alias et al. (2020) who found the overall prevalence of MSS among 1ry school teacher Malysia 40%, but this may be attributed to lower daily working hours worked by their participants where about 87% work from 1 – 4 hours per day and only 13% work from 5 – 8 hours per day, [2] while in our study 76% work more than 40 hours per week which is more than 8 hours daily . Another study by Souza et al. (2020) found very much lower prevalence of MSD among teachers in Brazil 24.3% with lower back the most affected 16.1%. But in Souza study, their low prevalence was attributed to their strict case definition (A case was considered when a teacher reported pain with a minimum duration of one week or with a minimum frequency of once a week, pain should not result from acute and was accompanied by severity level ≥ 3, demand for medical assistance, absence from work, and working changes caused by health limitations).[12] While in our study, we reported any MSS in last 12 months either pain, discomfort or limitation of movements which lasted for at least 24 hours and can't get relieved after rest. This makes our case definition broader and recruits any MSS, so gives higher prevalence.

Regarding the affected regions, lower back was the most affected region (57%) followed by neck region (38%) while wrist and hands were the least affected. This may be attributed to the requirements of the teaching profession from prolonged static postures as standing or sitting and frequent bending and twisting of the trunk and neck bending, all increase the load on the musculoskeletal system especially lower back and neck region. A study conducted by Kraemer and his coworkers in 2020 reported that 100% of teachers reported pain in musculoskeletal system in the last 12

months with the highest affection in the lower back 60% followed by neck 56%[13] and this was in agreement with our findings. Atikah and Sulieman in (2019) conducted their study among teachers in Kelantan, Malysia and concluded that lower back was the most affected region followed by neck region.[14] An Egyptian study conducted in (2017) in preparatory schools found prevalence of MSDs in the last 12 months 96% with neck and back most affected 83.5%.[15]

Participants were asked about the description of their trunk posture, back support, and head to down posture during work. About 79% stated prolonged standing posture, 33% stated turning around frequently (twisting) and 20% kept bending for long time. Fifty-three percent of participants had more than one awkward posture during work. This was consistent with a study conducted by Fahmy et al (2022) among schoolteachers in Cairo, Egypt and found that 70% of their participants stated bent posture for long time, 67% had prolonged standing and 34% twisting.[8]

About 47% did not have back support during work and 54% admitted daily head down for at least one hour. Ndonye study in Kenya (2019) found 50% of teachers have no back support and all his participants had head down posture but with different durations up to > 4 hours [16] Fahmy et al. also (2022) found that 90% of schoolteachers had head down posture.

Different risk factors for MSDs were studied; significant risk factors in bivariate testing were entered in a binary logistic regression model to show the significant predictors of MSDs among teachers.

Age was significant risk factor in the model where > 35 years old participants had 1.9 greater risk compared to younger participants (25 – 35 years). The most probable cause for the increased frequency of MSD among older teachers is that as people age, their muscle mass declines, they lose connective tissue flexibility, and the cartilage between their joints thins.[17]

Lacking enough rest between sessions was a risk factor (OR=2.07; p= 0.025). This agreed with Atikah and Sulieman (2019) who concluded that teachers who did not have nap during work time are at increased risk of work-related MSDs.[14]

Bending for a long time was the most associated predictor in the model (OR=3.4, p=0.017). This explains the high prevalence of lower back affection among our participants. Fahmy et al., also found significant association between bending for a long time MSDs among teachers.[8]

In conclusion Teachers are at increased risk of MSDs due to their professions requirements that involves prolonged static postures and awkward postures as bending, twisting and head down postures. The most prevalent MSDs among teachers were lower back, neck and shoulders disorders while least affected were wrists/hands. Ergonomic programs should be addressed to teachers including their training about ideal use of muscle and prevention of awkward postures. Awareness regarding MSDs should be provided to teachers to help early detection and their adequate treatment to prevent disability.

Ethical Approval

REFERENCES:

1. Antonelli BA, De Paula Xavier AA, Oenning P, Baumer MH, Da Silva TFA, Pilatti LA. Prevalence of cervicobrachial discomforts in elementary school teachers. In: Work. Vol 41. ; 2012:5709-5714. doi:10.3233/WOR-2012-0927-5709

2. Alias AN, Karuppiah K, How V, Perumal V. Prevalence of musculoskeletal disorders (MSDS) among primary school female teachers in Terengganu, Malaysia. Int J Ind Ergon [Internet]. 2020;77:102957. Available from: https://doi.org/10.1016/j.ergon.2020.102957

3.

4. Armstrong TJ, Buckle P, Fine JF, et al. A conceptual model for work-related neck and upper-limb musculoskeletal disorders. Scand J Work Environ Health. 1993;19(2):73-84. doi:10.5271/sjweh.1494

5. Chaiklieng S, Suggaravetsiri P. Risk factors for repetitive strain injuries among school teachers in Thailand. In: Work. Vol 41. ; 2012:2510-2515. doi:10.3233/WOR-2012-0491-2510

6. Chiu TTW, Lam PKW. The prevalence of and risk factors for neck pain and upper limb pain among secondary school teachers in Hong Kong. J Occup Rehabil. 2007;17(1):19-32. doi:10.1007/s10926-006-9046-z

7. Chiu TW, Lau KT, Ho CW, Ma MC, Yeung TF, Cheung PM. A study on the prevalence of and risk factors for neck pain in secondary school teachers. Public Health. 2006;120(6):563-565. doi:10.1016/j.puhe.2006.01.007

8. Chong EYL, Chan AHS. Subjective health complaints of teachers from primary and secondary schools in Hong Kong. International Journal of Occupational Safety and Ergonomics. 2010;16(1):23-39. doi:10.1080/10803548.2010.11076825

9. Fahmy VF, Momen MAMT, Mostafa NS, Elawady MY. Prevalence, risk factors and quality of life impact of work-related musculoskeletal disorders among school teachers in Cairo, Egypt. BMC Public Health. 2022 Dec 1;22(1).

10. Althomali OW, Amin J, Alghamdi W, Shaik DH. Prevalence and factors associated with musculoskeletal disorders among secondary schoolteachers in Hail, Saudi Arabia: A cross-sectional survey. Int J Environ Res Public Health. 2021;18(12).

11. Abdul Rahim AA, Jeffree MS, Ag Daud DM, Pang N, Sazali MF. Factors Associated with Musculoskeletal Disorders among Regular and Special Education Teachers: A Narrative Review.

Int J Environ Res Public Health. 2022;19(18). doi:10.3390/ijerph191811704

12. Ceballos AG da de C, Santos GB. Factors associated with musculoskeletal pain among teachers: Sociodemographics aspects, general health and well-being at work. Revista Brasileira de Epidemiologia. 2015;18(3):702-715. doi:10.1590/1980-5497201500030015

13. Souza CS, Cardoso JP, Aguiar AP, MacÊdo MMSR, Da Silva Oliveira J. Work-related musculoskeletal disorders among schoolteachers. Revista Brasileira de Medicina do Trabalho. 2021;19(1). doi:10.47626/1679-4435-2020-545

14. Kraemer K, Moreira MF, Guimarães B. Musculoskeletal pain and ergonomic risks in teachers of a federal institution. Revista Brasileira de Medicina do Trabalho. 2021;18(3):343-351. doi:10.47626/1679-4435-2020-608

15. Atikah Mohamad Adnan N, Suleiman Murad M. Association between Prevalence of Work-Related Musculoskeletal Disorders and Work-Related Ergonomic Factors of Special Education Teachers in Kota Bharu, Kelantan. Vol 312.; 2019.

16. Gendy E, Mm K. WORK RELATED MUSCULOSKELETAL DISORDERS AMONG PREPARATORY SCHOOL TEACHERS IN EGYPT. Vol 41.; 2017.

17. Ndonye N. PREDICTORS OF WORK-RELATED MUSCULOSKELETAL DISORDERS AMONG PRIMARY SCHOOL TEACHERS IN MACHAKOS COUNTY, KENYA.; 2019.

18. Roberts S, Colombier P, Sowman A, et al. Ageing in the musculoskeletal system: Cellular function and dysfunction throughout life. Acta Orthop. 2016;87:15-25. doi:10.1080/17453674.2016.1244750.