Relationship between Musculoskeletal Disorders and Anthropometric Measurements in Security Guards Working in Krishna Hospital, Karad

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ABSTRACT

BACKGROUND

Musculoskeletal disorders (MSDs) are very common amongst security guards. MSD is the main cause for the increase in rate of absenteeism. MSDs are formed gradually in people who have inappropriate position while working. In view of the fact that the security guards continuously stand in a static posture for most of the time, MSDs are progressively formed over time, and this may have considerable impact on their personal and social life. This study was helpful to find out the level of health problems and stress associated with MSDs and techniques to reduce these risk factors among the security guards which are related to work. We wanted to find out the relationship between Musculoskeletal disorders and anthropometric measurements in security guards in this study.

METHODS

It is an observational study with total 90 male participants. Participants belonging to the age group of 25 – 60 yrs. and working for 6 to 12 hours daily were included. Participants with recent history of trauma, fracture, surgical, and local and systemic infections were excluded. A Nordic musculoskeletal questionnaire was used and anthropometric measurements were taken.

RESULTS

The obtained results revealed that out of 90 subjects, 96.6 % had musculoskeletal disorders in various areas while 3.3 % did not complain of any musculoskeletal discomfort in any area. There is positive correlation between body mass index, height, weight, age, and the musculoskeletal disorders.

CONCLUSIONS

Study results concluded that there is relationship between the musculoskeletal disorders and anthropometric measurements in security guards.

KEY WORDS

Musculoskeletal Disorders, Anthropometric Measurements, Correlation, Security Guards, Body Mass Index

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DOI: 10.14260/jemds/2021/421

How to Cite This Article:

Karande AP, Ahire YR, Varadharajulu G, et al. Relationship between musculoskeletal disorders and anthropometric measurements in security guards working in Krishna Hospital, Karad. J Evolution Med Dent Sci 2021;10(28):2056-2060, DOI: 10.14260/jemds/2021/421

*Submission 08-03-2021,
Peer Review 11-05-2021,
Acceptance 18-05-2021,
Published 12-07-2021.*

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BACKGROUND

Need for security guards have increased subsequently in the past few years with increase in crime rates and violence in society. Safety and security are among the most important basic requirements for men. People managed to place scientific, technological advances and living conditions to healthier standards after providing security and safety which are the essential needs of people.¹

Role of security guards is to monitor, guide, maintain, the areas (Colleges, Hospitals, IT companies, Bank, Sport stadium etc.) and also prevent and protect people from crimes and hazards. Security guards are the ones who are having high risk at work because of crime and violence, which affect their well-being. Therefore, the physical fitness of security guards cannot be compromised. So, they should be trained well for ideal exercise programs which will be required in their daily task.²

Security guards spend most of their working hours in standing position and hence they are more prone for work related musculoskeletal disorders due to inappropriate position during working.

Musculoskeletal disorders are degenerative conditions and inflammatory conditions affecting joints, muscles, peripheral nerves, tendons, supporting structures etc. It causes fatigue, future pain and physical disability in the future because it affects multiple joints resulting in increased work restrictions, increased absenteeism and shift to other jobs.^{3,4}

The disorders that are caused because of work related events are referred to as work related musculoskeletal disorders (WMSD) where workers experience discomfort in more than one joint, body parts, pain in joints, experience radiating pain, swelling and tingling.^{4,5}

When workers spend more than 50 per cent of their working time standing, that is, in a prolonged standing position, they are exposed to potential work accidents.

Standing more than 4 hours per day exposes a worker to lumbar pain, while 50 % are caring for healthy people report back leg discomfort, even after two hours of extended rest. Security officers spend almost their entire working time standing. As a result, they are at a greater risk than other professions of standing for an extended period of time.⁶

Factors such as gender, age, height, body mass index, weight and general health status are risk factors that are linked to musculoskeletal disorders among security officers.⁷ The achievement of these risk factors is useful in reducing the amount of work associated musculoskeletal disorders. It will improve the lifestyle of security officers by being physically and mentally healthy, safe, efficient, and also increase the productivity of job.⁷

Standing and seated occupations require persons to remain in a static position for longer periods of time, which can cause lower back discomfort. This has a negative impact on their professional performance and quality of life.

Overweight and obesity have resulted in the increased risk of premature death furthermore in accordance with the increase in comorbidities such as diabetes mellitus, hypertension, hyperlipidemia, atherosclerosis, coronary heart diseases, gout, gall bladder disease, respiratory disease, arthritis and certain varieties of cancer.⁸

Back pain is frequently present in the security guards. High level of physical activities and prolonged standing disturbs the normal posture of spine and more prone to develop pain,

because of this the strength, mobility, and flexibility of spinal musculature is affected. Excess of physical activity is the major cause of back pain. Bad posture, prolonged standing, and prolonged sitting leads to spinal disorders.⁹

Objectives

To study the

1. relationship between musculoskeletal disorders and height
2. relationship between musculoskeletal disorders and weight
3. relationship between musculoskeletal disorders and Body Mass Index in case of security guards.

METHODS

This is a cross-sectional observational study conducted from November 2019 to May 2020 at Krishna institute of medical sciences, Karad. Sample size was 90 and done by simple random sampling. Materials used in the study were consent form, Nordic musculoskeletal questionnaire, measuring tape, weighing machine and calculator.

Sampling Method

$$N = \left[\frac{Z\alpha + Z\beta}{c} \right]^2 + 3$$

Where,

$$C = 0.5 \ln \left(\frac{1+r}{1-r} \right)$$

N = number of subjects required

Z α = the standard deviation for $\alpha = 1.96$

Z β = the standard deviation for $\beta = 0.842$

r = expected correlation coefficient

Total number of subjects in study N = 90

Inclusive Criteria

1. Age group: 30 - 50 years
2. Working hours: 6 - 12 Hours
3. Length of employment: more than one-year
4. Gender: Male

Exclusive Criteria

1. History of trauma.
2. Any diagnosed cases of local and systemic infection and malignancies.
3. Any history of fractures.

Surgical History

Relationship between musculoskeletal disorders and he Permission was taken from the authorities in the area where the study was to be conducted. Based on the inclusion and exclusion criteria, sample population was selected. The procedure and purpose of the study were explained to the participants.

Consent form was filled by those who were willing to participate in the study. Following the consent form, questionnaires were administered which was Nordic Musculoskeletal questionnaire. After the fulfillment of the questionnaire, anthropometric measurements of the participants were taken. The measurements taken were Body Mass Index, Height and Weight. Based on these, comparison was done between the anthropometric measurements and musculoskeletal disorders.

Anthropometric Measurements

1. Height (meters)
2. Weight (kilograms)
3. Body Mass Index [Quetelet's Index] = weight (kgs) / height (m^2)}

BMI Classification

- Grade I – 18 - 24.9 (Normal)
- Grade II – 25 - 29.9 (Overweight)
- Grade III – 30 - 40 (Obese)
- Grade I Obesity - 30 - 34.9
- Grade II Obesity – 35 - 39.9
- Grade III Obesity – Above 40

Nordic Musculoskeletal Questionnaire

The following questions were used in this questionnaire

- Question 1: Have you at any time during the last 12 months had trouble (such as pain, ache, numbness, discomfort) in: neck, shoulder, wrist / hand, upper back, low back, hip / thigh, knees or ankle / feet.
- Question 2: During the last 12 months have you been prevented from carrying out normal activities (e.g.: jobs, housework, hobbies) because of trouble in:
- Question 3: During the last 12 months have you seen a physician for this condition:
- Question 4: During the last 7 days have you had trouble in.

This chart includes discomforts in neck, shoulder, arm, elbow, hand, wrist, thigh, knee, hip, upper back, lower back, ankle, and foot

Statistical Analysis

After collecting, data were analyzed applying GraphPad InStat software. Descriptive statistics including average, standard deviation, range were computed for data series. Then the relationship between MSDs and anthropometric measurements were investigated by using Pearson's coefficient correlation test.

RESULTS

90 security guards participated in the study. Out of 90 subjects, 96.6 % had musculoskeletal disorders in various areas

whereas 3.3 % did not have complaints of any musculoskeletal discomfort.

Higher prevalence of MSDs, 53.33 % (48 / 90) had been found in the age group greater than 40 years. With the increase in age there was increase in MSD symptoms in different body parts. In this study there is positive relationship between age and lower back musculoskeletal disorders with P value = 0.0192 [Table 2].

Variables	Minimum	Maximum	Average (Standard Deviation)
Height	152	185	165.55 (5.03942)
Weight	52	90	75.76 (8.910353)
Body mass index	20.7	25.4	27.11 (3.034233)

Table 1. Anthropometric Statistics

Musculoskeletal Disorders	Anthropometric Measurements			
	Height	Weight	BMI	Age
Neck	R = 0.04674 P = 0.6618	R = 0.014 P = 0.8957	R = 0.0069 P = 0.9484	R = 0.04871 P = 0.6485
Shoulder	R = - 0.3121 P = 0.0027	R = 0.2046 P = 0.0531	R = - 0.1148 P = 0.2812	R = 0.09442 P = 0.3760
Upper back	R = 0.2141 P = 0.0427	R = - 0.01607 P = 0.880	R = 0.1658 P = 0.1183	R = 0.0337 P = 0.7533
Elbow	R = 0.004 P = 0.96	R = - 0.01607 P = 0.8805	R = - 0.08982 P = 0.3998	R = 0.0484 P = 0.6499
Wrist / hand	R = - 0.1175 P = 0.2700	R = - 0.08095 P = 0.4482	R = - 0.08599 P = 0.4203	R = 0.0147 P = 0.8902
Lower back	R = 0.08962 P = 0.4009	R = 0.08112 P = 0.4472	R = 0.1301 P = 0.2216	R = 0.2465 P = 0.0192
Hip / thigh	R = 0.01402 P = 0.8957	R = 0.07503 P = 0.4822	R = - 0.00834 P = 0.9377	R = 0.1324 P = 0.2135
Knee	R = 0.1361 P = 0.2008	R = 0.1283 P = 0.2281	R = 0.0469 P = 0.6606	R = 0.1035 P = 0.3316
Ankle / foot	R = 0.06531 P = 0.5408	R = - 0.2414 P = 0.0219	R = - 0.1932 P = 0.0681	R = 0.0404 P = 0.7053

Table 2. The Relationship between Anthropometric Measurements and Age with MSDs (Pearson's Test Results)

Musculoskeletal Disorders	Normal	Overweight	Obese	Obese Class I
Neck	6	15	5	0
Shoulder	2	7	2	0
Upper Back	2	1	0	0
Elbow	0	3	0	0
Wrist / Hand	0	1	0	0
Lower Back	12	32	16	1
Hip / Thigh	4	5	3	1
Knee	12	38	16	1
Ankle / Foot	2	5	0	0

Table 3. Musculoskeletal Disorders Distribution According to BMI

Musculoskeletal disorders	Height (cm)				
	150 - 160	160 - 170	170 - 180	180 - 190	
Neck	4	19	2	1	
Shoulder	6	5	0	0	
Upper Back	0	1	2	0	
Elbow	1	2	0	0	
Wrist / Hand	1	0	0	0	
Lower Back	12	44	5	1	
Hip / Thigh	3	9	1	0	
Knee	10	46	10	1	
Ankle / Foot	2	4	1	0	

Table 4. Musculoskeletal Disorders Distribution According to Height

Security guards who have MSDs, have difficulty in doing daily activities in past 12 months and a few of them have created trouble in doing daily activities of past 7 days. This restriction during the previous 7 days may be maintained during the previous 12 months. In the beginning, a body tries to regulate to fret from extended standing position, but slowly it fails to adapt and causes MSDs. In this study in relation to BMI out of 90 subjects, 20 % were in the normal range, 55.55 % were in the overweight range, 22.22 % were in the obese range and 2.22 % were in the obese class I. There is no relationship between body mass index and musculoskeletal disorders with P value > 0.05 [Table 2].

	Have you at any time during the last 12 months had trouble (such as ache pain, discomfort numbness) In:	During the last 12 months have you prevented from carrying out normal activities (e.g. job, housework, hobbies) because of this trouble in:	During the last 12 months have you seen a physician for this condition	During the last 7 days have you had trouble in :
NECK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
SHOULDERS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
UPPER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ELBOWS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
WRISTS/ HANDS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
LOWER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
HIPS/ THIGHS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
KNEES	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ANKLES/ FEET	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes

Chart 1. Nordic Musculoskeletal Questionnaire

Musculoskeletal Disorders	Weight (kg)			
	50 - 60	60 - 70	70 - 80	80 - 90
Neck	1	7	13	5
Shoulder	1	6	2	2
Upper back	0	2	0	1
Elbow	0	0	3	0
Hand / Wrist	0	1	0	0
Low back	2	20	20	19
Hip / Thigh	0	5	3	5
Knee	3	19	27	19
Ankle / Foot	2	3	1	1

Table 5. Musculoskeletal Disorders Distribution According to Weight

In this study according to height out of 90 subjects, 17.8 % were in the range of 150 – 160 cm, 70 % were in range of 160 – 170 cm, 11.1 % were in the range between 170 and 180 cm and 1.1 % were in range of 180 – 190 cm. In this study, there is no relationship between height and shoulder musculoskeletal disorders with P value = 0.0027 [Table 2], but there is relationship between height and upper back musculoskeletal disorders with P value = 0.0427 [Table 2]. Back pain is frequently present in security guards. High level of physical activities and prolonged standing disturbs the normal posture of spine and more prone to develop pain.

In this study according to weight out of 90 subjects, 4.4 % were in the range between 50 and 60 kgs, 32.2 % were in the range of 60 – 70 kg, 36.7 % were in the range of 70 – 80 kgs and 26.7 % were in the range of 80 – 90 kgs. In this study, there is a relationship between weight and ankle and foot musculoskeletal disorders with the P value = 0.0219 [Table 2]. Individuals with the standing occupation might be experiencing ankle or foot pain because of maintaining bad postures for longer time. The ankle MSDs can be increased by wearing uncomfortable footwear for longer time and remaining in the static posture for longer time causes muscle fatigue and pain due to coactivation of agonist-antagonist muscles of lower limb.

DISCUSSION

This study was conducted to find out the relationship between MSDs and anthropometric measurements (body mass index, height, weight) amongst security guards. In this study 90 subjects were included based on inclusive and exclusive criteria. All of them were males aged between 25 and 60 years. In this study there is correlation between age and lower back musculoskeletal disorders with P value = 0.0192 and $r = 0.2465$. Back pain is frequently present in security guards. Prolonged standing disturbs the normal posture of spine and more prone to develop pain. This affects the strength, mobility and flexibility of spinal musculature and its occurrence is considerably linked with age and high level physical activities. Spinal problems have effect on different regions of spine with lumbosacral and cervical regions being most involved in pain as maximum movement is presented here. Excess of physical activity is the major cause of back pain. Sitting and standing postures are characterized by a high prevalence of low back pain. Long hours of work with no adequate rest between the two can lead to low back pain. Pain occurs primarily because prolonged sitting can cause high degree of stress to the spine i.e., the discs need to withstand an abundance of compression forces and there is an increase in intradiscal pressure, which can cause the tissues to creep progressively. While in an upright position, maintenance of the posture can cause muscle fatigue; moreover, pain can also be caused due to the stress placed on the discs resulting from excessive lordosis and due to coactivation of the agonist antagonistic muscles of the spinal column.⁶ In this study, there is correlation between height and shoulder musculoskeletal disorders with P value = 0.0027 and $r = -0.3121$ [Table 2]. There is correlation between height and upper back musculoskeletal disorders with P value = 0.0427 and $r = 0.2141$ [Table 2]. The pain in the shoulder in guards

may be due to repetitive movements of the upper limb by opening the door frequently and holding heavy weapons.¹⁰ The security guards are exposed bilaterally to a strong load on the trapezius muscles, in addition to the prolonged bending of the head forward. In individuals, obesity is combined with physiological disability, in precisely joint and chronic conditions such as cardiovascular disease, diabetes and some cancers. Degenerative osteoarthritis and cartilage disintegration jointly with musculoskeletal distress have been reported as part of the incapacity spectrum associated with obesity. Musculoskeletal conditions significantly reduce a person's ability to exercise, and additionally chronic pain has been reported to negatively influence a person's quality of life.¹¹ Overweight and obese individuals reported musculoskeletal pain caused by changes in joints like the knee and ankle.¹¹ There is correlation between weight and ankle and foot musculoskeletal disorders with the P value = 0.0219 and $r = -0.2414$. Body mass index and foot disorders were found to have a powerful association between overweight / weight gain and overall foot pain particularly chronic plantar heel pain (in non-sports individuals). There is also association with hallux valgus, tendinitis, OA of foot, and flat foot. Incidence of foot pain in overweight subjects has been related to fat mass instead of solely BMI. This study helps the organization to assign jobs to their employees based on age and health of an employee. For instance, field jobs can be assigned to young and physically fit employees. Desk jobs like camera monitoring, register entries etc. can be assigned to old age employees. Also, the ideal working hours for employees should be maximum 6 – 8 hrs. daily. The assignment of jobs based on age and physical fitness may help the organization to increase overall productivity and growth. In addition, employees will also get better work life and work satisfaction.

CONCLUSIONS

There is significant relationship between height and shoulder and upper back disorders. There is significant relationship between weight and ankle / foot disorders but there is no significant relationship between musculoskeletal disorders and body mass index.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jemds.com.

REFERENCES

- [1] Punnett L, Wegman DH. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. *J Electromyogr Kinesiol* 2004;14(1):13-23.
- [2] Tinubu BM, Mbada CE, Oyeyemi AL, et al. Work-related musculoskeletal disorders among nurses in Ibadan, South-West Nigeria: a cross-sectional survey. *BMC Musculoskelet Disord* 2010;11(1):12.
- [3] Halim I, Omar AR, Saman AM, et al. A review on health effects associated with prolonged standing in the industrial workplaces. *IJRRAS* 2011;8(1):14-21.
- [4] Sadeghi N, Habibi E, Sajjadi SA. The relationships between musculoskeletal disorders and anthropometric indices in public vehicle drivers. *International Journal of Collaborative Research on Internal Medicine & Public Health* 2012;4(6).
- [5] Pillai D, Haral P. Prevalence of low back pain in sitting vs standing postures in working professionals in the age group of 30-60. *International Journal of Health Sciences and Research* 2018;8(10):131-7.
- [6] Ahmad A, Mazlan NH. The kind of mental health problems and its association with aggressiveness: a study on security guards. *Int J Psychol Behav Sci* 2012;2(6):237-44.
- [7] Moy FM, Atiya AS. Lifestyle practices and prevalence of obesity in a community within a university campus. *Journal of Health and Translational Medicine* 2005;8(1):33-8.
- [8] Adnan H, Javaid M, Khan LG, et al. Frequency of back pain in security guards/work environment factors. *JRCRS* 2017;5(2):66-9.
- [9] Arun P, Chavan BS, Bhargava R, et al. To study the prevalence of musculoskeletal disorders in security guards. *International Journal of Physiotherapy* 2015;2(6):905-10.
- [10] Smith SM, Sumar B, Dixon KA. Musculoskeletal pain in overweight and obese children. *Int J Obes (Lond)* 2014;38(1):11-5.
- [11] Narouze S, Souzdanitski D. Obesity and chronic pain: systematic review of prevalence and implications for pain practice. *Reg Anesth Pain Med* 2015;40(2):91-111.